Contributions to Finance and Accounting

Umit Hacioglu
Tamer Aksoy *Editors*

Financial Ecosystem and Strategy in the Digital Era

Global Approaches and New Opportunities

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Foreword

The financial system is not an end in itself but a means to serve social and economic welfare. Nevertheless, the dramatic development of financial markets and institutions, in terms of both sophistication and magnitudes, has overshadowed that of the real economy. The disproportionate financialization of the global economy is akin to Icarus' rise. If the financial markets are to be salvaged from collapsing, their rise should be tamed by regulations and ethics.

The new millennium got rolling with global financial crises putting the financial ecosystem in the spotlight. The crises were referred to as the "global meltdown," hinting that the financial system and institutions could not carry the actualized risks that had loomed over decades. Since the crises, reform attempts were made to strengthen the deficiencies in the financial system. However, the reformed aspects of the system hardly make it crises-proof and socially well-serving.

The global financial ecosystem is clearly at a crossroads due to both internal and external forces. Internally, flabby regulations, ambitious financial product design, technology, and overly speculative (and more often than not, manipulative) behavior are among the prime risk factors. Externally, social, economic, and technological trends are formidable players putting pressure on the financial ecosystem. Central banks are challenged and are in a slow but strong change, both in terms of policy frameworks and structures. Capital markets continue to produce new products including new derivatives. Banking institutions continue to learn better risk management but will continue to face new challenges.

All these generate a continuous stream of both new risks and opportunities. In the new attempts to reform the financial architecture, generation of social benefits would require mitigation of risks while keeping the opportunities wide open to players.

Given this background and recent trends, this volume is a well-timed attempt to analyze the current status of the financial ecosystem and strategies to generate benefits for the society and players. It brings together a rich set of expert authors discussing critical challenges faced by the global financial architecture.

The volume covers a wide spectrum of significant issues, covering inter alia, impact of digitalization including artificial intelligence and cryptocurrencies,

interactions with non-financial businesses, financial and non-financial business strategies, linkages with sustainable development, audit and risk management processes, corporate governance and social responsibility issues, and branding and valuation. I congratulate the editors and authors for their significant contribution to the literature on contemporary finance.

Rector, Ostim Technical University Murat Yulek
Ankara, Turkey

Preface

Recently, there has been a significant change in capital markets and competitive business environment. This change stems from advances in data science and communication technologies. In this new digital era, recent issues shape our understanding of the business and financial ecosystem. Individualized products, cyber-physical systems (CPS), Internet of Things (IoT), cloud computing, and cognitive computing are some of the key components in this transformational change, the so-called Fourth Industrial Revolution or Industry 4.0. Additionally, blockchain technologies are redefining rules of the game in traditional finance. It also shapes traditional business operations and their connectedness with capital markets. Therefore, centralized characteristics of the financial ecosystem need to adapt to these transformational changes. Banks as intermediaries today seek new ways to transfer values with more efficiency and less amount of time. Throughout its blockchain ecosystem, some projects are financed with initial coin offerings without any intermediaries. It is more accurate, less costly, and promising. However, the risks are tremendous as there are no monitoring or regulatory bodies in this decentralized network activity. Therefore, we need to develop a clear understanding of transformational change in the financial ecosystem in the new era. Moreover, a decentralized network economy should also be evaluated from a holistic perspective with the contributions of international scholars.

This novel book emphasizes on highlighting contemporary issues in the financial and business ecosystem in the new era of digital change. This book with its sections and chapters contributes to the understanding of financial ecosystem and strategy with global approaches and new opportunities surrounding global business operations.

Authors from various fields evaluated new business trends, corporate strategies, and alternative finance channels and strategies in this pivotal reference book. We designed this publication to contribute in restoring the firms' competitiveness with developing adaptive business strategies and alternative financing models in a turbulent business environment. By this publication, we also aim to describe and discuss new approaches in contemporary management and finance within the changing

financial ecosystem. Therefore, the significant contribution of this book is its ability to develop a futuristic managerial practice.

Distinguished researchers in this publication have contributed to the success of this collaborative work by the inclusion of their respective studies from various fields. Contributors in this study formulated new insights for the changing financial ecosystem and questioned its future in a globalized financial system.

This book is composed of four complementary sections with 17 chapters. The first section outlines the components of *financial ecosystem and decentralized finance*. Chapters in this section made assessments on a decentralized financial system through financial market innovation from an economic perspective. Section two continues by outlining *strategic thinking in business ecosystem*. In this regard, the evolutions of business strategies and investment with its future have been assessed. The third section develops a deeper understanding of the *digital corporate governance and sustainability*. In this section, the authors assessed the connection between sustainability and digital transformation. In the last section, *valuation, digital services, and related topics* have been examined. In this section, contributors developed a critical approach to related issues in the business and financial ecosystem. The contents of the chapters are as follows:

Chapter 1 examines the investor behavior and composition of financial asset portfolios. Dr. Kaplan and Gyeabour analyzed the effects of asset-related brand equity in order to understand the brand equity dimensions' effect on an investor's financial behavior.

Chapter 2 measures the impact of tacit knowledge on individual and financial performances with a field study in Turkey. Dr. Tarim and her colleagues from various disciplines examined the tacit knowledge's impact on individual and financial performances.

Chapter 3 evaluates the digitalization process of capital markets backed by data from a fieldwork in Turkey. Dr. Uysal and Bozkaya assessed the recent regulatory developments.

Chapter 4 introduces decentralized finance with its importance for economic development. Dr. Ozcan seeks to introduce the basics of so-called decentralized finance (DeFi) through an exploration of blockchain technology in the field of finance.

Chapter 5 develops a futuristic view on the financial connectedness of energy and commodity markets and systemic risk. Dr. Bozkus and Dr. Kahyaoglu investigated the existence of financial connectedness between energy markets and commodity markets together with systemic risks.

Chapter 6 develops a practical approach to business strategy for sustainable development in the digital era. Dr. Ilhan evaluated the future of green management from a multidisciplinary perspective.

Chapter 7 analyzes the risk, asset, and liability management in banking by developing a conceptual and contemporary approach.

Chapter 8 evaluates artificial intelligence in internal audit and risk assessment process for corporations. Researchers highlighted the effects of artificial intelligence applications.

Chapter 9 initially evaluates the renewable energy resources for business investments in Turkey by using fuzzy multi-criteria decision-making methods. This research is a guide for business and enterprises that intend to make investment in renewable energy.

Chapter 10 underlines the importance of digital corporate governance as an inevitable transformation process. This chapter evaluates the impact of digitalization on CG practices discussed from the perspective of developing technologies and institutionalization and revealing potential effects and transformations.

Chapter 11 develops a critical approach to the link between strategic digital marketing and sustainability. Dr. Baltaci's study aims to explain the concepts, methods, and opportunities for using digital marketing for businesses.

Chapter 12 examines corporate social responsibility disclosure. In this chapter, an adequate picture of corporate social responsibility, its most important historical stages, and the challenges facing its disclosure is presented.

Chapter 13 assesses sustainability issue in full service carriers versus low-cost carriers with a comparison between Turkish Airlines and Pegasus Airlines. Dr. Yilmaz and Kose explored how two airlines, Turkish Airlines, as a full service carrier (FSC), and Pegasus Airlines, as a low-cost carrier, have addressed sustainability in their business models over the period of four years between 2014 and 2018.

Chapter 14 links the brand valuation and contemporary methods used in determining brand value from a financial perspective. Dr. Sahin's study classifies crucial brand valuation methods by revealing brand and brand value issues, explaining each one considering its advantages and disadvantages.

Chapter 15 examines digital service taxes as the fiscal result of digital transformation.

Chapter 16 focuses on the valuation of securitized balance sheet assets based on Monte Carlo simulation with a special reference to the Turkish finance sector.

Finally, *Chapter 17* develops an understanding of green human resource management and its connection with corporate social responsibility for a sustainable environment.

This book gathered colleagues and professionals across the globe from multicultural communities to design and implement innovative practices for the entire global society of practitioners in business, economics, and finance. The authors of the chapters in this premier reference book developed a new approach to strategic and financial issues in the digital era with an elaborate understanding of financial innovation on the basis of the changing financial ecosystem.

Finally, distinguished authors and professionals with respect to their studies in the field contributed to the success of the existing literature with their theoretical and empirical studies from multidisciplinary perspectives in this novel book.

Istanbul, Turkey

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In this new book, we have many colleagues and partners to thank for their impressive contribution to this publication. First of all, we would like to praise the people at Springer International Publishing AG: editors, Dr. Prashanth Mahagaonkar and Mrs. Rocio Torregrosa, who have the attitude and substance of a genius and continually and convincingly conveyed a spirit of adventure with regard to this research at each stage of our book development process, our Project coordinator Mr. Parthiban Gujilan Kannan and all the Springer team, without whose persistent help this publication would not have been possible, and others who assisted us in making critical decisions about the structure of the book and provided useful feedback on stylistic issues.

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We would also like to thank all of the authors of the individual chapters for their excellent contributions.

We would particularly like to thank the Bussecon International Academy Members for their highest level of contribution in the editorial process.

The final words of thanks belong to our family and parents separately. Their pride in this challenging accomplishment makes it even more rewarding to us.

Umit Hacioglu
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Editors and Contributors

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Umit Hacioglu is a professor of finance at Ibn Haldun University, Istanbul, Turkey. He received his PhD in finance and banking from Kadir Has University in 2005. Before he was appointed as an associate professor at Istanbul Medipol University in 2005, he worked for Beykent University at the Faculty of Economics and Administrative Sciences. Applied business strategies, corporate finance, and financial decision making are the main pillars of his interdisciplinary research. He is currently working on digital transformation, cryptocurrency markets, blockchain ecosystem, and financial market innovation in emerging markets. He has authored 14 editorial books as premier reference books. Pioneering global publishers currently released some of the most recent books entitled *Global Business Strategies*, *Digital Business Strategies*, *Blockchain Ecosystem and Financial Market Innovation*, and *Strategic Fit and Design in Business Ecosystem* in 2020. Dr. Hacioglu had editorial roles in international journals. He is nowadays serving as managing editor of the *International Journal of Research in Business and Social Science*, *International Journal of Business Ecosystem and Strategy*, and *Bussecon Review of Finance & Banking Studies*. He is a founding member of the "Society for the Study of Business and Finance" (SSBF) and managing director of Bussecon International Academy in Istanbul, Turkey.

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Part I
Financial Ecosystem and Decentralized Finance

Chapter 1
Investor Behavior and Composition of Financial Asset Portfolios: An Overview of the Effects of Asset-Related Brand Equity

Burçin Kaplan and Solomon Anti Gyeabour

Abstract Marketing and finance fields are attracting researchers to conduct studies that blend both disciplines., Recently, behavioral science was added to the admixture so as to understand the attitude of a human being towards marketing activities and their effect on his/her financial decision-making process, leading to a different field of studies referred to as branding and behavioral finance. The purpose of this chapter is to understand the brand equity dimensions' effect on an investor's financial behavior, their role in his decision-making process and their subsequent impact on the investor's final portfolio composition. This study augments existing literature and findings on this subject. It concludes that brand equity dimensions have an impact on investor behavior and intention to start an investment, and are taken into consideration when constructing a portfolio.

Keywords Brand equity · Brand equity dimensions · Investor behavior · Financial markets · Portfolio construct

1.1 Introduction

Individual investor's behavior can affect the assets general performance in the market or in the stock market (Zhang and Wang 2015). Such an individual has rational behavior when performing financial activities or financial transactions. Investors take into consideration all the needed information to finalize their decision (Bennet and Selvam 2013). This will lead to questioning the investors' attitude toward new investment, the influence of risks and returns, and the offered

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investments marketing and branding activities. Studies were conducted in the behavioral finance and marketing fields to understand the logic behind investment choices, investors' decision-making process toward new investment (Gabaix et al. 2006).

Previous researches discussed the marketing and branding activities represented by brand equity and its effect on the individual behavior toward financial assets based on the assumption that attitude in the financial or stock market is affected indirectly by the attitude in the goods and services market (Çal and Lambkin 2017). Popular brands that are highly promoted, or brands with satisfied loyal customers, have more potentials for their stocks to be selected as financial assets investment by investors (Billett et al. 2014). Generally, brand equity represents the deference in consumer response to the marketing activities of a brand based on his knowledge about the brand, which includes the expected positive or negative value that a consumer may link to a brand (Keller 1993).

This study reviews the investor behaviors and the consideration taken when constricting financial portfolios. It spotlights the individual investors' response to branding activities based on their risk and returns perceptions. It also discusses the effect of brand equity dimensions' effect on investor's attitudes, behaviors, and intentions to invest. Brand equity dimensions are awareness, associations, quality or performance, and loyalty. It contributes to behavioral finance and marketing research, especially the financial asset brands positioning and its effect on investment decisions-making.

1.2 Literature Review

1.2.1 Investor Perceptions and Decision-Making

Previously, it was believed that cash allocation decision of selecting investment products was exclusively rationale, relying on expected returns to be obtained (Barber and Odean 2008). Recently, non-financial variables were added to the traditional propositions of investment products selecting decision, such as perceptions of customers and investor's cognitive evaluation (Çal and Lambkin 2017). In recent literature on marketing and finance, researchers questioned the traditional idea of investment decisions-making based on the anticipated financial returns. They emphasize the financial firms and brands' influencing role on the investor's perceptions, evaluation, preferences, and decision-making (Aspara and Tikkanen 2010).

Reviewed literature concentrate on identifying and simplifying the rules that control the decisions making process of the investors, which they apply in selecting the final financial decisions (Clarkson and Meltzer 1960; Kahneman and Tversky 2012; Kumar and Goyal 2015). Tversky and Kahneman (1974), who explained that when making decisions of a complex and uncertain nature, individuals make use of the rule of thumb strategy or rely on their mental shortcuts, introduced the empirical idea. Related recent studies concurrently spotlight the importance of this approach

and how it could possibly lead to biases in decision-making (Carmines and D'Amico 2015; Gigerenzer and Gaissmaier 2011; Kurz-Milcke and Gigerenzer 2007).

Researches indicate that almost half of individual investors, when making investment decisions, rely on the heuristic approach. Towards reducing risk, individual investor targets long time existing multinational companies (Çal and Lambkin 2017). Heuristics approaches are quite useful when time is considered as an essence (Waweru et al. 2008), however, heuristics approaches sometimes lead to biases (Tversky and Kahneman 1974). Other researchers criticized Heuristics approaches for neglecting base rate, ignoring the sample size, and conjunction fallacy (Chandra 2017).

Most studies discussed the simplifying role of branding in the heuristics approaches that an investor uses in making his daily financial decision (Grullon et al. 2004; Keloharju et al. 2012). Although these studies were respectively unique, they had a common foundation of understanding the behavior of an individual that goes beyond the expected returns, and takes brands and financial market interaction into consideration (Çal and Lambkin 2017).

The brand recognition concept in financial trading underscored by Merton (1987) shows that usually investment opportunities (stocks) with higher brand recognition, reputation and image have low risk and offer lower returns. On the other hand, investment opportunities (stocks) with lower recognition have a high risk and need to compensate with comparatively higher returns to attract investors. According to Fang and Peress (2009), brand recognition and the needed rate of return has a negative correlation. However, Borges et al. (1999) explained that individual investors decide to invest in assets with recognized brands since there is a value of a brand name and it is essential for the heuristics process.

1.2.2 Brands and Investment Opportunities

Behavioral finance and economic psychology recent studies explored the considerations that impact investor's decision-making process to invest, according to their perceptions of the investment products (Aspara and Tikkanen 2008; Statman 2004; MacGregor et al. 2000).

In this regard, Frieder and Subrahmanyam (2005), found that reputable companies and brands are preferred and attracted by individual investors. Huberman (2001) also found that investors' decision-making and choices are affected by a non-financial characteristic such as brand familiarity.

According to Barber and Odean (2008), appropriately marketed and well-positioned brands in the investor's mind, has a high chance to be taken into consideration when making an investment decision. Besides, Aspara and Tikkanen (2010) explained that when two corporates have similar risks and returns, the investor would target the corporate that has a highly identified brand. Keloharju et al. (2012) also found that investors feel comfortable with brands that they had previous experience with and may repeat business with these brands. Billett et al.

(2014), found that there is a correlation between the investors' positive decision to choose investment assets and the familiarity or reputation of those assets. Therefore, having a well-positioned brand in the investors' mind, will lead that brand to be a preferred choice for investment.

Brand equity has been widely discussed in the literature, and categorized into three: customer-based brand equity, investment or financial brand equity, and the combination of the two aforementioned (Keller 2013; Kapareliotis and Panopoulos 2010; Kim et al. 2003; Barwise 1993; Aaker 1992). In recent researches, brand equity concept has been extended from the product and service sectors to cover the investment and financial sector as well (Jacobsen 2009).

1.2.3 Behavioral Finance

Researchers propound that behavioral finance is a discipline that views investors as feeble and fanatical with irrational behaviors. The researchers further added that behavioral finance combines theories in psychology and economics to explain irrational behaviors and how they help investors undertake decisions to invest their funds. In fact, in behavioral finance, the structure of data and qualities of market player's influence venture choices of individuals deliberately. The most well-known human attributes (fear, outrage, eagerness, magnanimity) place an extensive accentuation on our choices about money. Mind (getting a handle on a circumstance), reason (long haul outcomes of the activity taken), and feeling (thinking about a game-plan) are interrelated; they are the springs behind the human choice. Human behavior is commonly receptive, not proactive; along these lines, it is hard to make forecasts based on limited standards. Behavioral finance can effectively clarify why an individual has settled on a choice. However, it experiences challenges in measuring what impacts that choice will have on the individual (Oprean and Tanasescu 2014).

Before the amalgamation of behavioral finance with financial management and economics, the conduct of investors in the capital market was interpreted as dependent on the monetary utility hypothesis. While, scientific studies on behavioral finance reveal the significance of psychological variables (Foster and Kalev 2016). Behavioral finance is significant both at individual and corporate levels. Usually, most studies on corporate behavior are identified with capital structure, budgeting, or financing issues (Jureviciene et al. 2014). The connection between financial science and other social sciences, known as financial psychology or behavioral finance, inspects the dynamic procedure of investors and their reaction to various states of financial markets and underlines the effect that personality, culture, and judgment of individuals may have on their investment decisions.

The behavioral finance paradigm tends to take the perspectives that complete expectation, adaptable costs, and complete information appear to be unreasonable in speculation choices. At the end of the day, behavioral finance is another paradigm in the speculations that manage the efficient comprehension and forecast of general

components and choice makings with an accentuation on sets of principles. As such, behavioral finance together with monetary, classic models investigates the market patterns precisely and decisively (Aren et al. 2016).

1.2.4 Brand Role in Behavioral Finance

Individual investors prefer to invest in stocks that they know and have ideas about or previous experience with. Having information about a corporate and what it can offer concerning risk and returns is important for the investor when forming his investment plan of maximizing potential returns and minimizing potential risks (Azwadi 2011). Brand awareness is considered to be a source of information for investors. It is a brand equity dimension, and it represents the brand's existence in consumer's memory. The more the investor is aware of a brand, the more he will hold shares of that brand for a longer period and the more investment, and trading he will conduct with that brand shares (assets) (Aspara and Tikkanen 2010). Investors are willing to invest and trade with prestigious brands assets with all confidence due to their trust in those brands and their corporates and their perception of these corporate performances (Nourbakhsh and Arghavani 2016). The investor's perceived risk and expected return is controlled by easily recognizing the brand, creating trust, and overall brand awareness (Asgarnezhad et al. 2017).

In addition to brand awareness, "internal and external elements of the brand and its related perceived benefits could affect the investors' attitude towards the brand" (Asgarnezhad et al. 2017). The investors' positive attitude toward a brand or a corporate and his response to its marketing activities will affect his decision in investing in its stocks (assets).

According to Asgarnezhad et al. (2017), investor's attitude can be divided in to cognitive, emotional, and behavioral:

- The cognitive part represents the extent of investor knowledge about the brand, according to the related information availability and how it is positioned to target new and potential investors.
- The emotional part is about the investor evaluation and appreciation of the brand, whether the investor likes the brand or not.
- The behavior part is very important as it represents the investor's commitment toward a brand and shapes the decisions that lead to investing in the stocks (assets) of that brand or a corporate.

To conclude, brand equity affects investor attitude and behavior toward investments. According to the investors' evaluation of perceived risk and return, a high-perceived return with low perceived risk is more favorable.

1.3 Construction of Theoretical Relations

1.3.1 Effects of Brand Equity Dimensions on Investor Behavior

Brand awareness: is considered the first and core element of brand equity. It is "the potential customer's ability to recognize and recalling a specific brand of a product or a service from a range of similar competitive brands" (Aaker 1991). It has the role of competing between the products or services and their brand. According to Alba and Hutchinson (1987), brand awareness is "what leads the consumer to have a different experience or what helps the to introduce the brand to potential consumers."

When there is a need for new products or new services consumers consider the brands that they know and have a position in their minds. A well-known branded financial asset has a high potential to be select by an individual investor rather than a less branded counterpart.

Brand loyalty: Aaker (1991) describes brand loyalty as a measure of attachment that a consumer shows towards a particular brand. Brand loyalty is perceived as the "core" of the brand equity model. A customer is classified to be loyal when he/she stays loyal to the patronage of a particular brand irrespective of the changes made to the brand in terms of cost or value amendments. Research has shown that customers in the loyal category/segment tend to respond more favorably to marketing stimuli than those tagged as switching or non-loyal customers (Grover and Srinivasan 1992).

Brand loyalty is generally categorized into behavioral and attitudinal components. The behavioral brand loyalty has to do with the frequency or relative volume of the consumer patronage of the brand and therefore lays more emphasis on the purchase or usage history. The attitudinal brand loyalty shows the consumer's preference for a specific brand, and which is exhibited in the long-term commitment shown to that brand (Aaker 1992).

Brand associations: Consumers make decisions to purchase or use a brand based on the associations they have stored in their memories overtime (Hastak and Mitra 1996). Aaker (1991) defined Brand association as anything (of a brand and its image) stored in memory by the consumer mostly in a meaningful way. According to Keller (1993) brand associations typify objective features and functions, as much as subjective value (example: price, quality, lifestyle, location, and competitive alternatives).

Perceived quality/performance: Most marketing research has tried to identify suitable measurement or metrics by which the quality of brands can be evaluated or assessed. Zeithaml (1988) propounds that perceived quality is the customer's judgment of a product, thus how perfectly it meets and exceeds their needs or how superior that product is regarded in comparison to competing products. It is important to note that these judgments are subjective opinions but not an actual professional evaluation from experts or managers about the product in question.

1.3.2 Investors and Risk Behaviors

The expression "risk lover" can sometimes be misleading. Risk lovers are sometimes perceived as people who undertake risky activities just for the love of it as they derive their fun and excitement from it. A few studies have contributed to the existing knowledge in this area. Soane and Chmiel (2004) provided enlightening research, which assessed the impact of risk perception on two risk domains. In the investment world, risk lovers do not do what they do for the fun of it but for the risk-return tradeoff, which states that the higher the risk, the higher the possibility of returns. Investors assume a measurable amount of risk based on certain quantifiable objectives or factors. These reasons are mostly induced by the high probable payouts and their ability to stand the "loss of everything" or "gain of everything". By this, it can be said that investors are high-profit potential lovers but not risk lovers (Scannell 2005).

Other researchers disagree with the expression "risk lovers." For example, Coricelli et al. (2002) and Graboves (2005) prefer to use the expression "risk seekers"than "risk lover." Besides, Page (2005) and Fuller (2005) would use "risk-takers" instead of "risk lovers"; while Scannell (2005) suggests the moniker "high payoff seekers" is the most appropriate.

Based on the above discussion and devoid of any psychological excitement derived from taking up any given risk, it can be said that almost every individual, firm, and organization to an extent, assume the risk of losing the investment with the hope of receiving a higher return on that investment. Hence, the moniker risk-loving is not out of place. From the above stance, anything beyond that extent, that individual, group of individuals, or legal entity is referred to as "risk-averse"meaning for those individuals any potential profit is enough and nothing justifies losing an initial investment. And anything precisely to that extent, that individual, group of individuals, or legal entity is referred to as "risk-neutral"denoting a neutral stance to risk appetite (Scannell 2005).

This study highlights a very vital input to the explanation of an investor being risk-averse or loving is the structure of the investors' utility function for wealth. Again it can be said that an individual's risk aversion or loving behavior is dependent on the nature of the risk involved and the individual's level of earnings, which subsequently influence the composition of their financial asset portfolio.

1.3.3 Financial Assets

Financial asset are liquid asset or instrument that derives its value from an underlying contractual agreement. Examples stated include but not limited to cash, stocks, bonds, mutual funds, and bank deposits. Barasinska et al. (2012) conducted a survey to determine whether individuals in households in Germany held financial assets. The financial assets the researchers anticipated to investigate included bank deposit

(current and savings), mortgage policies, assurance policies, fixed deposits (State savings bonds, banks savings bonds issued and mortgage-backed bonds), securities of companies listed on stock exchanges (stocks, bonds, mutual funds), and equities of non-listed companies. Although a specific amount invested in the individual assets were not documented, the research revealed that individuals in the sample category preferred to hold bank deposits, life assurances, and mortgage saving plans. Over the 4 years of the observatory research conducted, the researchers highlighted that the figures did not change much except for a few declines in the figures of bank deposits and life assurances (Barasinska et al. 2012).

1.3.4 Managing and Constructing the Portfolio of Financial Assets

There is no unified approach to analyze how to combine assets in a financial portfolio or evaluating a portfolio itself. However, researchers have suggested various methods to measure the combination of individual portfolios, such as investigating the correlation between the returns on the collective assets within a single portfolio according to the information of the cash allotted to each asset and its related returns. Such information is needed to ascertain the logic behind the portfolio combination, and which asset to keep, and which one to change (Barasinska et al. 2012; Goetzmann et al. 2005).

A lot of surveys have been conducted on which assets individual investors usually hold and the spread of worth in those individual or group of assets. However, these researchers in extracting vital financial information from private individuals that aids in their studies have expressed the difficulty it entails. In research, Campbell (2006), brings to light how majority of private individuals in the USA hold a portfolio of financial assets that are poorly diversified. According to the survey conducted by Campbell, the poor was identified to hold more liquid assets, for example, cash, demand funds, etc., whiles the middle-class investors were identified as allocating their funds to liquid savings like life assurances, savings accounts, etc. A similar study undertaken in Europe to investigate the behavior of individual investors showed similarity in the investment behavior to that of the USA individuals.

Unlike professional investors, it is common for non-professional investors to adopt heuristic or naïve strategies in the bid to diversify their portfolio. For example, a typical non-professional will spread his worth equally among the number of assets he/she wants to invest in thus applying the $1/n$ strategy (Goetzmann and Kumar 2008). In the ensuing sections, this research will review more on the naïve strategies implemented in investment by non-professionals for portfolio diversification, and also attention will be paid to the sophisticated approach to investment portfolio diversification.

Portfolio Diversification Strategy: In concord with the adage "don't put all your eggs in one basket", this diversification approach focuses on spreading worth across financial assets without having a proper and detailed risk-return profiling of all individual assets in the portfolio. Also, the typical behavior of naïve investors is investing in many different types of assets as possible (Barasinska et al. 2012). In the study conducted by these researchers (Barasinska et al. 2012), it was revealed that the larger number of the sampled individuals invested funds in two or three financial asset types, whiles a little above1% of the sample size held an investment in six different types of financial assets. This research, based on the above proposition, can add that naïve individuals try to spread their risk and return by investing in several financial assets that they deem profitable and less risky.

Sophisticated Portfolio Diversification Strategy: This strategy of portfolio composition measure is regarded as the science of portfolio composition. It is constructed to inculcate a more sophisticated investment plan. This strategy goes beyond accounting for the number of assets in the portfolio to analyzing the degree of risk and potential returns in the portfolio (Barasinska et al. 2012). In constructing this sophisticated strategy, assets are classified into risk categories namely; low risk, moderate risk, and high risk (Barasinska et al. 2012; Blume and Friend 1975; Börsch-Supan and Eymann 2000).

In determining the degree of riskiness, the mean-variance approach is used. However, in the German survey, Barasinska et al. (2012) due to lack of adequate data on the returns on the financial assets deployed a rather simple but feasible classification based on the works of Blume and Friend (1975) and Börsch-Supan and Eymann (2000). A few things are worth noting under this classification. Bank deposits are considered safer and less risky because their returns show no variations and are fully guaranteed by the banks or firms that accept them. The study further categorized fixed interest assets and life assurance policies as not riskier but riskier than a bank deposit. According to the research-fixed-interest instruments are deemed stable but the actual returns are dependent on the duration and the financial institution's ratings. Again, it was highlighted that life assurance policyholders bear not the entire risk of losing their funds. However, the actual returns are pecked upon the occurrence of an uncertain event and sometimes significantly lesser than what the investor expected.

Equities of both listed and non-listed companies are considered to be risky. This is due to the volatility and uncertainty associated with such stocks. Following the higher the risk the higher the return principle, in their research, the authors assigned less expected returns to financial assets in the safe category. "Moderately risky" assets were matched to moderate expected returns; and financial assets that belong to the riskiest category were assigned to the highest expected return (Barasinska et al. 2012).

Barasinska et al. (2012), proposed seven portfolio contracts types:

– The first portfolio construct type is termed the low-risk portfolio construct. This portfolio contains only safe financial assets.

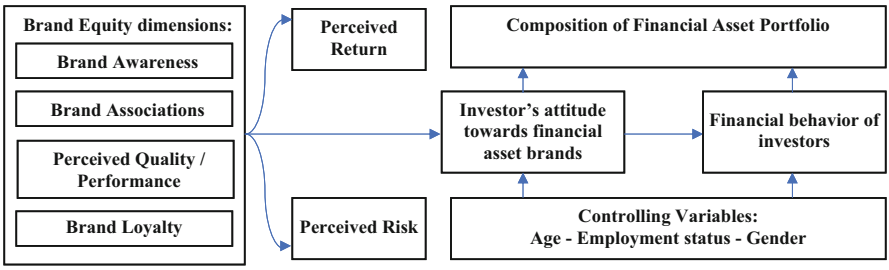

Fig. 1.1 Proposed Conceptual model. Source: Nouri et al. (2017)

- The second is termed as the moderate risk portfolio construct because the portfolio is made up of only moderately risky financial assets.
- The third construct type is termed the high-risk portfolio construct also because it contains only financial assets with high risk.
- The fourth portfolio construct type contains safe assets and moderately risky assets.
- The fifth is a portfolio that has a combination of safe assets and risky assets.
- The sixth has a combination of moderately risky assets and risky assets.
- Finally, the seventh, which is considered as a fully diversified portfolio, has all three classes of assets.

The findings in the German study by Barasinska et al. (2012) showed that private investors in the sample class of households played it safe with their investment choices. Majority of the sample class held what can be considered as incomplete portfolios with only safe assets or a small combination of safe assets and moderately risky assets. A few of the sample class possessed portfolios that contained financial assets across the three classifications, however, they constituted the minority. This research based on these previous findings concludes, pending further investigations, that most individual investors forgo higher returns because they want to play it safe.

The detailed discussion presented above will lead to the final theoretical relations framework presented in Fig. 1.1.

1.4 Discussion and Conclusion

Both old and recent studies have focused on investigating investor behavior and factors that influence that behavior (Frieder and Subrahmanyam 2005; Gabaix et al. 2006; Gompers and Metrick 2001; Huberman 2001; Keloharju et al. 2012). One strand within these studies is a detailed review of the impact of brand equity and other related portfolio constructs on investment choices and ideal portfolio of financial assets. The revelations made by these studies highlight the fact that attitudes and perceptions toward brands in the wider consumer goods and service markets have a spillover effect on the financial asset market. Although, these studies

have tremendously added to existing literature by largely bringing to light the connection between consumer behavior and investor behavior, and the vital role of brand equity construct. This chapter deepens and adds more to the ongoing literature on the effects of the Investor Based Brand Equity dimension on the investor, a perspective in their risk behaviors, and how their portfolio construction decision is influenced. Thus this research serves as a "one-stop-shop" for unveiling all these concepts. To ascertain this goal, we following relations are proposed for further researching:

- The extent of brand awareness of financial assets among actual and prospective investors will be correlated with their attitude towards the brands and their financial behavior and relationship will be mediated by perceived risk and perceived returns.
- There is a correlation between brand associations (of the financial assets) and investor's attitude towards the brands and their financial behavior; a positive brand association leads to a positive attitude and behavior, adverse brand associations lead to unfavorable attitude and behavior
- There is a correlation between the brand's perceived quality/performance and investor's attitude towards the brands and their financial behavior; high perceived quality/performance will be positively correlated with favorable attitudes, and behaviors, low perceived quality/performance will be correlated with unfavorable attitudes and behaviors
- There is a correlation between brand loyalty concerning previously holding financial assets and investor's attitude towards the brands and their financial behavior
- There is a correlation between the financial behaviors of investors and the composition of the financial asset portfolio

A careful search and critique of previous empirical studies conducted across Europe, America, and Asia were conducted. The results show that brand equity presents itself in four dimensions namely, brand awareness, brand loyalty, brand associations, and perceived quality. These dimensions influence the investor's attitudes (intentions to invest). The results further show that naïve individual investors try to spread their risk and return by investing in several financial assets that they deem profitable and less risky whereas, professional investors follow the science of investment by investing across the three classes of an asset (safe, moderately risky, and risky) to obtain a well-diversified financial asset portfolio. Another significant revelation by this study is an explanation of an investor being risk-averse or loving is the structure of the investors' utility function for wealth. Finally, an individual's risk aversion or loving behavior is dependent on the nature of the risks involved and the individual's level of earnings, which subsequently influence the composition of their financial portfolio. This study was limited to the review of previous empirical research; however, this suggests an opportunity for future research. It would be very interesting to use the variables in this study to conduct empirical research focusing more on specific financial assets as brands.

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Chapter 2
Measuring the Impact of Tacit Knowledge on Individual and Financial Performances: A Field Study in Turkey

Merve Tarim, Erdem Erzurum, A. Fatih Akçan, Ömer Faruk Gürcan, Halil Zaim, and Selim Zaim

Abstract Knowledge has become a key factor for business success because of the rapidly changing market conditions and globalization. Tacit Knowledge is a field being researched by many scholars to understand how it could benefit companies. In this chapter, tacit knowledge's impact on individual and financial performances was measured utilizing data that was generated through a self-administered survey. The questionnaire was distributed to service companies randomly selected from the database of Istanbul Chambers of Commerce.

Keywords Tacit knowledge · Individual performance · Financial performance · Knowledge management

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2.1 Introduction

Knowledge has become a key factor for business success because of the rapidly changing market conditions and globalization. Knowledge is a crucial resource for learning new things, solving task-related problems and creating and sustaining core competencies (Wu and Lee 2007). Knowledge provides the much-needed know-how to the betterment of organizational operations by merely contributing to production, product design, process optimization, and efficiency of the workforce (Choi and Lee 2002; Chou and He 2004; Erden et al. 2008; Grant 1996; Nonaka et al. 1996; Patil and Kant 2014).

To understand the nature of knowledge better, Knowledge has been categorized. Tacit vs. explicit knowledge, as suggested by Polanyi, is the most frequently cited distinction in the literature (Roos and Roos 1997). Many researchers in various disciplines have investigated the concept of tacit knowledge. However, it is still considered under explored area of knowledge and hence not yet fully understood. It is argued that tacit knowledge is quite likely the most difficult to manage; however, if managed properly, it is also the knowledge dimension that significantly increases organizational performance. It is mostly perceived as a critical asset influencing a firm's ability to gain and maintain its competitiveness (Choi and Lee 2002; Kogut and Zander 1993; Pathirage et al. 2007).

Benefiting from tacit knowledge properly is a challenge to organizations that want to disseminate knowledge within itself or encourage innovation (Mooradian 2005). Organizations need to build proper systems to transfer and manage tacit knowledge effectively, which will sustain organizational performance. The organizational performance is comprised of financial and non-financial performances. Financial performance includes tangible or monetary benefits such as revenue, return on assets, current ratio, and profit margins. In contrast, non-financial performance refers to intangible benefits such as customer satisfaction, company reputation, and innovation capability (Muthuveloo et al. 2017).

Several studies concur that tacit knowledge has an impact on organizational performance (Arnett and Wittmann 2014; Garrick and Chan 2017; Keskin 2005; López-Cabarcos et al. 2019; Murumba et al. 2020; Muthuveloo et al. 2017); working performance of employees (Cianciolo et al. 2006; Hedlund et al. 2003; Manaf et al. 2018; Reychav and Weisberg 2009), and innovation capability (Gokmen and Hamsioglu 2011; Harlow 2008; López-Cabarcos et al. 2019; Wang and Wang 2012; Yang 2012). Although tacit knowledge's popularity in the literature is evident, research reports from literature are rare, and there are contradictory results on the relationship between tacit knowledge and financial performance. Some researchers such as Manaf et al. (2018), López-Cabarcos et al. (2019) supposed that tacit knowledge is implicitly tied in with financial performance. There is a need for further research to see the direct relationship between tacit knowledge and financial performance (AlMulhim 2020).

This study constitutes a model that shows tacit knowledge dimensions and evaluates its impact on the individual and financial performance. It also aims to

explain whether an individual performance mediates the relationship between tacit knowledge and financial performance by employing an empirical research method. The data was collected from firms working in the service sector in Turkey. The rest of the chapter is organized as follows: Section 2.2 provides a concise review of the relevant literature. Section 2.3 presents an overview of the research methodology and a description of the data collection and data preparation efforts. Section 2.3 also provides detailed descriptions of the steps involved in carrying out the analysis and presents the obtained results. Section 2.4 discusses the findings and implications and concludes.

2.2 Understanding the Role of Tacit Knowledge

Knowledge Management is a necessary context for scholars to understand the adaptation to dynamic environment of the changing World. In literature, there are two types of knowledge helping us how we can define them. They are tacit and explicit knowledge. "Explicit" or codified knowledge is the type that can be stored and accessible which means that it is easy for every person and every company to reach. The other type is Tacit Knowledge, which takes part in human mind including opinions, experiences and their perceptions; is something personal and hard to reach. It is known that, every human being is unique that is why it is possible to say that every human being is a tacit knowledge resource (Choi and Lee 2002; Nonaka 1994, 1998; Nonaka et al. 1996).

In today's dynamic World, knowledge is one of the most important resources for companies especially gaining access to the accurate knowledge. Because, there is so much knowledge in the external World, however, just a pint-size out of the lot is valuable and exact. For that reason, a company's basic task is to find out the right knowledge to reach the outcome that they want. While scholars are asking questions comparing tacit knowledge and explicit knowledge, it is known that the most important thing about survival is to adapt the changing World, that is why the right question must rather be that which type of knowledge will be helpful in this process. Explicit knowledge is defined as documents, papers, books, databases, and policy manuals and it emphasizes the opportunity to create, store, share, and use an organization's explicitly documented knowledge, which means that it is easy to be found. On the other hand, tacit knowledge is something hard to uncover. According to Polanyi, "Tacit knowing is seen to operate here on an internal action that we are quite incapable of controlling or even feeling in itself. We become aware of our operation of it only in the silencing of a noise (Polanyi 1966)." The important thing about this type of knowledge; if it is not accessible by every person or company, it means that it can create something different (Choi and Lee 2002; Lijuan and Xiaoying 2014; Borges 2012; Baumard 2002; Cabrera-Suarez et al. 2001; Zaim et al. 2015).

2.2.1 Tacit Knowledge and Intellectual Capital

Tacit knowledge is something rare, beneficial, perfectly irreplaceable, and impossible to imitate kind of resource. By this opinion, firms manage to maintain competitive advantage in resource-based view knowledge can be obtained from experienced and skilled people which is a kind of strategy can be referred to as human strategy. When it is admitted that every human being is a tacit knowledge resource, it is a company's duty to reach that tacit knowledge which is hidden in the employees' minds to find a solution to store that knowledge in order to create competitive advantage (Ambrosini and Bowman 2008; Choi and Lee 2002; Nonaka and von Krogh 2009; Coleman 1988; Meyerson 1994; Zaim et al. 2012).

Companies or institutions should make investments on their human capital to transform their employees into intellectual capital. In order to gain the competitive advantage or to be the leader firm in the whole sector, a company should use the employee's tacit knowledge. The advantage also depends on how different that tacit knowledge is. That is why, firms hire different people according to their abilities, technical skills, education and etc. It could be argued that if a company's tacit knowledge is formed by diversity, complex problems can be solved, adaptation capacity to changing World will be higher and that company's survival is inevitable. When we observe today's international and multicultural companies, they are managing diversity correctly to create innovation by using their different employees' tacit knowledge in the process in order to gain the competitive advantage. If a firm can manage diversity, it means that they can use the whole tacit knowledge coming from different people's minds and also they can transform that tacit knowledge into explicit knowledge by creating innovation which is the highest necessity for survival (Arnett and Wittmann 2014; Briant and Naddef 2004; Gordon 1995; Jiing-Lih et al. 2007; McAdam et al. 2007; Venkatamaran and Shane 2000; Zaim et al. 2015; Zaleznik 1990).

2.2.2 Tacit Knowledge and Social Capital

In order to survive in the long term, a company should create its tacit knowledge resources. Inside the firm, the intellectual capital creates the resource, however, there must be another resource in the external World, which is the social capital. In social capital there are different stakeholders, which are, consumers, competitors, suppliers, NGO's, etc., have connected each other by social networks. If that network's bonds are strong enough, the knowledge, which is coming from, will be useful and correct. Because there is so much incorrect information in the external World which can lead the company in a wrong way about consumer behaviors, marketing strategies or investment decisions etc. Intellectual capital is our tool firstly to use their own tacit knowledge in the process and create innovation; secondly they are the key to separate the knowledge coming from social capital according to its utilization

and accuracy. Besides, the intellectual capital can create social capital by using social networks (Coleman 1988; Farr 2004; Kolankiewicz 1996; Lounsbury 2000; Meyerson 1994; Nahapiet and Ghoshal 1998).

2.2.3 Tacit Knowledge and Innovation

Many scholars found out that tacit knowledge and innovation had a strong relationship. Gokmen and Hamsioglu (2011), Tamer Cavusgil et al. (2003), Seidler-de Alwis and Hartmann (2008) found that tacit knowledge has a positive and significant impact on innovation and business performance. In order to gain the competitive advantage, firms must create innovation as a sustainable process. While creating innovation, different ideas must be needed. Different ideas come from different people who are working together harmoniously and collaboratively in a company, which has a diversity management culture. In this kind of culture, people can use and share their tacit knowledge to create innovation because, according to that kind of cultures, every person is valuable and their ideas too, because of that those firms can create innovation and transform tacit knowledge into explicit knowledge by transforming the idea into a product or service (Briant and Naddef 2004; Gokmen and Hamsioglu 2011; Gordon 1995; Sahut and Peris-Ortiz 2014; Seidler-de Alwis and Hartmann 2008; Soto-Acosta 2016; Tamer Cavusgil et al. 2003; Zaim et al. 2015).

2.2.4 Tacit Knowledge and Financial Performance

Many scholars are searching the impact of tacit knowledge on financial performance to see the survival ability of the companies. However, in this process to see the output, firstly all inputs should be detected. In order to increase financial performance, there must be a suitable culture in the organization, which helps the employees to hare their ideas easily. Another important tool is, to create that kind of culture, there must be a leader manager who can encourage employees to share their ideas, work in cooperation and make them feel valuable and beneficial for the company. That leader manager can transform human capital into intellectual capital. The intellectual capital, which is full of different people with ideas, will create innovation by using their tacit knowledge. By creating innovation, a product or a service, that knowledge will be no longer tacit at all. Intellectual capital will also create social capital because of social networks (Avolio et al. 1999; Bass 1985, 1995, 1997; Coleman 1988; Farr 2004; Jiing-Lih et al. 2007; Kolankiewicz 1996; MacKenzie et al. 2001; Meyerson 1994; Nonaka 1994, 1998; Sahut and Peris-Ortiz 2014).

They will also analyze the data, which is coming from their social capital, according to its usage or correctness, in order to use that knowledge in the innovation

process. For increasing the financial performance, firstly the environment, which supports to reach tacit knowledge, must be created.

Secondly, according to their skills, abilities, education, etc., correct employees should be selected and hired and then, some methodologies like organizational learning or knowledge sharing must be created to get that tacit knowledge from the employees (Bass 2000; Briant and Naddef 2004; Gordon 1995; Lawson and Lorenz 1999; Pellegrini and Scandura 2006; Putnam 1995; Reber 1989; Venkatamaran and Shane 2000; Zaleznik 1990).

AlMulhim (2020) made a research about the effect of tacit knowledge and organizational learning on financial performance in service industry in Saudi Arabia. According to results, Tacit Knowledge and Organizational Learning can provide a new way to continually improve the performance of the organization. This study develops Tacit Knowledge as a quantifiable measure and connects this to the Financial Performance of organizations (profitability and growth).

Nguyen and Ha (2020) searched the relation between social capital dimensions, knowledge sharing, and firm financial performance in Vietnam. The results show that all Social Capital dimensions significantly influence both tacit and explicit knowledge sharing. While Social Capital enhances both tacit and explicit knowledge sharing, knowledge sharing in turn is among the main mechanisms connecting Social Capital to a firm's financial performance.

2.3 Research Methodology

2.3.1 Survey Instrument and Data Collection

The survey instrument of this study was composed of questions that inquire levels of tacit knowledge, individual performance and organizational financial performance. The questions were adopted from studies of Matzler and Renzl (2007) and Berdrow and Evers (2010).

The original questionnaire, which served as the source, was formed with questions related to tacit knowledge and organizational performance. For the purpose of the questionnaire used in this study, the performance questions were enhanced with two sets of questions related to individual performance and organizational financial performance. Predicating on semi-structured interviews with several knowledge workers and discussions with professional knowledge managers and academicians in the field, the appropriateness of question order, wording and format were checked for accuracy. In this study, both individual performance and organizational financial performance were evaluated through perceptional indicators. Each item was rated on a five-point Likert Scale, where the verbal statement "strongly agree" was anchored at numeral 1 and numeral 5 indicated the verbal statement "strongly disagree".

Data was collected through a self-administered questionnaire. The questionnaire was distributed to service companies that were randomly selected from the database of Istanbul Chambers of Commerce. These companies operate in service areas of

banking and finance, cargo, communication, information technology, and retail, catering, food and tourism sectors. The questionnaire was mailed to the general manager of each company with a letter that requested delivering the questionnaire to knowledgeable workers to complete it. A total of 2778 usable responses were obtained and were considered for the subsequent analysis.

A comparison between first and second halves of the responses was conducted to check the data for non-response bias (Armstrong and Overton 1977). From both halves, approximately 50% of responses were selected randomly. These former and late response groups were compared by *t*-tests for all variables included in the study. No significant difference was found between the groups ($p > 0.1$) and this insignificance was accepted as a proof of absence of response bias.

An examination of participant distribution on sectoral basis revealed that of all received responses 23.4% were from banking and finance, 18.2% were from tourism and entertainment, 13.5% were from communication, 13.1% were from food and catering, 8.9% were from IT and 8.2% were from retail sector. As for participant work status, more than half of all respondents were engineers with 56.5%. 6.7% were high-level managers and 13.2% were mid-level managers. The rest of participants were either technicians (10.9%), experts (9.4%) or data analysts (3.2%). Respondents were mostly males (73.8%) and females (26.2%) formed the minority. 17.6% of the firms were identified as large firms which have more than 500 employees.

2.3.2 Analysis and Findings

The data analysis was carried out through a three-step process. In the first step, an exploratory factor analysis (EFA) was used to identify tacit knowledge construct's structure with varimax rotation to minimize correlations between subdimensions. For the second step, first-order and second-order confirmatory factor analyses (CFA) were employed with tacit knowledge measurement models. The influence of important factors forming tacit knowledge on individual performance and financial performance, and the mediation influence of individual performance on relationship between tacit knowledge and financial performance were measured in the third and last step by using a covariance-based SEM method. These steps are presented and discussed in more detail in the following subsections.

2.3.3 Exploratory Factor Analysis (EFA)

Existence of conceptual and statistical overlap is a problem in research. As a remedy, distinct and non-overlapping variables can be searched for in the full data set. In such an attempt, an EFA was conducted on tacit knowledge with varimax rotation to

Table 2.1 EFA results

Factors	Factor loadings
Factor 1: Individual knowledge	
Verbal communication	0.719
Interpersonal communication	0.717
Listening	0.700
Problem solving	0.673
Time management	0.626
Writing (written communication)	0.626
Learning capacity (desire and ability)	0.621
Personal traits (characteristics)	0.613
Coordination	0.555
Factor 2: Managerial knowledge	
Risk taking	0.743
Conceptual skills	0.711
Visionary thinking	0.697
Innovative thinking	0.662
Organization ability	0.579
Strategic thinking	0.577
Planning ability	0.576
Factor 3: Expertise knowledge	
Educational level	0.698
Professional development	0.692
Training	0.692
Task responsibility	0.665
Technical (practical) knowledge	0.628
Expertise knowledge	0.627
Professional discipline	0.522
Factor 4: Collective knowledge	
Peer relations	0.719
Knowledge sharing	0.691
Peer assist	0.677
Team communication	0.649
Supervisor-subordinate communication	0.590
Teamwork	0.566
Collective working	0.502

Source: The table made by authors

identify and extract any subdimensions of the construct. The results of this exploratory factor analysis are given in Table 2.1.

The EFA on these 30 items belonging to tacit knowledge construct yielded four factors, which explained approximately 67% of the total variance. All items loaded satisfactorily on these four factors. Based on the emerged structure, factor 1 was named as Individual Knowledge. Personal traits, ability to learn, communication skills, self-management and similar competencies and knowledge generate Individual Knowledge. Factor 2 was titled as Managerial Knowledge. This factor refers to

the competencies and knowledge that pertain to leadership, decision making, planning, problem solving, coordinating and organizing. Factor 3 was termed as Expertise Knowledge. This type of knowledge is task related and is work specific and professional by nature. Factor 4 was named as Collective Knowledge. Employee abilities such as cooperation, collaboration and team working skills form Collective Knowledge. The value for Kaiser-Meyer-Olkin measure emerged as 0.95, supporting the EFA result validity. As for internal consistency, Cronbach's α values of tacit knowledge subdimensions varied satisfactorily between 0.90 and 0.95.

The literature of knowledge management agrees with the multidimensional nature of tacit knowledge. Nonaka (1994) divides tacit knowledge into cognitive and technical dimensions. Wagner (1987) introduces the social aspect as a crucial dimension of tacit knowledge (Jisr and Maamari 2017). In this study, individual knowledge forms cognitive dimension; managerial knowledge and expertise knowledge form technical dimension and collective knowledge forms social dimension of tacit knowledge.

2.3.4 *First and Second Order Confirmatory Factor Analysis (CFA)*

In the second step, construct validity of tacit knowledge was assessed by first and second order confirmatory factor analyses. Results obtained from these analyses are summarized in Table 2.2 below, which openly supported the former EFA results regarding tacit knowledge construct.

We further examined all variables' standardized regression weights, and these were also found to be significant ($p < 0.001$), which provided support to constructs' convergent validity (Gerbing & Anderson 1988), as shown in Table 2.2. CFA results indicated good model fit ($\chi^2 = 1783.407$ (df = 371, $p < 0.05$), χ^2/df = 4.807, GFI = 0.958, AGFI = 0.947, CFI = 0.978, TLI = 0.974). All values of goodness-of-fit indices were very close to 1.0, indicating that the measurement models provided good support for the factor structure determined through the EFA. The model parameters were estimated using the method of maximum likelihood.

Likewise, a good fit was also found in second-order CFA analysis ($\chi^2 = 1816.355$ (df = 373, $p < 0.05$), χ^2/df = 4.870, GFI = 0.957, AGFI = 0.946, CFI = 0.977, TLI = 0.973). All of the indices values were again very close to 1. These results lead to the conclusion that both models showed a good fit when taken into account with relevant factors. Maximum Likelihood Method was used to calculate model parameters. Regarding each variable, the majority of the indices were acceptable (Cheung and Rensvold 2002; Hair et al. 1998). Additionally, an examination of factor loading significance levels was conducted for each component and none emerged as insignificant (Anderson and Gerbing 1988). Furthermore, the values of average variance extracted (AVE) and composite reliability (CR) were calculated (Hair et al. 1998).

Table 2.2 CFA results

Construct	Std. regression weight[a]
Individual knowledge (alpha = 0.95, CR = 0.93, AVE = 0.58)	
Verbal communication	0.813
Interpersonal communication	0.735
Listening	0.699
Problem solving	0.750
Time management	0.757
Writing (written communication)	0.785
Learning capacity (desire and ability)	0.777
Personal traits (characteristics)	0.773
Coordination	0.768
Managerial knowledge (alpha = 0.93, CR = 0.91, AVE = 0.59)	
Risk taking	0.767
Conceptual skills	0.792
Visionary thinking	0.803
Innovative thinking	0.700
Organization ability	0.805
Strategic thinking	0.799
Planning ability	0.720
Expertise knowledge (alpha = 0.92, CR = 0.91, AVE = 0.60)	
Education level	0.768
Professional development	0.798
Training	0.757
Task responsibility	0.803
Technical (practical) knowledge	0.743
Expertise knowledge	0.832
Professional discipline	0.717
Collective knowledge (alpha = 0.90, CR = 0.90, AVE = 0.55)	
Peer relations	0.824
Knowledge sharing	0.817
Peer assist	0.751
Team communication	0.789
Supervisor-subordinate communication	0.568
Team work	0.750
Collective working	0.664

Source: The table data calculated by authors

[a]All standardized regression weights are significant at $p < 0.001$

As Table 2.2 presents, CR value varied in a range of 0.895 and 0.926, which provided proof of acceptable construct reliability. Strong scale convergent validity was also found, since the AVE values were greater than the suggested level (0.50).

Table 2.3 Discriminant validity

Test description	Unconstrained model χ^2	Constrained model χ^2	Difference
1 Individual—Managerial	537.321	576.529	39.208*
2 Individual—Expertise	507.057	531.894	24.837*
3 Individual—Collective	450.734	518.790	68.056*
4 Managerial—Expertise	302.994	329.229	26.235*
5 Managerial—Collective	291.793	313.726	21.933*
6 Expertise—Collective	347.009	411.657	64.648*
*$p < 0.01$			

Source: The table data calculated by authors

2.3.5 Discriminant Validity

Discriminant validity unveils how unique the measures of different dimensions of Tacit Knowledge factors are when considered together. Table 2.3 summarizes the results of pairwise tests conducted to investigate discriminant validity. The discriminant validity criterion was strongly supported with these findings.

2.3.6 Common Method Bias

In accordance with the recommendation by Podsakoff and Organ (1986), potential bias was checked with one-factor test. To group the variables per suggestion by Harman's test, a factor analysis with principal components extraction was conducted along with factor analyses on all the included items. Four factors had Eigen values greater than one. These factors explained 42.25 percent of total variance. With these test results, it was shown that common method bias did not constitute a problem.

2.3.7 Structural Model

Structural model is given in Fig. 2.1. Cronbach's alpha method was used for the unidimensionality of each construct. As indicated in Table 2.4, all of the Cronbach's α values were above the threshold value of 0.70 (Hair et al. 1998). This test supports unidimensionality and hence it was approved as being reliable. There were seven items measuring individual performance. These items compare performance, craft knowledge, success, motivation level, institutional affiliation, value generation and satisfaction level of employees with rival firms' employees. Likewise, seven items again were employed to measure financial performance. These items compare revenue growth, net profit, cash flow, profit to revenue ratio, return on assets, profitability, and share of net revenue of firm with rival firms.

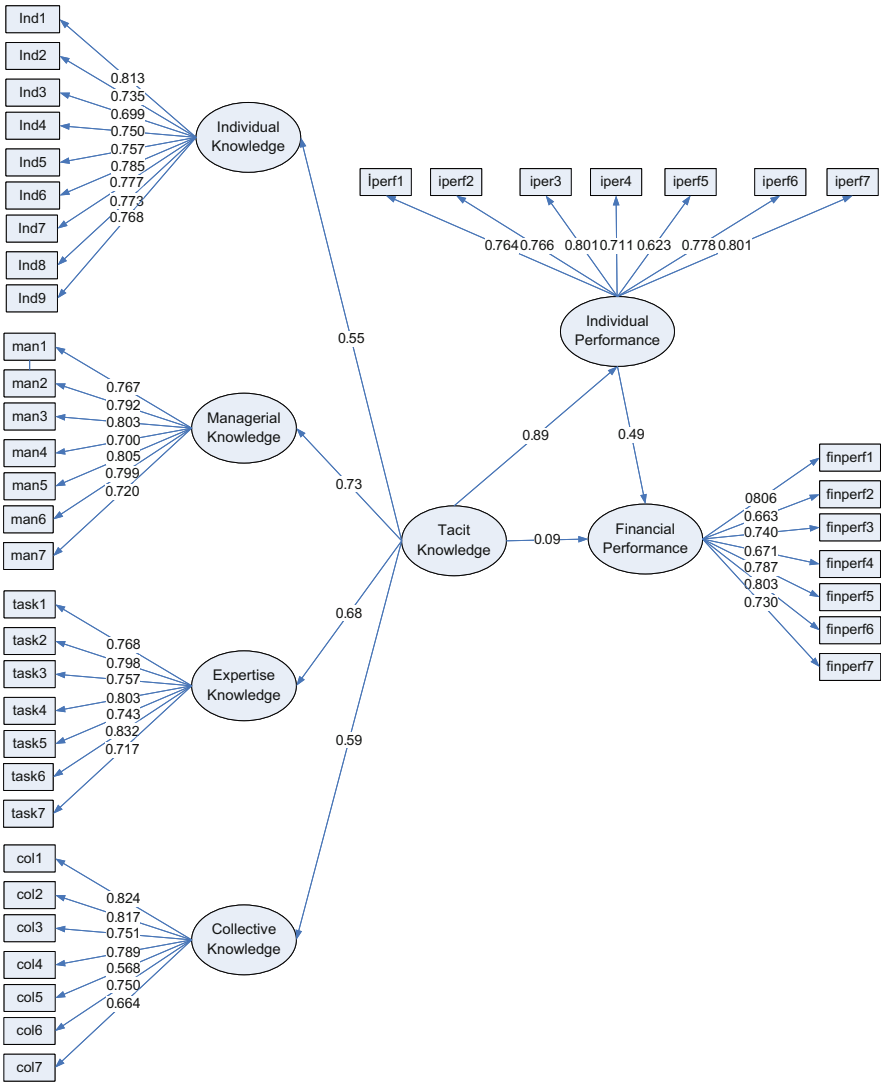

Fig. 2.1 Results of the path model (Source: The figure data calculated by authors)

Structural equations modeling (SEM) were used for testing relationships in the research model. Obtained values for goodness-of-fit indices [$\chi^2 = 4036.165$ with df = 818; χ^2/df = 4.934; GFI = 0.934; AGFI = 0.923; TFI = 0960; CFI = 0.964; RMR = 0.035; RFI = 0.950; IFI = 0.964; RMSEA = 0.038] reached acceptable levels. The results showed a good fit.

Table 2.4 Unidimensionality test

Constructs	Number of indicators	Cronbach alpha
Individual knowledge	9	0.930
Managerial knowledge	7	0.919
Expertise knowledge	7	0.915
Collective knowledge	7	0.896
Individual performance	7	0.908
Financial performance	7	0.904

Source: The table data calculated by authors

Table 2.5 Regression weights between constructs in path model

Hypothesis	Causal path	Regression weights
H1	Tacit knowledge—Financial performance	0.09
H2	Tacit knowledge—Individual performance	0.89
H3	Tacit knowledge—Financial performance (Through mediating impact of Individual performance)	0.43

Source: The table data calculated by authors

2.3.8 Hypothesis Test Results

Path model and regression weight results are given in Fig. 2.1 and Table 2.5. The relationship between tacit knowledge and financial performance was insignificant ($Y11 = 0.09$, $p > 0.05$), thus not supporting H1. The relationship between tacit knowledge and individual performance was significant ($Y12 = 0.89$, $p < 0.05$), supporting the claim of H2 that there was a positive relationship between these constructs. This result conformed to findings from previous studies in the literature.

In order to be able to speak of existence of a mediation effect, four important conditions need to be satisfied (Baron and Kenny 1986). There was a full mediation in this study. First, the regression weight of the independent variable, tacit knowledge, and the dependent variable, financial performance, was found to be insignificant ($Y11 = 0.09$, $p > 0.05$). Secondly, the independent variable has to be a significant predictor of the mediator: the regression weight of the independent variable, tacit knowledge and the mediator, individual performance, was found as significant ($Y12 = 0.89$, $p < 0.05$). Third, the mediator must be significant predictor of the dependent variable: the relationship between the mediator, individual performance, and the dependent variable, financial performance was found to be significant ($\beta 21 = 0.49$, $p < 0.05$). Finally, the independent variable's influence on the dependent variable had to shift when the mediating variable is introduced: Formulas 1 and 2 show that the effect of tacit knowledge on financial performance changed when controlling for the individual performance. It is concluded that the relationship between the tacit knowledge and financial performance was significant when individual performance was included. Therefore, individual performance fully mediated the relationship between tacit knowledge and financial performance, supporting H3.

In addition, Sobel test was employed (Baron and Kenny 1986; Crawford and Sobel 1982) to confirm a full mediation, since the Sobel z test value was significant (test statistic = 12.52).

$$Y12 * \beta 21 = 0.89 * 0.49 = 0.436 \tag{2.1}$$

$$Y11 = 0.09 \tag{2.2}$$

2.4 Conclusion

In this chapter we have identified the impact of tacit knowledge on individual and financial performances. According to results the significant relation can be seen which is supporting the literature. It is possible to say, tacit knowledge is a critical issue in the competition of the firms. The world is changing in a rapid way and to survive in this non-predictable environment, the firms should find new ideas, which will affect both the individual and financial performances. Tacit knowledge is the resource to help firms to create new ideas. However, to use that resource, there must be a culture supporting their employees and accepting them as the firm's intellectual capital. Otherwise, it will be hard for a company to reach that tacit knowledge and store it. Because, if there is no knowledge sharing atmosphere and the opportunities to help employees to increase their individual performances, there is no reason for an employee to make any contributions. For increasing both individual and financial performances, firstly the environment, which supports to reach tacit knowledge, must be created. Secondly, according to their skills, abilities, education, etc., correct employees should be selected and hired and then, some methodologies like organizational learning or knowledge sharing must be created to get that tacit knowledge from the employees.

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Chapter 3
Digitalization in Turkish Capital Markets: A Regulatory Approach

Erkan Uysal and Sevinç Bozkaya

Abstract Technological developments have played an important role in all dimensions of the business world. Regulators, corporations, investors, and intermediaries were forced to adopt new perspectives to cope with continuous technological changes in a dynamic capital market environment. Digitalization became inevitable and players in capital markets have transformed their operations, behaviors, and decision-making methods dramatically to achieve better performance. In such a rapidly changing environment, capital markets regulators are forced to adopt new digital technologies to cope with the change and increase regulatory efficiency. The vitality of information in capital markets brought new ways to handle and analyze data for better financial decisions and sound regulations. As capital market corporations and intermediaries transformed into digital managerial perspectives, regulators are forced to adapt accordingly. Regulation involves a wide spectrum including disclosing timely and accurate data for investors to achieve better decisions, enforcing corporations for compliance, having intermediaries work efficiently, investor education, and market surveillance. In this chapter, the recent regulatory developments regarding digitalization in Turkish capital markets are elucidated.

Keywords Capital markets regulation · Digital asset · Dematerialization · Clearing and settlement · Public disclosure platform · Digital technology

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3.1 Introduction

Recent developments in capital markets resulted in increased transaction volume especially in digital platforms and the introduction of new financial products, and this in turn changed the nature of capital markets. In such a dynamic market with increasing international transactions, digitalization became a significant issue bringing regulators new challenges. These challenges forced regulators to focus more on regulations related to digital activities to protect investors and maintain the soundness of financial institutions and companies. The capital markets industry is based on data. However, the degree of digitalization in this industry lags behind other financial services, comparatively. Going digital in capital markets will be a result of innovation rather than operations and enablement (WEB1 2020).

Digital transformation of capital markets brings advantages. With digitalization, capital market activities contribute to both efficiency and flexibility of transactions and reduce transaction costs. On the other hand, there are also disadvantages of digitalization. For example, electronic exchanges that operate without intermediaries face the risk of customers not fulfilling their cash and security obligations. Moreover, there is an information security risk that may result in the theft of vital customer information as a result of unauthorized users accessing the system including cyber-attacks.

Digitalization changes our understanding of professional services. Product diversity and access to different markets both enrich the capital market activity and there arises a need to make better regulations. As the capital markets area is data-based, innovation will be an important part of capital markets' digitalization.

3.2 Regulation in Capital Markets

3.2.1 Need for Regulation

The main function of financial markets is to transfer funds from those who have savings or funds without investment opportunities to those who have opportunities and need these funds in an economy. So that resources will be used in productive activities and all economic units will be better off. A well functioning financial market is crucial to economic growth.

Financial crises around the world have shown that weak financial systems have resulted in devastating economic consequences. According to studies of the World Bank: "*deep and broad financial markets have enhanced access to finance for more firms and individuals at an acceptable cost, and reduced volatility distortions and risk by improving transparency, competition and diversity of products and services*" (The World Bank Study 2003). To attain deep, broad, and well functioning financial markets, there should be sound regulations.

Financial regulation encompasses a wide range of activities, from setting accounting standards, through bank capital requirements to insider dealer legislation, controls on money laundering, and rules on investor protection (Davies and Green 2008). However, there are two main reasons for regulation in financial markets (Mishkin 2007).

– Increase information to investors, and
– Ensure the soundness of financial intermediaries.

There are wide ranges of regulations regarding the protection of investors, from the prevention of capital market crimes in capital markets to regulations such as public disclosure. Regulations made in the capital markets for the protection of investors cover the regulation of business rules regarding financial products or services offered by intermediary institutions to their customers. The regulation of business conduct rules is especially important in terms of ensuring the balance between protecting the investor in new financial products and services and providing sufficient flexibility to the market environment (Kınık 2002).

Information is the key to financial market development. Due to the lack of correct and timely information asymmetric information problem arises in the markets. This problem can be seen in two ways namely; adverse selection and moral hazard (Rose 1994). Asymmetric information negatively affects the efficient functioning of financial markets and may also keep investors away from financial markets. To prevent this problem in capital markets, securities market regulators require corporations issuing securities to disclose certain information about their sales, assets, and earnings to the public and restrict insider-trading activities trading by the largest stockholders (known as insiders) in the corporation.

The objective of capital market regulation is to ensure the functioning and development of capital markets in a secure, transparent, efficient, stable, fair, and competitive environment and to protect the rights and interests of investors. However, in an interconnected global capital market, regulators around the world should act in harmony. For this purpose, The International Organization of Securities Commissions (IOSCO) was formed in 1983. IOSCO produces principles as a guide for securities regulation. As will be explained in detail in the following parts, IOSCO regulations cover all regulatory issues including the problems arising from today's technologically driven capital markets.

IOSCO, as the leading international body that brings together the world's securities regulators, is a global standard setter for the securities sector. Its membership regulates more than 95% of the world's securities markets in more than 115 jurisdictions and it continues to expand. The IOSCO Board is made up of 34 securities regulators ranging from developed country regulators to emerging country regulators including Turkey (WEB2 2020).

The main role of IOSCO is to develop, implement, and promote adherence to international standards for securities regulation. It cooperates with the G20 and the Financial Stability Board (FSB) on the global regulatory reform agenda. IOSCO principles are regarded as a guiding tool for all security market regulators around the world. Regarding the regulation of trading securities on a digital platform, IOSCO

suggests three principles to be taken into account, namely; the protection of investors, ensuring that securities markets are fair, efficient, and transparent, and the reduction of systemic risk. To attain these goals, IOSCO suggests that the following principles should be followed in the process of making regulations on securities transactions to be made on the Internet (WEB3 2020).

- "*The fundamental principles of securities regulation do not change based on the medium,*
- *Consistent with the fundamental principles of securities regulation, regulators should not unnecessarily impede the legitimate use of the Internet by market participants and markets,*
- *Regulators should strive for transparency and consistency regarding how their regulations apply in an Internet environment*,
- *Regulators should cooperate and share information to monitor and police securities activity on the Internet effectively,*
- *Regulators should recognize that electronic media and the use of such media is likely to evolve*" (WEB3 2020).

As can be seen from the above-mentioned principles, IOSCO strongly recommends regulatory authorities adapt to the technological changes in their regulations. The changes in financial markets resulting from technological developments are an inevitable fact, so the regulators should be part of this process to help world financial markets and economies to be better off.

3.2.2 Capital Market Regulation in the Digital Age

The pace of digitalization all over the world almost in all areas also forced regulators to reconsider their approaches and to develop new regulatory systems. The definition of digitalization in the Oxford Advanced Learner's Dictionary was given as: "*Digitalization is the process of changing data into a digital form that can be easily read and processed by a computer*." (Lea and Bradbery 2010). Another definition of digitalization is given at www.gartner.com such that: "*Digitalization is the use of digital technologies to change a business model and provide new revenue and value-producing opportunities; it is the process of moving to a digital business*" (WEB4 2020).

Considering that digitalization is inevitable, it can be said that the regulatory authorities, corporations, intermediary institutions, and investors will face new challenges. There will be extreme data load and will require new methods and systems to cope with it. With the use of this massive data, structured or unstructured, to facilitate decision-making, there would be new approaches to be integrated into decision-making processes. In this regard, capital market companies should benefit a lot by adopting digitalization as a discipline during their establishment (Göksu 2020).

In the past, the bid-ask prices were written on the papers, and related information was recorded in spreadsheets, and the parties were interacting directly. As a result of technological developments in capital markets and the aim of attaining efficient costs, acceleration in the pace of digitalization is observed. Developments in technology and widespread use of the Internet enable capital market activities to be carried out in the digital environment as well as traditional methods. The scope of digital transformation in capital markets mainly focuses on the purchase and sale of securities in an electronic environment, and the storage of trading records on a digital platform.

Technological developments are available at every step of the capital market transactions. At the first step, gathering data from global capital markets and integrating them into the intermediary's order processing system needs to be fast, timely, and at an efficient cost. The main advantage of technologies is that they make it as efficient as possible everyone around the globe can access the information. Moreover, technologies play an important role in establishing the link between real-time data to provide that the decisions are based on correct, timely, and complete data. This, in return, reduces the risks for related parties (WEB5 2020).

Digitalization not only affects trading but also has a strong impact on all capital market participants; namely, stock exchanges, publicly held companies, intermediary institutions, and investors. Due to the complexity of and continuous innovations in capital markets, regulators are granted extensive regulatory powers to respond to the new digital environment (Bartos 2002).

3.2.3 Stock Exchanges

The increase in technology and the Internet have had a profound effect on the structure of equity markets (Kim 2007). In recent years, it has been observed that European Stock Exchanges forced markets and operators to innovate and implement the new technologies to deal with the dynamic regulatory environment. Especially in Europe, there is a greater tendency for stock exchanges to merge for ensuring competitive advantages to have more efficient costs and better distribution of assets. Even though these have a significant effect on the fusion decision, the main reason is to cope with the challenges raised by recent technological innovations (WEB5 2020). Globalization along with digitalization has brought increased specialization and volatility in capital markets (Hanson et al. 2003).

The implementation of the Markets in Financial Instruments Directive (MiFID I) in 2007 resulted in a significant increase of Multilateral Trading Facilities (MTF) in Europe. MiFID I regulates the conduct of investment services and aiming for investor protection (WEB2 2020). The main goal was to increase competition among financial institutions. Technological innovations in dynamic capital markets led to the rise of MTFs as an alternative to the old-fashioned stock markets. MTF, a type of Market Data Processor (MDP), is a term for a self-regulated financial trading platform in European regulatory jargon**.** MiFID defines it as a non-exchange trading

platform, which is operated by an investment firm or market operator. These are alternatives to the traditional stock exchanges where a market is made in securities, typically using electronic systems (WEB5 2020).

The implementation of MiFID I brought up some issues about the regulation of these new markets. In 2018, with the revisions and amendments in MiFID I, the second version, namely MiFID II, addressed that; the law should protect investors. MiFID II reviewed the best execution policy, and specifically required that necessary steps will be taken by firms to ensure a favorable processing of customer's orders (WEB5 2020).

As a result, the new policy has a strong effect on small and medium-sized enterprises since it facilitates their financing through stock markets. So, to survive, small and medium enterprises have to rely on electronic trading by using main operators. This in turn leads directly to more digitalization in capital markets. As a result, all European stock exchanges are integrated into one of the four biggest stocks groups: namely; London Stock Exchange (LSE), Euronext, NASDAQ-OMX, and Deutsche Börse, with the exceptions of some small markets (WEB5 2020).

Even though mergers are an emerging trend in Europe's financial markets to cope with increased competition, the North American markets are showing a pattern oppositely. It is observed that more and more low-cost exchanges are emerging. The examples are the MEMX (member exchange) and Small Exchange and MIAX (Miami Equities Exchange). The main objectives are to avoid the high fees charged by bigger exchanges, to increase competition, and to simplify equity trading in the United States. These developments also reinforce capital markets' digitalization (WEB5 2020).

3.2.4 Publicly Held Companies

Regarding digital technologies, one of the most important impacts in regulations on publicly held companies is the need for digital security requirements in their Initial Public Offering (IPO) and financial reporting activities. Going public is an expensive, time-consuming process for companies. The process of going public involves steps through an IPO that must be approved by the securities regulatory authority and comply with all requirements. The purpose of an IPO is to meet the financing requirements of the issuing company by selling shares to the public. As the market expanded with digitalization and new customers encourage going public, increased regulation can be a challenging factor. Digital transformation will force publicly held companies to provide their duties like reporting and public disclosure by new methods rather than traditional ways.

Public companies can raise funds in the new global markets by allowing the investing public to purchase shares of the company. The financial reports are the main source of information for investors and all related parties ranging from creditors to government authorities. So companies have to invest in digital technologies for digital reporting. Lack of competence and strategy is among the factors

slowing down the development of digital technology in companies. In terms of the capabilities of the independent manager in public companies, it may be recommended that public companies should be experienced in IT processes to increase profitability. With digital transformation, the business model and processes of the company can also be rebuilt.

Digitalization had made it easy for all parties to make better decisions by accessing more information. It is important to establish an electronic platform through which companies can efficiently communicate with other companies, shareholders, and investors. It is possible to access all the available data from anywhere anytime due to the digitalization of corporate data including financial reports. The implementation of international standards such as International Accounting Standards (IAS) regarding Financial Reporting in the capital market is important for the development of markets. Strengthened disclosure will enhance the greater comparability in accounts of companies as a result of the adoption of International Accounting Standards (IAS).

Moreover, a comparable digital filing system would ease the integration of capital markets throughout the global financial environment. This could provide a single point of entry for regulators, as well as for issuing companies and investors. For example, in the US, through SEC's EDGAR (electronic data gathering analysis and retrieval) system, the US capital markets have access to very accurate corporate information either financial or non-financial. In Europe, although there is not a common system, there are discussions about having a system, which would strongly contribute to the integration of European capital markets. A European EDGAR should allow the automatic notification system, as mentioned under the "European passport for issuers", to work effectively. Instead of having a system in which bilateral notification of all authorities regarding the approval of prospectus of an issue, such information could be entered on a multilateral basis in a European Database (Lannoo 2001).

3.2.5 Intermediaries

Due to technological developments, the Internet became a major transaction tool in capital markets. The number of transactions via the Internet has shown a remarkable increase in recent years. In the early 2000s, digitalization has emerged in capital markets, the numbers just doubled compared to the late 1990s. Total stock trading transactions in the world markets are increasingly carried out through online accounts (Kınık 2002).

A survey by the Accenture Company in 2018 shows that capital markets intermediaries seem to have a clear picture of the competitive challenges and changes ahead. According to this survey; "*more than 90% of respondents say that within five years, virtual assistants will handle more than half of customer interactions, and 87% predict that most business-to-business financial transactions will take place on a blockchain*". The industry is changing so quickly that if capital market firms and

institutions can't react fast, they'll be left behind. For this reason, in some areas such as Artificial Intelligence (AI) and cloud computing, capital markets firms have been investing large sums of money for a more digital future to improve efficiency. However, the survey results suggest that a lack of collaboration with IT, incompatible systems, and compliance challenges can stand in the way of getting the most out of their investments. Also, according to the survey, it is clear that change management can be a challenge for investment firms (WEB6 2020).

The main reason for capital market intermediaries to invest in digitalization is that the cost of providing financial services on digital platforms is much less compared to the costs in traditional methods. However, this has resulted in investors' avoidance of using investment-banking services to some extent. Intermediaries with advanced facilities that offer services in globalized capital markets operate with lower commissions. Unless local intermediaries provide services in an electronic environment to reduce their operating expenses, there would be downward pressure on their profitability due to global competition. Management's support to transform into digital trading requirements is vital for the success of these local intermediaries in competition.

Moreover, if it is considered that, as transaction costs are reduced and access to all kinds of information becomes possible due to the progress and widespread use of digitalization day by day, disintermediation is a point mentioned in the discussions on brokerage systems in the world. On the other hand, capital market transactions in the future will not be carried out in a pure trading environment. Capital markets are moving towards systems that allow all stages from worldwide to become fully automated before and after trading and concluding the transaction with a single entry into the systems of the parties mutually. Even though it is thought that there is no need for intermediaries in theory, financial intermediaries will continue to be included in the financial system (Kınık 2002).

Although the computer-based discount brokerage firms operate in a very similar way especially to high discount brokerage firms, no human interaction is established with the customer after the execution of the transactions. The customer profile of the discount-brokerage market consists of investors who know more about what they want and do not need guidance while making their financial planning, who are knowledgeable about capital markets, who are generally technology-friendly and very sensitive to the commission rates charged by brokerage houses (Karakoç 2003).

As trading on digital platforms started to have a significant share, the EU amended MiFID Directives and published new directives known as MiFID II (Markets in Financial Instruments Directive II) to have a better functioning of markets and protection of investors. The MiFID II Directive, in effect as of January 3rd 2018, brought more transparency and protection for European investors by separating the fees paid to intermediaries. MiFID II requires institutional investors to pay a separate fee to brokerage firms for their research (reports, phone calls with analysts, etc.) and activities for accessing companies (conferences and roadshows, one-on-one meetings with company executives, etc.).

Moreover, MiFID II states that clients should be charged for the information provided by the intermediaries. In other words, this information should not be given

to motivate investors to place their orders within the same broker. With MiFID II, asset managers should not attract a customer's trading order in exchange for investment analysis. This rule favors investors and positively affects digitalization in capital markets (WEB7 2020).

Finally, in MiFID II, transparency is the keyword. For the sake of transparency, OTC trades were limited and strict rules have been enforced to end trading of shares and other equity instruments in legally grey areas. MiFID II promotes the establishment of Organized Trading Facilities (OTF), which will take the place of OTC trade for increased transparency in both pre-trade and post-trade.

Intermediaries invest more in technology, especially in artificial intelligence and cloud systems. According to the "Report on New Opportunities for Securities Industry", cloud systems and RPA (Robotic Process Automation) is preferred more for advanced analytics shareholders with more professional preferences in capital market firms. Artificial Intelligence (AI) ranks after and is followed by technology transformation and block chain. It is important for industry leaders that; "*digital transformation is a strategic imperative for the front, middle and back-office processes*". They need to determine the tipping point by analyzing trends and understanding their results much faster than others (WEB1 2020).

3.2.6 Investors

Trading at electronic platforms enables investors to have easy access to financial services at lower costs. As a result of digitalization, new brokerage firms that provide trading services in the electronic environment have entered the market. This increased competition gave investors options so that they could choose among more intermediaries with fewer costs.

With digitalization, investors have faced with an information overflow. The investor can collect market data through the Internet and can access the latest market news via platforms such as web pages and e-mail message boards. This has decreased the asymmetric information because both the investors and the intermediaries had access to capital markets information symmetrically.

On the other hand, the excessive use of social media in all areas led social media groups to mediate in manipulation, fraud, and other illegal practices. Another regulatory issue during digital transformation is related to information security risk. An information security risk may result in the theft of vital customer information because unauthorized users may access the system. Moreover, individual investors have difficulty protecting their personal information and most of them connect to the Internet from computers that do not have firewall protection (Kınık 2002).

The regulatory authorities faced new challenges to cope with such problems and were forced to develop effective regulations. The diversity in the financial services and products offered and the differences in the experience of the investors regarding

capital markets products and services cause a dilemma in the regulations (Çakın 2020).

3.3 Capital Market Regulations in Turkey

3.3.1 Overview of Turkish Capital Markets

The origin of an organized securities market in Turkey goes back to the second half of the nineteenth century. The first securities market in the Ottoman Empire was established under the name of Dersaadet Securities Exchange in 1886. The goal was to provide a platform for trading the bonds issued to finance the Crimean War. Dersaadet Securities Exchange served great possibilities for European investors who were searching for higher returns in Ottoman markets (WEB8 2020).

During World War I, the operations of the exchange halted. After the new Turkish Republic was established, a new law was enacted to reorganize the underdeveloped capital markets, namely; Istanbul Securities and Foreign Exchange Bourse in 1929. In a short time, the Bourse started to operate very actively and contributed to the financing requirements of enterprises during the development stage of the young republic. Unfortunately, the events of the period, especially the Great Depression of 1929 and the approaching World War II, hindered further growth. During the industrial developments of the following years, there was a significant development both in terms of trading and the number and size of corporations, which began to use financing by going public. Those shares had a very high and growing demand from mostly individual investors a well as some institutional investors (WEB8 2020). However, the growth of the markets slowed down and there was very little activity until the 1980s.

After the enactment in liberal economic programs of the 1980s, Turkish capital markets improved by the introduction of a new legislative framework and institutions. In 1981, the "Capital Market Law" was enacted followed by the establishment of the Capital Markets Board of Turkey (CMB) as the sole regulatory authority. Later, as the regulations concerning operational procedures were enacted, the Istanbul Stock Exchange was formally inaugurated at the end of 1985 (WEB8 2020).

CMB, as the main sole independent regulatory authority, "licenses intermediary institutions and collective investment institutions, registers corporations issuing securities, and additionally supervises the clearing organization and securities and precious metal exchanges established in Turkey (WEB9 2020). As of 2020, the participants of capital markets operating under the supervision of CMB are as follows:

- *"507 corporations registered with CMB for shares issues, of which 393 were actively traded on the Istanbul Stock Exchange,*
- *107 brokerage houses,*

- *42 banks, which have a license to deal in off-exchange trading and repo transactions,*
- *702 mutual funds,*
- *84 foreign mutual funds,*
- *9 securities investment companies,*
- *35 real estate investment companies,*
- *11 venture capital investment company,*
- *50 portfolio management companies,*
- *9 rating companies*
- *Istanbul Stock Exchange,*
- *Istanbul Gold Exchange,*
- *Takasbank (Clearing and Settlement Bank).”* (WEB9 2020).

3.3.2 Regulatory Structure and Capital Market Organizations

An independent authority, namely the Capital Markets Board (CMB), mainly regulates Turkish capital markets. However, there are also some self-regulatory institutions to which CMB delegates authority to some extent to increase the regulatory efficiency and to decrease the cost of regulatory practices. In the following part, these institutions are explained.

3.3.3 Capital Markets Board

Securities are the instruments that evidence the financial rights, and in some instances, the power to control the corporations (Hazen 2009). CMB is the main independent regulatory body enforcing the securities laws. The main purpose of the CMB is to ensure that the capital market operates with confidence, clarity and determination, and the protection of the rights and interests of investors. CMB regulates capital market institutions as well as the issue and trading of capital market instruments to provide a reliable, efficient, fair, transparent, stable, and competitive environment in which the rights and interests of investors will be protected. Scope of regulations covers publicly held corporations, intermediaries, investors, and all related exchanges including electronic exchanges and other electronic securities markets. On its web site, CMB defines its regulatory functions regarding primary and secondary markets as follows:

3.3.3.1 Functions Related to the Primary Markets

- *“registration of the publicly held companies and the capital market instruments to be issued or offered to the public,*

- *ensuring accurate and complete information dissemination in the markets in conformity with the disclosure system adopted by amendments to CML by law no. 3794,*
- *regulation of the establishment requirements and operating principles for independent external auditing companies,*
- *regulation of the standards for financial statements and reports to be prepared by the corporations and to determine the principles for their auditing and announcement procedure,*
- *determination of the standards for prospectuses and circulars published in the public offering of the capital market instruments,*
- *to oversee all kinds of announcements, advertisements, and publications related to the capital markets to prevent dissemination of misleading information,*
- *determination of the principles for proxy voting in the general assembly of the publicly held companies,*
- *to regulate the issuing process of capital market instruments,*
- *to regulate the issues and public offerings of capital market instruments by nonresidents,*
- *to regulate margin trading on capital market instruments,*
- *to regulate the rating of financial instruments,*
- *to regulate and supervise public offerings and capital market activities and transactions that are made through all kinds of electronic communication tools and media and similar tools including the internet and pursuant to general rules to provide for and supervise the use of electronic signatures in activities within the scope of the CML"* (WEB10 2020).

3.3.3.2 Functions Related to the Secondary Markets

"*In the secondary markets, the CMB has the authority and responsibility:*

- *to regulate and supervise both the organization and the operation of the stock exchanges and the over-the-counter markets,*
- *to regulate and supervise the clearing, settlement, and custody systems,*
- *to regulate and supervise precious metal exchanges,*
- *to regulate and supervise future contracts based on economic and financial indicators, capital market instruments, commodities, foreign currency and precious metals*" (WEB9 2020).

3.3.4 Borsa Istanbul

Borsa Istanbul is the main exchange in Turkish capital markets as well as an important part of global stock exchanges. All the exchanges under the supervision of CMB were merged under the roof of Borsa Istanbul (previously known as the

Istanbul Stock Exchange) in 2013. This merger in 2013 has provided the opportunity to domestic and international investors to invest in various products in organized and reliable aforementioned markets. There are four main markets operating in Borsa Istanbul, namely; equity market, debt securities market, derivatives market, precious metals, and diamond market.

3.3.5 Association of Intermediary Institutions (TCMA)

The Association of Capital Market Intermediary Institutions of Turkey was established in March 2001 as a self-regulatory organization in the Turkish capital markets supervised by CMB. The brokerage houses and banks that are authorized for capital market operations constitute the members of the Association. In 2014, portfolio management companies and investment funds joined the association, and the name turned into Turkish Capital Markets Association (TCMA). The primary aim of TCMA is to regulate intermediaries in Turkey so that fair competition and solidarity among its members along with prudent and disciplined conduct of business will be achieved (WEB11 2020).

3.3.6 Central Registry Agency (CRA)

Central Securities Depositories (CSD) are post-trade institutions playing a very significant role in capital markets. A CSD has to conduct one or more of the following functions; "*operating a Security Settlement System (SSS), performing the first registry of securities and holding securities accounts centrally*" (WEB12 2020).

The first authorized central securities depository, The ISE Settlement and Custody, Inc. (Takasbank) was established by the ISE in 1992. Its main duty was to perform settlement of all transactions on the ISE markets either in cash or securities. Until 1995, it physically kept shares of listed companies on a participant (mainly an intermediary) based on its physically immobilized systems. Following the financial crisis in 1994, some financial intermediaries went bankrupt. Then, the Takasbank was legally empowered for the establishment of a beneficiary owner based physical system. The Takasbank was granted a license for investment banking activities in 1997. During this period, new certificates were printed for capital increases and the physical issue of stock certificates continued. However, the shares of publicly traded companies listed in ISE were deposited at Takasbank, initially on a participant basis followed by an investor basis later. Therefore, old law regarding valuable papers and the physical system was legally binding for securities until 2005 as the Takasbank continued its functions (WEB12 2020).

The dematerialization of mutual funds in April 2005 was the first step. Following this, in November 2005, all shares being traded on the ISE were completely in

electronic form. Since 2005, all of the new issues of securities have been in electronic form.

CRA was established as the central depository for all dematerialized capital market instruments in 2001. "*CRA dematerializes and registers capital market instruments and the rights attached in the electronic form concerning issuers, intermediary institutions, and right holders*" (WEB13 2020). Dematerialization is the electronic recording of capital market instruments, instead of storing them in a physical form, without any change in their qualities and associated rights. As CRA became the main depository institution, Takasbank's role was limited to being a clearing and settlement institution.

3.3.7 Clearing House

Istanbul Takas ve Saklama Bankası A.Ş. (the "Takasbank"), the central clearing and settlement house in Turkey, also provides Central Counter Party (CCP) services for specific BIST markets. As part of the CCP practice; "*Takasbank operates through the open offer method in which Takasbank acts as the buyer against the seller and as the seller against the buyer, to fulfill the clearing and settlement of trades conducted in the relevant markets. In other words, Takasbank, as a CCP, undertakes to conduct the clearing and settlement of the trades of its members in the respective markets and, based on this, Takasbank requires each CCP member to deposit a sufficient amount of collateral and guarantee fund contribution to avoid any pre-trade or post-trade risks that may be incurred by market participants*" (WEB14 2020).

The main purpose and activity of the Takasbank are to; "*provide clearing, settlement, and custody services within the framework of the capital market and related exchange regulations as well as rendering investment banking services within the scope of the Banking Law and other banking regulations in Turkey*" (WEB6 2020). Takasbank aims to complete settlement transactions of Turkish Capital Markets with minimizing risks, providing liquidity to the relevant money and capital markets and without errors and on time. It renders clearing and settlement services in a full automation environment via an on-line connection with the organized markets.

Moreover, Takasbank provides the following services for the spot platform where electronic commodity certificates based on cotton, wheat, barley, bean, lentil, corn, oat bran, olive, rough rice are traded: commodity certificate registration in Takasbank system, International Securities Identification Number (ISIN) allocation and execution of settlement transactions through Takasbank Real Time Gross Settlement Delivery vs. Payment (RTGS DVP) systems.

3.4 Recent Regulatory Developments Regarding Digitalization in Turkish Capital Markets

Regulatory frameworks and values have become increasingly important since the digital platforms became more and more commonly used. The increasing volume of digital capital market activities requires new approaches to the regulation of markets. These approaches are aimed to strengthen the trust in the market by providing effective, transparent, and accurate information, as well as protecting investors' rights and interests. Regulations regarding digitalization should aim to bring advantages like time and cost savings and also decreasing operational risks.

It was determined as an absolute necessity to establish a well-organized and computerized surveillance system for the markets due to the development of the Turkish securities markets. In the leadership of the IT department, all departments of CMB take an important part in digitalization studies. The main responsibilities and functions of the IT Department are to form a real database and a reliable computerized system data processing based mostly on the cloud system. New CMB regulations define rules and procedures regarding the management of information systems of all capital market participants.

The CMB formulates its regulations regarding digitalization mainly following with IOSCO principles and EU directives. In the second report of IOSCO dated 2001, it was stated that the capital market activities carried out electronically have increased the volume and number of trading activities, variety of trading parties and their experiences, and the complexity of trading. Moreover, it also stated the negative effects on systems capacity and security due to higher security breaches. As a solution to this problem, IOSCO issued some guidelines and directives for regulators as follows:

- "*managing capacity to accommodate growth;*
- *conducting periodic capacity stress tests;*
- *assessing technological performance and vulnerabilities;*
- *developing backup technology systems to handle outages;*
- *developing procedures for handling system capacity problems;*
- *providing for notification and alternative means to place orders when Internet access is slow or unavailable;*
- *providing adequate investor telephone access;*
- *installing systems to help detect, prevent and deter unauthorized access;*
- *implementing ongoing monitoring and crisis management procedures;*
- *implementing systems to maintain data integrity whether stored, in transit, or displayed on the client's screen;*
- *instituting controls to maintain the integrity of software source code;*
- *undertaking regular expert security testing, whether in-house or outsourced;*
- *using encryption, authentication, and non-repudiation techniques (e.g., the use of digital certificates from certification authorities) as appropriate;*
- *protecting the system against viruses;*

– *utilizing audits by professional IT auditors;*
– *maintaining records enabling the reconstruction of financial transactions;*
– *establishing an efficient machinery for handling complaints; and*

undertaking investor education." (WEB15 2020).

CMB, as mentioned earlier, follows IOSCO principles as the main regulatory guide to integrating into global capital markets. In this regard, there have been regulatory developments in Turkish capital markets in recent years, which have affected all capital market participants.

3.4.1 Public Disclosure Platform

The Public Disclosure Platform (PDP) is an electronic platform to publicly disclose electronically signed notifications required by the regulations. According to regulations, the information should be disseminated and disclosed to the public with an electronic signature. (WEB10 2020).

According to the Capital Markets Board of Turkey's (CMB) "Communiqué Regarding Principles of Submitting Electronically Signed Information, Documents, and Notifications to the Public Disclosure Platform", all information and documents that have to be publicly disclosed should be sent to the PDP. CRA-Investor and Corporate Governance Services Department operates and manages the system on a 7/24 basis. The system covers over 700 companies, 1000 investment funds, and 3000 users all over Turkey.

PDP is structured such that everyone will have access to disclosed information about Borsa Istanbul companies, through the Internet at low costs. As PDP receives notifications through electronic certificates, companies are obliged to keep a sufficient quantity of valid electronic certificates to keep a continuous flow of notifications. Moreover, before applying to the CMB for the initial registration of participation certificates or an IPO, publicly held companies or exchange-traded funds (ETFs) should get electronic certificates from the electronic certificate provider. These certificates are required for being listed on the Borsa Istanbul. Furthermore, PDP serves as a database that provides easy and low-cost access to historical information.

Besides Borsa Istanbul companies and ETFs, mutual funds, venture capital investment funds, real estate investment funds, investment firms, pension funds, foreign funds, and portfolio management companies also may send notifications to PDP. Independent audit companies, on the other hand, send the electronically signed financial statements to the relevant company electronically to be announced to the public if an independent audit is required.

The regulation regarding PDP should draw a framework for how and for how long, information that could affect investors' trading decisions or the valuation of securities will be shared with the public through the media or other means of communication (Kınık 2002). The use of the Internet in public disclosure brings

continuous access to information on web sites. In this regard, publicly held companies should take necessary actions to provide up-to-date information on their websites provided that the information is accurate. Moreover, Internet technology allows hyperlinks and multimedia facilities, which are not available in traditional methods. The use of hyperlinks should be regulated so that the related documents and responsibilities of the companies would be clarified (Ünal 2000).

3.4.2 Dematerialization of Capital Market Instruments

The definition of dematerialization is given in Investopedia as follows: "*Dematerialization is the move from physical certificates to electronic bookkeeping. Actual stock certificates are then removed and retired from circulation in exchange for electronic recording*" (WEB16 2020). Some trading institutions due to the fact they have the most accurate form of record-keeping require dematerialized accounts. Dematerialization was designed to offer more security, as well as increased speed, to financial trades. It has become the norm in bookkeeping for financial institutions.

Regulations of most capital market authorities oblige intermediaries to know their customers. As every investor has a different risk-return profile, it is important for intermediaries need to know the risk appetite of their customers. In case the investor has not enough knowledge of markets and experience, they may face huge losses from the transactions on electronic platforms. If intermediaries have information about the customers' financial condition, risk and return preferences, it will be possible to help investors reach rational information about the risks they can take (Barber and Odean 1999).

According to IOSCO's recommendations regarding the regulation of securities transactions carried out electronically, it is necessary to revise the regulations in a way to protect investors in electronic transactions. Basic principles of the capital market regulations do not differ according to the instruments, whether it is on electronic platforms or in traditional trading methods.

In line with IOSCO recommendations, CMB issued regulations regarding the dematerialization of securities in Turkish capital markets. According to law; "*capital market instruments shall be issued in the dematerialized form in the electronic environment, without certificates. The Board determines the capital market instruments to be issued in dematerialized form and the rights to be monitored on record; establishes the principles and procedures regarding their dematerialization as to their types and issuers, the record-keeping and the termination of the monitoring of records belonging to issuers who have lost membership conditions*" (CML 2019).

Also, "*rights related to dematerialized capital market instruments shall be monitored by the CRA. The records shall be kept by CRA members, in the electronic environment created by this agency*" (CML 2019).

In the same article, it is also said that: "*Measures, attachments and all kinds of similar administrative and judicial requests concerning the dematerialized capital market instruments shall be carried out by CRA members. Provisions in the related*

laws regarding the follow-up and collection of receivables for which a notice has been made in the electronic environment shall be reserved. Publicly-held corporations may fulfill their obligations established in this article via the electronic environment provided by the CRA" (CML 2019).

After 2005, issues of new securities have all been in electronic form. In the physical system, which prevailed until November 2005, physical certificates were legally binding, however in the new system after 2005 records held at CRA have been legally binding. The new law removed the physical issue of securities and rights affixed on them. The new electronic system is part of a different new legal platform. The new system eliminated physical shares and introduced depositing of shares and affixed rights in an electronic platform, and this eliminated the legal basis of the valuable papers. The digital system has changed many legal principles regarding the valuable papers law. It led to the rise of new institutions and the legal bases of the rights to be affixed on shares was changed. In the old physical system, only stocks being traded, in other words, floating shares, were physically deposited in Takasbank. In the new electronic recording system all shares, floating and non-floating shares, are kept in electronic, dematerialized, form. With the new legal system, all issued shares, either floating or non-floating, of publicly traded companies are held in CRA in the electronic system. Moreover, all mutual funds, corporate bonds, covered bonds, warrants, commercial papers, and asset-backed securities are also issued and held in the same way as shares.

Rights affixed on all dematerialized securities are also kept in CRA records. Takasbank's position as a depository institution is to hold issued stocks in physical form. On the other hand, CRA is mainly a central depository institution and it holds securities in electronic form along with the rights affixed on them. According to law, CRA's records are attributed legal basis. In this new structure, CRA performs full functions of a typical Central Securities Depository (CSD).

According to the new regulation of dematerialization, in registering the transferred securities to related books, the records at CRA can be considered as the basis by issuers without any need for other documentary proof. CRA not only acts as the Central Securities Depository but also performs a function such as assessing an investor's status against issuers. This is the "registry" function as defined in post-trade jargon. So, CRA has combined the depository function with the registrar function.

Furthermore, the new Turkish Commercial Code clarifies the legal platform of the records held at CRA. If registered shares of listed companies are traded on an exchange, the new law states CRA should inform the corporations about the identity of the seller-buyer and the number of securities sold or will provide electronic access to companies in to access the information (WEB12 2020).

3.4.3 Other Regulations

As one of the main pillars regarding digitalization studies is the launch of the BISTECH Technological Transformation Program initiated in 2014. "*BISTECH is a technological infrastructure that allows algorithmic trading and high-frequency trading operations in Borsa Istanbul*" (WEB17 2020). It was established after a strategic memorandum of understanding between Borsa Istanbul and NASDAQ. The purpose of BISTECH is the operation of all markets on a single platform. This program decreases order-processing time down to below 100 ms. In return, more professional investors are attracted so that remarkable increases in trading volume are achieved.

Another topic of digitalization is the web content of the intermediaries. With the new regulations, intermediaries that process order transactions electronically should include the following information on their web sites.

- Execution of order submission, transactions, and settlement
- All the information about capital market instruments, stock exchange, and markets
- Notification of customers about their responsibilities for following electronic transactions
- The content of "contingency plans" prepared against possible risks.

Another topic is the electronic signature. CML states that "It is among the duties and powers of the Capital Markets Board of Turkey to regulate and supervise the principles of using electronic signature in issues and public offerings, capital market activities and transactions carried out through all kinds of electronic information communication tools and media including the internet and similar tools, and transactions within the scope of the law".

3.5 Conclusion

Globalization brought dramatic changes in every aspect of the business. Companies, consumers, governments, financial markets, and regulators all had to change their business conducts. The increased competition resulted in the complexity of operations and digitalization became a strong tool for dealing with new challenges.

Especially in financial markets, due to the speed of transactions and the complex nature of decision-making in investment activities, digitalization played a very significant role. Capital market participants, namely publicly held companies, intermediaries, investors, and regulators, employed information systems to cope with the dynamic nature of markets. Considering the important function of financial markets in economic development, the adaptation to a new digital era is very important. In recent years digitalization changed capital markets so that markets would be more

efficient, fair, and stable. All capital market players transformed their information systems so they could face the challenges brought by competition.

In capital markets, significant steps were taken by regulators to provide a fair trading platform and to protect investors by providing accurate, comprehensive, and timely information. International Organization of Securities Commissions (IOSCO) publishes principles as guidelines for effective regulation. Capital market regulators all over the world adopt these principles. Capital Markets Board of Turkey, using IOSCO principles and EU Directives as a guideline, regulated Turkish capital markets to compete with dynamic global capital markets and to attract more funds to Turkish markets. It is inevitable to organize markets in line with digital transformation and regulate markets accordingly.

In recent years Turkish capital markets showed important structural changes regarding the development of digitalization in markets. All publicly traded securities were dematerialized and necessary institutions were established. Central Registry Agency was restructured so that all securities are kept safely without losing any legal base. Moreover, intermediary and customer relations were regulated so that intermediaries would invest in their IT operations to protect investor rights and interests. Also, there have been new regulations regarding how companies would apply digitalization in their issues of stocks and other securities.

In sum, Turkish capital markets have shown remarkable progress in terms of digitalization. All aspects of the functions of the market are regulated in line with international regulatory standards. Operations in Turkish capital markets reached a level of digitalization such that international investors, as well as domestic investors can reach accurate, timely, and reliable information with a sound regulatory environment.

Technological developments have played an important role in all dimensions of the business world. Regulators, corporations, investors, and intermediaries were forced to adopt new perspectives to cope with continuous technological changes in a dynamic capital market environment. Digitalization became inevitable and players in capital markets have transformed their operations, behaviors, and decision-making methods dramatically to achieve better performance. In such a rapidly changing environment, capital markets regulators are forced to adopt new digital technologies to cope with the change and increase regulatory efficiency. The vitality of information in capital markets brought new ways to handle and analyze data for better financial decisions and sound regulations. As capital market corporations and intermediaries transformed into digital managerial perspectives, regulators are forced to adapt accordingly. Regulation involves a wide spectrum including disclosing timely and accurate data for investors to achieve better decisions, enforcing corporations for compliance, having intermediaries work efficiently, investor education, and market surveillance. In this chapter, the recent regulatory developments regarding digitalization in Turkish capital markets are elucidated.

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Chapter 4
Decentralized Finance

Rasim Ozcan

Abstract Newer and better ways of financing lubricates the wheels of an economy. In recent years, there have been phenomenal changes in technologies used in finance. One of such technologies was introduced by creating the first cryptocurrency Bitcoin. The technology behind this invention is known as blockchain. Although there are and there might be other use cases of blockchain technology, the finance era is important and currently it is the most adapted industry; currently there are a number of cryptocurrencies, tokens, smart contract applications among others. This article seeks to introduce the basics of—so called—decentralized finance (DeFi) through an exploration of blockchain technology in the field of finance. The focus is on the definition of decentralized finance, its elements, its current state and its future. Elimination of intermediary need, easier access, improved inclusiveness, and transaction speed, flexibility to write any contract that can be codable, immutability of transactions, better interoperability and censorship resistance are some of the main advantages of blockchain. Additionally, increased privacy, transparency, enhanced security, efficiency in the form of reduction in overhead costs for banks, and trust are considered as the benefits of blockchain technology in finance, hence for DeFi. Its power need due to the excessive computer power needs, setting standards in validating new blocks and in communicating between different networks are important issues. Besides, user experience, scalability, current speed of blockchain networks, regulations like AML and KYC requirements, the lack of regulation in DeFi, and interoperability are key issues as well. In summary, the current state of DeFi markets is not technologically able to provide a worldwide service at the scale the centralized finance provides. It needs improvements in its technology and sound regulations to gain wide acceptance.

Keywords Decentralized finance · DeFi · Blockchain · Cryptocurrency · Token · Smart contract · Bitcoin · Ethereum · Stablecoin · Permissionless · Borderless

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> Disruptive Innovation describes a process by which a product or service initially takes root in simple applications at the bottom of a market—typically by being less expensive and more accessible—and then relentlessly moves upmarket, eventually displacing established competitors. (Christensen et al. 2015).
>
> Is DeFi, Decentralized Finance disruptive?

4.1 Introduction

Money serves as a medium of exchange, a store of value and a unit of account. Throughout ages, it took different forms from being represented by precious metals to paper money, backed by gold and underwritten by governments. In modern times, it has taken the form of what is called plastic money, debit and credit cards. With the recent technological development in digital space, money once again has changed its form to digital money with the introduction of automated teller machines (ATMs) and digital banking at the start of the second millennium (John 2020a). However, starting with the second decade of the second millennium especially new technologies invented have enabled money gain the ability to be programmable. This has turned out to be disruptive development to the traditional finance.

Disruptive innovation is a term coined by Christensen (1997). It describes a process in which the initial step is simple but later expanding its availability and power to already established larger markets, hence disrupting incumbents. Blockchain technology can be considered as a disruptive innovation. It is introduced by Nakamoto (2008) as the underlying technology for Bitcoin, the first cryptocurrency. As put by Nakamoto, Bitcoin is "a peer-to-peer electronic cash system." It simply started as a cryptocurrency providing basic properties of money. Later, improvements in blockchain technology has programmability feature that eliminates the need for an intermediary, reduces costs of executing transactions etc. All these have become possible by basic features and programmability property of blockchain technology—together called decentralized finance (DeFi), whereas not possible in the traditional finance. Hence, the disruptive potential of decentralized finance grab attention not only from technology savvy people but also from established finance communities and lately from policymakers (Grigo et al. 2020).

One of the most important issues in the financial world is inclusion. People cannot have easy access to financial products and services traditional finance provide. Due to licensing and capital requirements, entry barriers are high in traditional finance. According to a World Bank report (Demirgüç-Kunt et al. 2018), only 69% of all adults have a banking account, hence, 1.7 billion adults are unbanked in 2017. To be an alternative to the traditional finance, a system needs to offer better prices (lower-costs) for small size transactions, to improve inclusiveness, to offer all in a secure way. DeFi can be considered as creating an entirely new financial system with better efficiency and inclusiveness with programmability (John 2020a). Hence, DeFi is "a peer-to-peer electronic financial instrument system" (John 2019).

DeFi improves inclusiveness by making use of permissionless networks. That is anybody who has a computer or like device and means to connect to the internet can participate in a DeFi transaction and enjoy its benefits without worrying about getting a license or any other entry barrier (Popescu 2020a). Hence, DeFi improves inclusion by diminishing barriers the traditional finance has and provide better affordability. According to Hoffman (2020) the average global remittance fee, for example, decreases from 7% to 3% as a result of eliminating the need for intermediaries by moving to DeFi. In addition, the first cryptocurrency, Bitcoin has proved that people can replace governments in backed up a new form of money with higher levels of transparency and improved inclusiveness.

There are privacy and security issues repeatedly in traditional finance as its centralized nature is more prone to such breaches. However, since DeFi keep information in a decentralized manner, it is not that much open to such security breaches.

As it happens in all new technology adoption life cycles, early adopters are people who can relate themselves to the new technology (Moore 2006); in a sense, early adopters are advantaged group of people in terms of familiarity to technology and access to means to it. However, as the new technology matures and gets wider acceptance, it will increase inclusiveness by providing better costs or better products to people who were excluded before.

DeFi's strong hold is to bring markets closer than before by eliminating the need for a middleman, achieving cost efficiencies, and providing open access to anybody who want to participate or develop any product in the system. In addition, decentralized nature of DeFi provides uncensored transaction; a central authority whether a government or large corporation does not have any control of DeFi transactions, hence they cannot enforce any regulation that would hamper financial activity like they could in traditional finance.

According to John (2020b), a person can "take out a loan on one platform, perform a leveraged trade on another, and exchange it back to the base asset," which is made possible by DeFi. Such transfers can be done at a speed that "create a more efficient, laissez-faire market," in comparison to the traditional finance at which, "state interventions routinely slow proper functioning" (John 2020b).

The current legal system is arranged by considering traditional finance. Its tools, the way it operates are all integral part of the current legal system. In addition, the traditional finance is internationally integrated and there are international regulations. To have widespread adoption, DeFi regulations have to be made, have to be part of the legal system throughout the world. Only then, DeFi can become diffused worldwide. For example, according to Raul (2018a), Bitcoin is legal in 99 countries, restricted in 7 countries, illegal in 10 countries; no information is available for 130 countries. Osmani et al. (2020) claims that blockchain technology "opens the door for developing a democratic open and scalable digital economy from a centralized one."

Ability of automated trust functionality and decentralized nature of blockchain technology eliminates the need of monitoring by a central authority (Zhao et al.

2016). However, they consider the current state of blockchain at an early stage and asking for further research to improve its efficiency, speed and security.

It took decades for traditional finance to reach today's level of integration and compatibility between banks, countries and regions. Think for example using a bankcard on different ATMs. There are still different ATM networks (for a bank of a group of banks) that either charging prohibitively high fees to a card that is not belonging to its own network or not allowing to carry out any transaction at all for cards outside of its own network. Currently DeFi is not immune to so-called interoperability problem. However, it will not take so long for DeFi to overcome this problem as smart contracts carry out the job. DeFi's decentralized nature will help to overcome this problem by laying down standards for different blockchain networks.

By benefitting from the distributed ledger technology and smart contracts, i.e., programmable money, DeFi adds benefits on top of what the traditional finance may provide (Christidis and Devetsikiotis 2016) describe smart contracts as "scripts that reside on the blockchain that allow for the automation of multi-step processes." As blockchain networks and DeFi applications mature, tokenization, adding new assets to a blockchain will pick up and see exponential growth (Popescu 2020a). In addition to offer new tools for finance and new ways will be possible due to its technological abilities, i.e., smart contracts and maybe more that cannot be thought right now.

The aim of this study is to explain fundamentals of decentralized finance, its structure, formation and promises on top of what the traditional centralized finance offer. The next section introduces decentralized finance; blockchain, definition of DeFi, its functionality, smart contracts and stablecoins are discussed in this section. Section 4.3 focuses on advantages of DeFi, whereas Sect. 4.4 discusses the issues with DeFi. A short DeFi markets recap is given in Sect. 4.5 in order to show how DeFi markets evolve. The last section concludes the study.

4.2 Decentralize Finance

As a use case of blockchain decentralized finance attract attention in the recent years. It is important to understand what it is, what it promises and whether it can provide its promises given the level of the related technologies, the state of the legal environment, potential improvements in related blockchain limitations and its existing or to be exist instruments. This section introduces blockchain technology and definition of decentralized finance (DeFi), and then talks about its functionally, smart contracts, and the notion of stablecoin.

4.2.1 Blockchain

Blockchain can be considered as continuously updated old style ledgers. One can trace back to the very first transaction from a terminal transaction. That is to say, the whole history of transactions recorded and kept safe, immune to getting lost or immune to any outside interference once recorded to the chain as a new block. Bitcoin introduced by Nakamoto (2008) is the first use case of blockchain technology and first cryptocurrency. There is no government or any assets backing Bitcoin, rather its value is created by the demand and its use by the general public spread the whole world. Its supply is also restricted. It is borderless; it can freely circulate around the world, at least until its usage will be totally banned by a government. Ethereum is the base cryptocurrency blockchain for DeFi with its ability to be programmable. Smart contracts are the basic elements of DeFi, and Ethereum has made it possible to write (in this case to code) contracts to be carried out when predefined conditions are fulfilled. As Chen and Bellavitis (2020) put it, "[b]lockchain technology can eliminate the need for intermediaries in financial transactions, as it can facilitate peer-to-peer transactions through distributed trust and decentralized platforms." Proponents of blockchain technology believe that it will not only revolutionize finance, but also health, logistics, management, and law as well.

Although blockchain technology will potentially affect many industries by providing new ways of doing tasks already existing and making currently impossible tasks possible, there are limitations for blockchain technology. First and foremost is the power need of blockchain due to the excessive computer power needs while reading and writing blocks. The possibility of quantum computer that will have the power to find out the crypto keys necessary to read and write blocks on a chain might be another concern soon. For a discussion on quantum-secured blockchain, see Kiktenko et al. (2018). Most importantly, setting standards in validating new blocks constitute another issue. There are different consensus mechanisms to validate a block in order to add it to a chain: proof-of-work, proof-of-stake, practical Byzantine Fault tolerance. Each has advantages and disadvantages compared to others. However, discussion of these consensus mechanisms is beyond the purposes of this article. For description of different consensus mechanisms, see Tan et al. (2020). In addition to these, as the whole history is kept on the chain, any verification attempt will consume more computer power and time with lengthening chains (Budish 2018). However, for the DeFi use case, distant past may not be as important as close past. Hence, it may not be considered as important as the close past of a transaction. Bose et al. (2019) puts it as "[t]he structure of validating transactions in the Bitcoin blockchain [for example] is akin to nearly everybody simultaneously counting their gross and net wealth every time they purchase a coffee" to explain the flawed design of blockchain. Considering the current state of blockchain technology, Zhao et al. (2016) concedes that it is at an early stage and asking for further research to improve its efficiency, speed and security.

Table 4.1 Types of Blockchains (depending on being private or public chain and being permissioned and permissionless)

Blockchain type	Who can read/write/validate on Blockchain	Who can participate in the consensus mechanism
Private permissioned	Restricted	Restricted
Private permissionless	Restricted	No restriction
Public permissioned	No restriction	Restricted
Public permissionless	No restriction	No restriction

Table 4.1 gives different blockchain structures depending on a blockchain being private or public chain and being permissioned and permissionless. For a detailed discussion, see Tan et al. (2020) and Pilkington (2015). There are four potential types of blockchain networks. Ethereum and Bitcoin are examples of public and permissionless blockchain for which who can read, write or validate on blockchain and who can participate in the consensus mechanism are not restricted to a specific person or persons.

Decentralized structure and elimination of the need for intermediaries to build trust between transacting parties, blockchain can decrease lower transaction costs. According to Tan et al. (2020), blockchain technology decreases monitoring costs and transaction costs. The decentralized structure also gives way to "decentralized, innovative, interoperable, borderless and transparent applications which facilitate open access and encourage permissionless innovations" (Popescu 2020a).

4.2.2 Definition of DeFi

DeFi is a collection of applications running on a blockchain as put by John (2020b). It is composed of applications that carry out traditional financial transactions as well as providing opportunities for new and innovative ways, for new types of transactions that are not possible in the centralized traditional financial system. Hence, there is difference between open finance, which is running traditional financial instruments or types of transactions on blockchain and DeFi, which includes those and new types of transactions that are not possible in the traditional centralized financial system. For a comparison of DeFi and Open Finance, check John (2019). There is no need to mention licensing and other legal requirements of open finance contrary to nonexistence of many of such requirements in the case of DeFi. Therefore, DeFi is a broader concept than Open Finance. Consequently, DeFi provides more opportunities. DeFi developers follow a number of principles as put in Popescu (2020b): open source and compatibility of product, observance of financial inclusion, and most importantly financial transparency. Therefore, main pillars of DeFi

are being permissionless, censorship resistant, programmable, and immutability of transactions (John 2020b).

In the centralized finance, one needs to get a license to do business, and people go through anti-money laundering (AML) and know your customer (KYC) procedures to participate in. However, in decentralized finance there is no central authority to issue a license or to check current AML or KYC requirements defined by the existing laws. Hence, anybody who has the means to access the Internet (a device and an internet connection) can take part in DeFi. More on AML/KYC in the issues with DeFi below.

As there is no central authority and regulations in DeFi, any censorship cannot be extended to DeFi, making DeFi censorship free at the current state. In addition, complex interactions that cannot be carried out by the central finance are the basics of DeFi; if one can code a transaction or an interaction between parties, it is possible in DeFi. It is the matter of codability, not the degree of complexity of transactions or interactions. DeFi allows customization through what is called smart contracts that cannot be achieved by the central finance. This will be better understood when smart contracts explained in Sect. 4.2.4. Immutability of transactions comes from the fundamental property of blockchain structure; any transaction once added to the distributed ledger, it is immutable and cannot be reversed. It becomes a part of the ledger permanently.

Schär (2020) considers DeFi as a niche market with its risks on the one hand and interesting features on "efficiency, transparency, accessibility and interoperability." He concludes that DeFi may help in reaching "a more robust and transparent" overall financial system. In addition, he also draws attention to properties of DeFi where neither participants needs to identify himself or herself. This is the permissionless structure in which trust issue is solved by the decentralized consensus mechanism.

4.2.3 Functionality

DeFi is a new way of doing finance by making use of blockchain technology. That is, DeFi can also carry out the functions the traditional finance offers. According to John (2020b), DeFi surpasses the central finance in international remittance, trading, and lending and borrowing transactions. Like Legos fit each other to form a structure, DeFi applications can be linked and fit each other to institute a complex transaction as a financial instrument. This property of DeFi is mostly referred by "money legos" DeFi Pulse (2019), Popescu (2020a), John (2020b). Being money legos introduces feasibility or increase efficiency in carrying out complex transaction that may not be possible otherwise. For example, it is possible to execute a transaction at one part of the world, then involving a trading in another part without worrying about country borders or regulatory restrictions.

As Totle (2019) points out interoperability is one of the fundamental characteristics of DeFi. Interoperability leads to emergence of peer-to-peer borrowing and lending platforms, decentralized exchanges, and tokenization platforms.

DeFi is a promise to wider and easier global access to expanded financial services. According to a World Bank report (Demirgüç-Kunt et al. 2018) only 69% of all adults have a banking account, 1.7 billion adults are unbanked in 2017. According to the same report, about 1 billion unbanked adults own a mobile phone; among those 480 million have some form of internet access. Considering that carrying out a DeFi transaction just needs a device and access to the Internet, the adults who are unbanked but having internet access have the infrastructure to be part of DeFi transactions. However, they are excluded from the centralized finance. Hence, DeFi can improve financial inclusion more compared to the centralized finance.

4.2.4 Smart Contracts

Just like mobile revolution is made possible by mobile applications, smart contracts are the revolution at the cryptocurrency sphere. Bitcoin is the first step in defining money from traditional sense to digital arena, backed by consensus of people—not by a state. Ethereum is the next step in defining programmable money by creating smart contracts. With smart contracts, anything that can be coded can be incorporated into the money, with self-execution capacity without the need for trusted intermediaries.

Szabo (1994) introduced the concept of smart contract as "[a] smart contract is a computerized transaction protocol that executes the terms of a contract." Together with expected objectives from a contract, minimization of the need for intermediaries is the most important objective in creating a smart contract (Szabo 1994). The idea is to embed contractual clauses in the hardware and software so that it is prohibitively expensive for one to breach a contract (Szabo 1997).

Bartoletti and Pompianu (2017) defines smart contracts as "computer programs that can be consistently executed by a network of mutually distrusting nodes, without the arbitration of a trusted authority." Ramos and Zanko (2020) adds that they are executed only if conditions specified at the time a contract written are fulfilled. Hence, a set of new features are provided by smart contracts as listed in Maesa and Mori (2020): "atomicity, an operation runs entirely or fails without affecting the state; synchronicity, the code is executed in a synchronous way; provenance, the code can only be executed by traceable external calls; availability, the code and associated data is always available; immutability, the code cannot be changed or tampered with after deployment; immortality, the code and data can only be removed if it commits a self destruct operation."

Christidis and Devetsikiotis (2016) describe smart contracts as "scripts that reside on the blockchain that allow for the automation of multi-step processes." In the case of cryptocurrencies, it is a new form of money that is *programmable*; a set of requirements can be set in order to complete a transaction described on a chain without the need of a middleman or trusted body to enforce the contractual requirements. Sets of interacting smart contracts are called decentralized applications (dApps).

Popescu (2020b) counts the benefits of smart contracts to include Automation, cost-efficiency and autonomy. The speed of execution and being free to write and to execute, automation and cost-efficiency are straightforward. Autonomy is the most important feature implying self-sufficiency of smart contracts, immune to manipulation and intervention from anybody. It is this property making smart contracts special, giving the power to be programmable.

Although Bitcoin is the first blockchain network, Ethereum has become the leading programmable blockchain network. Ethereum can handle any computational logic (Grigo et al. 2020) by making use of smart contracts, which are automatically executing transactions once pre-set terms, and conditions hold.

Smartcontracts can serve as a custodian as well with the ability to store cryptoassets; being programmable, one can customize timing, target and conditions to be carried out before finalizing a transaction (Schär 2020). Executions of the pre-specified conditions are carried out deterministically and transparently by smartcontracts. Hence, they minimize possibility of manipulations or outside intervention.

4.2.5 Stablecoins

Volatility of cryptocurrency prices is high. That creates a need for stable price cryptocurrencies, which is called stablecoins. Making use of different mechanisms can create a stablecoin. For example, the most widely used stablecoin, Tether (USDT) is dollar-collateralized; another one, DAI is pegged to the US dollar based on over-collateralization. In addition, USD Coin (USDC) is an example for a centralized one. "With optimized usability, deeper liquidity, and emerging composability, the DEX [decentralized exchange] ecosystem is getting stronger by each day" (Popescu 2020a). Tether, USD Coin, Paxos Standard, TrueUSD, DAI, Digix, HelloGold, BitUSD, can be counted as examples of stablecoins.

Since prices of stablecoins designed to stay stable, they can serve as unit of account and medium of exchange property of money well compared to regular cryptocurrencies. Hence, usage of stablecoins is increasing in DeFi projects (Padilla 2020).

According to collateralization method, there are four types of stablecoins: Fiat-collateralized stablecoins (examples are Tether and TrueUSD), commodity-collateralized stablecoins (examples are Digix and HelloGold), crypto-collateralized stablecoins (examples are BitUSD and Dai), and non-collateralized stablecoins (examples are Carbon and Kowala kUSD) (Rawal 2020).

4.3 Advantages of DeFi

Transparency, easier access, transaction speed, flexibility to write any contract that can be codable, immutability of transactions and censorship resistance are main advantages of blockchain over the traditional finance (Popescu 2020b). On the other hand, Osmani et al. (2020) also lists privacy, transparency, enhanced security, and efficiency in the form of reduction in overhead costs for banks, immutability, faster transactions and trust as the benefits of blockchain technology in finance.

Although current DeFi applications imitate the traditional financial instruments, one can expect much more (Grigo et al. 2020) as implementation of its technological abilities—smart contracts—are understood and adopted by more people from different industries as well as financial industry.

According to Grigo et al. (2020), DeFi can provide "an alternative financial system that is built bottom-up, completely decentralized, censorship-free, low-fee, fully-automated, and without counterparty risk," in a sense DeFi "democratizes financial services."

What DeFi provides on top of the traditional finance are decentralization, open source decentralized applications (dApp), and transparency. Decentralization provides many benefits including the elimination of the need for a trusted intermediary, automatization of monitoring and execution. Open source applications provide access to anybody who may want to develop new financial products or improvements, and provide transparency as what is carried out by a dApp can be seen or tested by outsiders. However, these features are not provided by the traditional financial system (Grigo et al. 2020). For example, according to an HSBC press release (HSBC 2018), distributed ledger technology can save enormous time in trade finance; the time required to get a letter of credit in the traditional finance is about 5–10 days, however, it just takes 24 h if blockchain technology is used.

In addition, as blockchain technology eliminates the need for an intermediary by using decentralized trust mechanism, already existing financial services and instruments can be provided in a decentralized borderless and transparent manner (Chen and Bellavitis 2020). This might lead to innovative business models that may not be feasible in the traditional finance (FSB 2019).

Dal Mas et al. (2020) points some of the cost advantages of DeFi. They show that usage of smart contracts decrease costs of transaction, "increase social trust and foster social proof behaviors that sustain the development of new [sustainable business models]".

An interesting point raised by Sydow et al. (2020) is about usage of blockchain in developing economies. Sydow et al. (2020) argue that blockchain is particularly useful for developing economies in which blockchain can mitigate the problems of transparency, manipulation and safety in data recording. In addition, Bruton et al. (2013) argues that "entrepreneurship offers a means through which people can break the cycle of poverty," and Ahlstrom (2010) argues innovative and growing firms leads to economic growth. Popescu (2020a) claims that bockchain has the capacity to present a foundation for decentralized business models in different industries and

to equip entrepreneurs with necessary tools. Considering all these together, one may say that blockchain technology can help developing countries to improve efficiency in their markets, hence achieve higher economic growth and welfare.

Increased efficiency, degree of transparency provided and accessibility hence improved inclusiveness are the properties of a financial system that DeFi promises (Schär 2020). DeFi encourage inclusiveness by decreasing costs to participate and to make transactions.

Although it is not fully interoperable at the current state due to differences between the underlying blockchains used, better interoperability in the senses of providing communication hence execution of transaction between multiple applications and platforms will lead to financial products and services that are not possible in the traditional finance.

4.4 Issues with DeFi

Although one of the basic idea of DeFi is simplicity, as DeFi matures its complexity increases especially for an ordinary person. Even for simple direct transactions, technical needs and user experience becoming more intricate (Popescu 2020a).

Transaction speed is the measure of speed a network transfers data between accounts once a transaction is desired to be carried out. Faster a network, faster the data transfers, faster validation of transactions, hence less congestion in the network. Hoffman (2020) and Strelenko (2018) mention transaction speed as another problem for the current state of DeFi. Different blockchain networks have different speeds. According to Hoffman (2020), Bitcoin can process 7 transactions/s whereas Ethereum can process 25 transactions/s. Strelenko (2018) gives Litecoin network speed as 56 transaction/s (tx/s), Bitcoin cash network as 61 tx/s, PayPal as 193 tx/s, Ripple network as 1500 tx/s, Stellar as 1000 tx/s compared to Visa network's speed of 24,000 tx/s. Raul (2018b) gives Ethereum speed as 20 tx/s and Bitcoin Cash speed as 61 tx/s. Obviously, with the current transaction speeds available blockchain networks are far from the speed of Visa network, which constitute a problem for DeFi to expand its network to greater populations. Hence, developing faster networks is essential.

Anti-money laundering (AML) regulations are essential part of the centralized financial system. However, by the construction a blockchain network, therefore DeFi running on a blockchain network does not require any such regulations. If AML regulations are introduced on a network, it becomes disputable that such a network is DeFi anymore, as there would be need to decide permissibility of a transaction. Therefore, a centralized check would be needed which contradicts the decentralized structure of DeFi. In addition, every country might have its own AML restrictions, at which a network becomes censored and cannot be borderless anymore in case AML regulations enforced. (Popescu 2020a).

Like every network economy, DeFi is a structure where the network effect is effective. Once the interoperability is satisfied to smooth out transactions between

different networks, the network effect will not be a problem anymore; the liquidity problem in small networks will disappear by the increased volume due to interoperability with other networks. Hence, the prices will be formed in a healthier environment, which will lead to increase in participation as well. Therefore, the operation of the whole system will be smoother.

Fraud is among problems preventing DeFi becoming a mainstream financial system (Chen and Bellavitis 2020). DeFi is susceptible to fraud if it is broken. There were twelve crypto exchanges being hacked in 2019 at which 510,000 user information and more than $292 million worth of cryptocurrency were stolen according to SelfKey (2020) that gives the details of individual cases as well. In addition, according to Casino et al. (2019), the Elliptic Curve Digital Signature Algorithm (ECDSA) "will be broken once a big enough quantum computer is built, rendering almost all blockchains insecure" and "quantum resilience becomes a major issue." The technical aspect of the topic is beyond the purposes of this article. Interested parties may see Kiktenko et al. (2018) and Rajan and Visser (2019).

According to Popescu (2020b) poor performance, low user-friendly platforms, therefore, increased user error probability and congested systems are problems DeFi needs to overcome for a worldwide adoptation in order to emerge as an alternative financial mechanism for all. As it happens in all new technology adoption life cycles, early adopters are people who can relate themselves to the new technology. For whom user experience is not among the top priorities. Moore (2006) provides detailed discussion of technology adoption life cycle, innovators, early adopters, early majority, late majority, and laggards. To reach general public, however, user experience has to be satisfactory enough. TokenInsight (2020) identifies "unsatisfying user experience" as a problem posing an obstacle to reach a wider adoption.

Theoretically speaking one can benefit from all sorts of products and services DeFi provides. However, in practice, in order to relate with DeFi, one needs a traditional bank account to transfer funds to and from DeFi. This itself carries the inclusion problem of the central finance into DeFi space. Lack of liquidity is another problem. Although it has been experiencing exponential growth, the size of DeFi is not comparable to the size of central finance yet. Grigo et al. (2020) points out that as network congestion gets higher there are delays in executing transactions, which translate into inefficiencies in forming prices; that too translates into liquidity risks. It will attract more users once the liquidity problem vanishes.

In DeFi world, participants have two sources of income: mining and commissions. By setup, commissions are decided by supply and demand, in this case congestion of a network—demand and supply for computer power and time to execute a transaction. That is the higher the congestion, the higher the commissions. As laid out by the transactions speed of different blockchain networks, slow network speed is a problem due to creation of congestion, therefore, high commissions or transaction fees. For example, according to TokenInsight (2020), on September 2nd 2020, average transaction fee hit $14—an all-time high—due to high congestion on Ethereum. In Ethereum blockchain, the term "gas" is used to refer to transaction fees. It is used as "a unit to measure how much computational energy" is required for a

transaction (Kim 2020). However, high transaction fees or commissions pose a threat against wider adoption of DeFi (TokenInsight 2020).

Regulation is another issue for DeFi. As stated earlier, DeFi eliminates intermediaries. Intermediary role is assumed by dApps. Then the questions become whether existing laws and regulations can be applicable? If not, then how to regulate and to what degree regulation should be extended in DeFi networks? Digitalization of intermediary role—smartcontracts—creates issues as well as opportunities in enforce laws. As everything is transparent and recorded on a blockchain and immutable, any information needed is available on the blockchain. On the other hand, for public and permissionless type blockchains for example access to such information is not permissible. If it is enforced to be revealed by law enforcement mechanisms, then such a blockchain will lose its desired properties and will become something else rather than public and permissionless decentralized network. Hence, these are challenges posing threat for blockchain networks to get wider dissemination, and for regulators to decide on ways, means and degree of regulations. Padilla (2020) provides a detailed discussion. Zetzsche et al. (2020) points out that the real problem is not that participant live in different countries rather, "they are dispersed and decentralized." To have widespread adoption, DeFi regulations have to be made, have to be part of the legal system throughout the world. Only then, DeFi can become diffused worldwide.

Schär (2020) names risks in DeFi as "smart contract execution risk, operational security and dependencies on other protocols and external data." Recall that smart contracts are computer programs i.e. codes. Since any transaction is not reversible on a blockchain, any mistakes done coding will be carried out without the ability to fix it if it is realized after the execution of a transaction.

Osmani et al. (2020) lists scalability, security risks, reversibility, interoperability and regulatory issues among the risks to adopt Blockchain into banking sphere in general. There is no full interoperability, as lack of interoperability between different blockchains has not been reached, since standards are not set yet (Chen and Bellavitis 2020), Maesa and Mori (2020) and Gao et al. (2018) too see scalability and efficiency among the main issues for widespread usage of blockchains, hence for DeFi. Tan et al. (2020) also mentions interoperability—related to the scalability too—as an issue as there are different types of blockchains—public—private, permissionless—permissioned on top of different smart contract functionalities.

A well-known problem is the energy and storage costs of DeFi. Osmani et al. (2020) sees current energy costs, potential increase in energy usage and prices as well as storage costs with the growing database needs as threats against wide adoption of DeFi.

Grigo et al. (2020) points that the current state of DeFi markets is not technologically able to provide a worldwide service.

4.5 A Short Recap of the Current State of DeFi Markets

Ethereum blockchain is the most widely used blockchain for DeFi applications. According to Guillou (2020), data show that daily average of new contracts has reached 30.5 K in November 2020 in Ethereum network. Data also show that 15% of active Ethereum addresses are active in DeFi. This ratio was 10% in August 2020 and 5% in January 2020. This shows that people are getting involved with DeFi at an increasing fashion.

According to Kim (2020), percentage of miner revenue from fees on Ethereum started the year 2020 less than 5%, hit almost 60% on September and came down to around 20% points later in the year. The finding of miner revenues coming from fees at an increasing rate can be considered as an indication of maturing DeFi markets.

DeFi has been experiencing a boom in number of users as seen in Fig. 4.1. The number of users is increasing exponentially as seen in the figure. Although it is too early to say that DeFi is becoming mainstream, it is in the right direction and going there fast.

The term "locked" is used for the funds that consumers sent to smart contracts on DeFi. Muzzy et al. (2020) provide a detailed discussion. These figures show how much total value locked (TVL) in DeFi smart contracts on the Ethereum blockchain during 2020. Figure 4.2 shows TVL in DeFi in Ethereum (ETH). It started the year with about three million ETH, and ended the year with about 7.2 million ETH, which hit its highest level on September 17, 2020 with 9.7 million ETH.

Figure 4.3 plots TVL in USD. Total value locked was in $600 millions. However, it hits $14.98 billion on December 30, 2020. Considering the widespread global economic problems due to the pandemic in 2020, total value locked in DeFi smart contracts had an astonishing increase during the last 1 year. The skyrocketing total value locked is another indication that DeFi is quickly becoming an established market.

DeFiprime defines decentralized exchanges (DEXs) as a cryptocurrency exchange, which operates in a decentralized way, without a central authority.

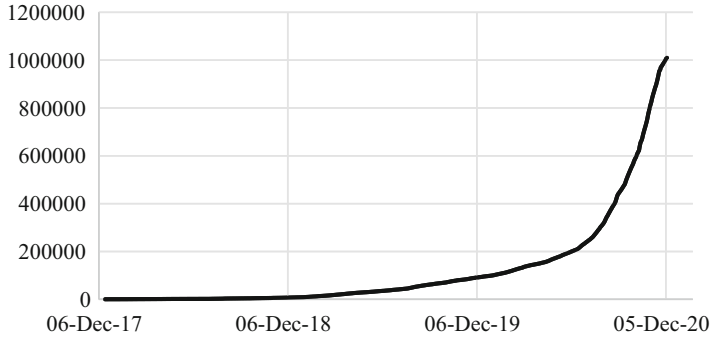

Fig. 4.1 Total DeFi users. Data Source: Dune Analytics. 7 Dec. 2020. Retrieved from https://duneanalytics.com/

Fig. 4.2 DeFi—Total Value Locked (TVL) in ETH. Source: DeFi Pulse. 30 Dec. 2020. Retrieved from https://defipulse.com/

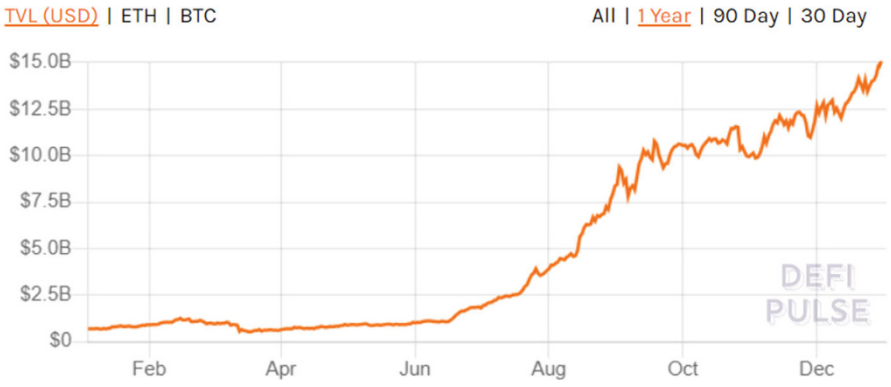

Fig. 4.3 DeFi—Total Value Locked (TVL) in USD. Source: DeFi Pulse. 30 Dec. 2020. Retrieved from https://defipulse.com/

Table 4.2 Top 10 DEXs by trading volume in Q3, 2020 (in billion USD)

Uniswap V2	$23.8
Curve	$7.9
1inch	$3.2
Balancer	$2.8
Sushiswap	$2.2
0x	$1.6
Swerve	$1.4
Kyber	$1.1
Tokenlon	$0.8
dYdX	$0.7

Data Source: TokenInsight (2020)

CoinMarketCap lists 46 DEXs. Table 4.2 gives total trading volume of top 10 DEX in Q3, 2020 in billion USD. According to the data, the top DEX is Uniswap V2 with $23.8 billion. Curve, 1inch, Balancer and Sushiswap follow with $7.9, $3.2, $2.8 and $2.2 billion respectively. Other DEXs had total trading volume lower than $2 billion as reported in the table. According to TokenInsight, the total trading volume in Q32019 was $708M, which surpassed $47 billion in Q3, 2020. This implies 6566% year-over-year increase in total trading volume, indicating that DeFi has become an established market fast.

Tokenization is another important element in DeFi. It can be defined as the process of adding new assets to a blockchain network. Its representation on a blockchain is called a token. By definition, tokens are essential part of the DeFi. There are 341,299 tokens exist on Ethereum blockchain by 4 December 2020 according to Etherscan. As it is a fast pace industry, for updated figures see https://etherscan.io/tokens.

4.6 Conclusion

This chapter explained the fundamentals of DeFi, its structure, formation and promises in relation to what the traditional centralized finance offer. Blockchain can be considered as continuously updated old style ledgers. One can trace back to the very first transaction from a terminal transaction. Bitcoin introduced by Nakamoto (2008) is the first use case of blockchain technology and first cryptocurrency. DeFi is a collection of applications running on a blockchain. As a use case of blockchain, DeFi has attracted attention in recent years. It is important to understand what it is, what it promises and whether it can provide its promises given the level of the related technologies, the state of the legal environment, potential improvements in related blockchain limitations and its existing or to be introduced instruments.

Transparency, easier access, transaction speed, flexibility to write any contract that can be codable, immutability of transactions and censorship resistance are some of the main advantages of Blockchain (Popescu 2020b). Beside, Osmani et al. (2020) noted privacy, transparency, enhanced security, efficiency in the form of reduction in overhead costs for banks, immutability, faster transactions and trust as some additional benefits of blockchain technology in finance, hence for DeFi.

Furthermore, there are a number of extended advantages and benefits of blockchain and DeFi. For example, Sydow et al. (2020) argue that blockchain is particularly useful for developing economies in mitigating the problems of transparency, manipulation and safety in data recording. Most importantly, it eliminates the need for an intermediary by using decentralized trust mechanism, which also eliminates border barriers among users. Transparency is another important feature of DeFi. Decentralized structure eliminates the need for intermediaries, and leads to lower transaction costs. Hence, the decentralized structure gives way to "decentralized, innovative, interoperable, borderless and transparent applications

which facilitate open access and encourage permissionless innovations" (Popescu 2020a), like smart contracts and stable coins. Smart contracts are the basic element of DeFi by which anything codable can be implemented by smart contracts. Automation, cost-efficiency and autonomy are among the benefits of smart contracts. Stablecoins can serve as unit of account and medium of exchange. Introduction of stablecoins bring stability to DeFi.

These notwithstanding, Blockchain and DeFi are not immune to drawbacks. For example, power need of blockchain due to the excessive computer power needs, and setting standards in validating new blocks and in communicating between different networks are challenges in deed of a deserved attention. Couple with these is user experience, current speed of blockchain networks, regulations like AML and KYC requirements, lack of regulation in DeFi, scalability, and interoperability issues. If regulation of the centralized finance carried out to DeFi, then DeFi is going to lose many of its main features like elimination of intermediaries. However, lack of regulation at all pose a threat to itself either as it will be a barrier against its inclusiveness and worldwide adoption. In summary, the current state of DeFi markets is not technologically able to provide a worldwide service as Grigo et al. (2020) points out. Its technology needs to be improved, at the same time; regulations to an acceptable level needs to be implemented in order to reach most people.

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Chapter 5
Financial Connectedness of Energy and Commodity Markets and Systemic Risk

Sezer Bozkus Kahyaoglu and Hakan Kahyaoglu

Abstract The aim of this study is to investigate the existence of financial connectedness (FC) between energy& commodity markets (EMs&CMs) together with systemic risks. The time-domain spillover approach and the frequency-domain spillover approach are used to investigate the financial interconnectedness across submarkets, i.e., CMs versus AMs. Data was taken from the Rogers International Commodity Index (RICI) and its energy sub-index (RICI-E) and commodity sub-index (RICI-M) respectively. Based on the best of our knowledge; it is important to stress that the reviewed empirical works do not analyze the volatility connectedness (spillovers) between the two markets. Hence, an analysis of the connectedness between those markets is the missing part in the literature. In this paper, the related contribution is made to the literature by implementing such an analysis. There is an asymmetric connectedness between energy&commodity markets. Hence, the relationship between the financialized EMs and CMs cannot be estimated by standard approaches. The connectedness between these two markets is an important source of impact, leading to the explosion of SR. It is a fact that financial stress leads to the SR, which can increase rapidly to significant size due to high spillover effects between financially connected submarkets. The determination of FC is essential for market players who invest in portfolio of assets to decide portfolio allocation, risk management, hedging and pricing strategies. Estimating the FC map of sub-markets provides valuable information for financial stability and energy price stability in the long run. Particularly, the submarket specific stress and its influence on other submarkets as well as FC in time can provide information for containing overall SR in the markets. This approach is essential to limit partial financial stress in the submarkets before it evolves into a SR and posing a severe threat to financial stability in

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the economy. In this study, it is revealed that there is a FC between the EMs&CMs depending on the analysis of these relations.

Keywords Financial connectedness · Systemic risk · Energy markets · Commodity markets

5.1 Introduction

It is a fact that the global financial markets grow rapidly in size and become more chaotic during the last decades. This growth and chaotic appearance of global financial markets do not only cause a change in the size of the connections but also a shift in the style of the markets and their connections. In addition, it is important to evaluate these connections among different parts of markets, and to understand the nature of connectedness between sub-markets. Therefore, these issues became essential to various fields of research and academic work such as analysis on financial risk management, hedging, portfolio management, and financial crisis management. Needless to say that the standard correlation-based measures are not sufficient for academics and finance professionals they have concentrated on the advancement of more comprehensive frameworks. However, these comprehensive frameworks still fail to notice various critical properties of connectedness, which may lead to systemic risks. The major aim of this paper is to investigate the existence of financial connectedness between energy markets and commodity markets together with systemic risks. It is generally accepted that an increase in volatility of energy and commodity markets is a systemic risk indicator for the world economy. Therefore, the connectedness between these two markets is an important source of impact, leading to the explosion of systemic risk. This relationship is generally experienced as a result of the "financialization" of these markets.

The organization of the paper is as follows: In the first part, studies on financial connectedness and, energy markets and commodity markets are discussed within the framework of the related literature. In the second part, prominent literature examples are presented by explaining the major issues and connections with our empirical work. In the third part, data is introduced by descriptive statistics and the methodology used are provided in detail simultaneously. The fourth part focuses on the empirical findings and hence, interpretations of the results are presented compared to relevant literature. Finally, policy recommendations are made as concluding remarks.

5.2 Literature Review

There is a huge and diverse literature on the commodity markets, which can be extended to Keynes (1923). The related literature exists which examines the pricing strategies in determination of commodity spot prices in connection with the need for storage and the development of commodity future markets. Routledge et al. (2000) examine the term structure for the forward prices considering the storable commodities. The authors note the facts about commodities and the importance of the non-negativity constraints on inventories. After the collapse of equity markets in 2000, institutions consider commodity products as a new asset class to invest in because there is a negative correlation between commodity and stock market returns (Erb and Campbell 2006; Greer 2000). Starting from the 2000s, commodity futures have become important investment product as much as the foreign equities and bonds in the international portfolio management strategy. This dramatic change, i.e., increased existence and dominance of financial investors in commodity markets is described as the "financialization of commodity markets" (Cheng and Xiong 2014).

Gorton and Rouwenhorst's (2004, 2006) joint work about commodity futures is valuable in the literature. Their work is indicating the "facts and fantasies" about such markets and treated as "symbolic rise of the commodities-as-an-investment" asset group. After the 2008 global financial crisis, the increase in volatility in all commodity markets, especially oil prices, caused investors to focus more on this issue and reveal that it is important to fix the prices. It is a fact that compared to other financial instruments; commodity market products are relatively more complex both for corporate and individual investors. In this respect, asset groups[1] and the asset allocation[2] strategy in commodity markets is discussed in relation to the financialization considering the fact that there is a growing importance of financial investors to these markets.

5.2.1 *Effects of the Financialization to the Commodity Markets*

Financialization is a fact described by various effects that may be related to major players in the commodity markets. The major effects of the financialization to the commodity markets can be summarized as follows:

[1] An asset group is a range of assets that have some primary economic similarities to each other, and have features that make them different from other assets that are not part of that group. This is important especially for portfolio optimization strategies (Scherer and He (2008).

[2] There are three major asset allocation strategies namely: strategic asset allocation (long-term), tactical asset allocation (short-term), and benchmark (portfolio weights) asset allocation (Fuss et al. 2006).

Firstly, Zaremba (2015) argues that there is a structural change in the commodity markets directly or indirectly related to financialization. Irwin and Sanders (2012) note another substantial change in the commodity markets, which is a transition from the traditional open-outcry system to the electronic trading systems. Trading systems in the commodity markets operate on model-based algorithms.[3] A standard system consists of a set of trading rules that determine when to buy and when to sell a futures contract. In this respect, Shah and Brorsen (2011) emphasize the improvements in liquidity and the decreased transaction costs by means of technological advancements in the commodity markets. Baker (2012) investigates the impact of financialization in a storage model. The author confirms the reduced level of transaction costs via financialization.

Secondly, there is a direct impact of the financial investors on prices in the commodity markets, and on their volatility levels (Basak and Pavlova 2013). In this way, significant increase in volumes, open positions and turnover is observed in the commodity markets leading to a change in the term structure that affect the roll yields and risk premiums (Frank and Garcia 2011). This situation is valid both for the organized markets as well as over the counter (OTC) markets.

Thirdly, the development of index funds and the entrance of index investors in the commodity markets. These kinds of investors usually take large-scale, long, and passive positions. Considering the trading strategies, the most suitable conditions for them are increasing markets and markets with backwardation in nature (Sanders and Irwin 2011). It is observed that most of the institutional investors prefer having a position in commodities contracts through a commodity futures index. The most famous indexes are namely, S&P Commodity Index (SPCI), the Dow Jones UBS Commodity Index (DJ-UBS) or Goldman Sachs Commodity Index (GSCI).

5.2.2 *Rising Financial Connectedness in the Energy and Commodity Markets*

Hamilton (2008) indicates the fact that "nine out of ten of the U.S. economic downturn" since World War II are started by a sharp increase in oil prices. Tang and Xiong (2011) note in their empirical work that there is an increasing correlation between energy and commodity markets after the foundation of index funds. Hence, the increased volatility level in energy futures may be related to the increased volatility level in commodity futures (Anatolyev and Barunik 2019; Avdulaj and Barunik 2015).

West and Wong (2014) study the connectedness of commodity markets and for this purpose, authors use monthly prices of energy, metal and agricultural

[3]The model-based algorithms are constructed on the recurring patterns in the commodity markets. These patterns have been discovered based on analysis of records. It should be noted that there is a need for the validity of these trading rules and this is called back-testing.

commodities. They establish a factor model based on these commodities, and conclude that the prices have a trend for reverting to the factor. Yin and Han (2015) analyze the commodity markets by decomposing the commodity returns into three major components, namely market level, industrial level and contract level respectively. These authors argue based on their empirical findings that the dynamic factor regarding the market level has become more influential since 2004. In addition to factor model analysis, there are various time series analysis applied in the literature. For instance; DCC-dynamic conditional correlation (Berger and Uddin 2016; Cabrera and Schulz 2016; Mensi et al. 2014), structural VAR (Wang and McPhail 2014) and VECM-vector error correction model (Issler et al. 2014) approaches are used in relation to financial connectedness and heteroscedasticity in the underlying price movements of energy and commodity markets to forecast the reasons behind the time-varying correlations.

5.3 Systemic Risk

There is not a prominent agreement in the literature regarding the definition of systemic risks yet. This is because each work focuses on different aspects of the systemic risks (Smaga 2014). However, the definition proposed by the ECB (2010) is generally accepted. Zigrand (2014) argues that the systemic risk consists of two major elements such that the first element is the risk as a specific function of the system and the second element is the risk, which is created by the system.

Similarly, Nier (2009) defines systemic risks in two dimensions, namely macro and micro-systemic risks and DeBandt and Hartmann (2000) propose the concept of systemic risks based on vertical and horizontal view respectively. In addition, Smaga (2014) shows the two major dimensions of the systemic risks as at Table 5.1. It is a fact that sometimes these definitions on systemic risks may overlap.

In a financial system, energy and commodity prices driven by consumption growth with different recurring components will eventually produce shocks with heterogeneous preferences of market players, and thus different sources of connectedness generating short-run, and long-run systemic risk (Bandi and Tamoni 2017: 2–3). Considering shocks with heterogeneous responses with different time frequencies and domains, global financial markets become interconnected with different roots due to differing expectations of market players. In order to capture such heterogeneous responses with different time frequencies and domains, Dew-Becker and Giglio (2013) propose a general framework for decomposing the connectedness to any frequency band of interest and these authors consider the frequency domain as a natural ground for determining the connectedness.

It is important to consider focusing on linkages between multiple levels of persistence underlying systemic risk (Broadstock et al. 2012; Ji et al. 2015; Liu et al. 2013; Smaga 2014). In other words, it is essential to determine the distinction between short run and long run in the financial system starting from cointegration literature of (Batten et al. 2015; Engle and Granger 1987; Lucey et al. 2014; Ohashi

Table 5.1 Two major dimensions of systemic risks

	Cross-sectional dimension	Time dimension
Aim of the analysis	Shock transmission mechanism	Build-up of macro financial imbalances
Approach	Point-in-time	Over the given period
The main area of analysis	Size of the financial system, its structure and the degree of interconnectedness, SIFI-single institution	Procyclicality
The role of macroeconomic factors	Exogenous	Endogenous
Objective of macro prudential measures	The increase in financial system resilience to shocks	Reducing the rate of imbalances accumulation and mitigating their impact
Examples of risk sources	Interconnectedness and similarities in risk exposures of financial institutions leading to exposure to symmetric shock, excessive concentration	Interlinkages between the financial system and the real economy, financial system regulation

Source: (Smaga 2014: 9)

and Okimoto 2016; Öztek and Öcal 2017; Yin and Han 2015; Zhang et al. 2018). Diebold et al. (2017) who argue that financial connectedness have a tendency to increase during commodity-market shocks, which could then spill over into the global markets.

5.4 Data and Methodology

In this section data and methodology is explained briefly before starting the model estimation stage.

5.4.1 Data and Descriptive Test Statistics

The data is taken from Rogers International Commodity Index[4] (RICI) and its energy sub-index (RICI-E) and metals sub-index (RICI-M) respectively. RICI is selected since it involves specific commodities, which are publicly traded on organized markets in order to provide confidence and ease of monitoring and recognition. Figure 5.1 shows the content of each sub-index quoted at RICI.

[4]The Rogers International Commodity Index® ("RICI®") is a composite, USD based, total return index, designed by James B. Rogers, Jr. in the late 1990s, comprised of 38 commodities futures contracts, quoted in four different currencies, listed on ten exchanges in four countries. Please visit www.rogersrawmaterials.com for details.

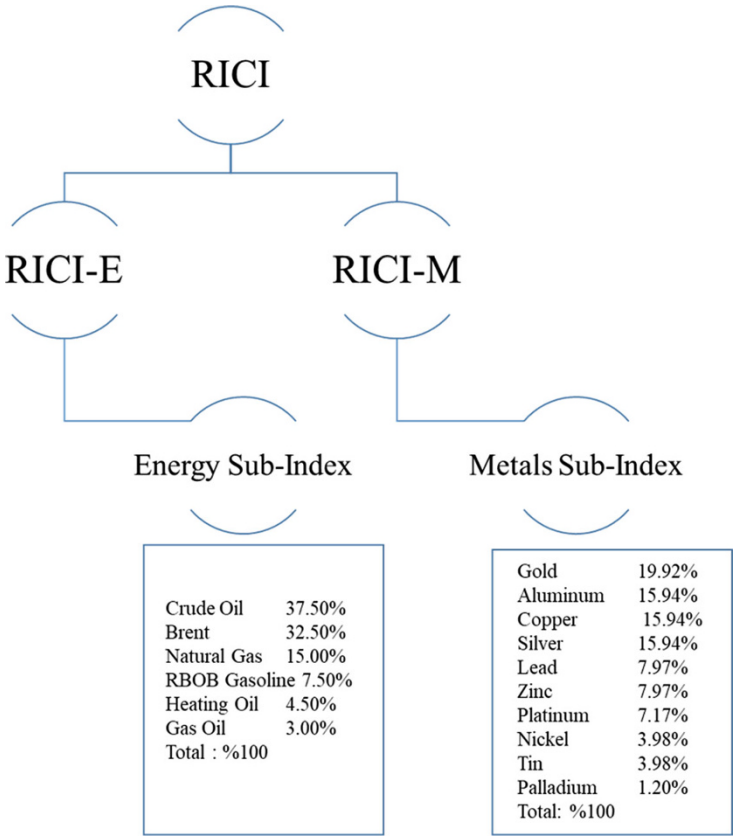

Fig. 5.1 Composition of RICI, energy sub-index and metals sub-index. Source: www.rogersrawmaterials.com

The data frequency is daily for the period of (04.01.2010–31.12.2019) in the total of (2.525) samples. The first variable consists of the return series of energy sub-index (RICI-E), namely RRNE and the second variable consists of the return series of metals sub-index (RICI-M), namely RRZM.

As a first step, the descriptive statistics and the volatility graphs of these variables RRNE and RRZM are shown at Table 5.2, Fig. 5.2a, b respectively. Considering the third and fourth moments of these variables; both RRNE and RRZM are negatively skewed (−0.101 and −0.309) and this means that they have asymmetric in shape with a slight departure from the normality.

In addition, RRNE and RRZM have kurtosis level higher than three, i.e. (7.288 and 5.508) which indicates the leptokurtic distribution corresponding to greater

Table 5.2 Descriptive statistics of energy sub-index (RRNE) and metals sub-index (RRZM)

	RRNE	RRZM
Mean	−0.0003	−7.64E-05
Median	0.0000	0.0000
Maximum	0.1345	0.0508
Minimum	−0.1196	−0.0590
Std. Dev.	0.0171	0.01048
Skewness	**−0.1014**	**−0.3092**
Kurtosis	**7.2883**	**5.5080**
Jarque-Bera	1931.41	699.24
Probability	0.0000	0.0000
Sum	−0.7829	−0.1921
Sum Sq. Dev.	0.7367	0.2761
Observations	2515	2515

extremity of outliers from the mean. Hence, the data is not normally distributed[5] based on the descriptive statistics and, specifically JB test statistics, which is a function of skewness and kurtosis of the data.

As a second step, the Augmented Dickey and Fuller (1981) (ADF), Phillips and Perron (1988) (PP), Kwiatkowski-Phillips-Schmidt-Shin (Kwiatkowski et al. 1992) (KPSS) and Fourier ADF (Enders and Lee 2012) unit root tests are applied to both of the return series in E-Views Program. ADF and PP are the most common and traditional unit root tests. The PP test is different from the ADF test in how it copes with the serial correlation and heteroscedasticity in the error terms. The PP test is more powerful than ADF test.

The major criticisms about these two tests are related to the sample power and size problem. For this reason, additional tests are applied to the data, i.e. KPSS and Fourier ADF tests. KPSS is used to conclude the existence of deterministic trend vs. stochastic trend in the data. Compared to PP and ADF, KPSS is a powerful unit root test.

On the other hand, KPSS test is unable to capture non-stationarity when there is a volatility shift in the series (Becker et al. 2006). In such a case, the unit root test may lead to false non-rejection of the null if the structural breaks in the series are not considered. In order to overcome this problem, Fourier ADF test is applied for the data in Gauss Program. Fourier ADF test can capture unknown number of structural breaks and break dates. The test results are given at below Tables 5.3, 5.4, 5.5, and 5.6 respectively.

In order to interpret the coefficients of the VAR method, the data used must be stationary. The test results indicate that both of the return series are stationary, and it is possible to proceed on the third stage, which is explained in the following sections.

[5] According to JB test statistics, the theoretical values of skewness (S) and kurtosis (K) are 0, and 3 under normality assumptions respectively.

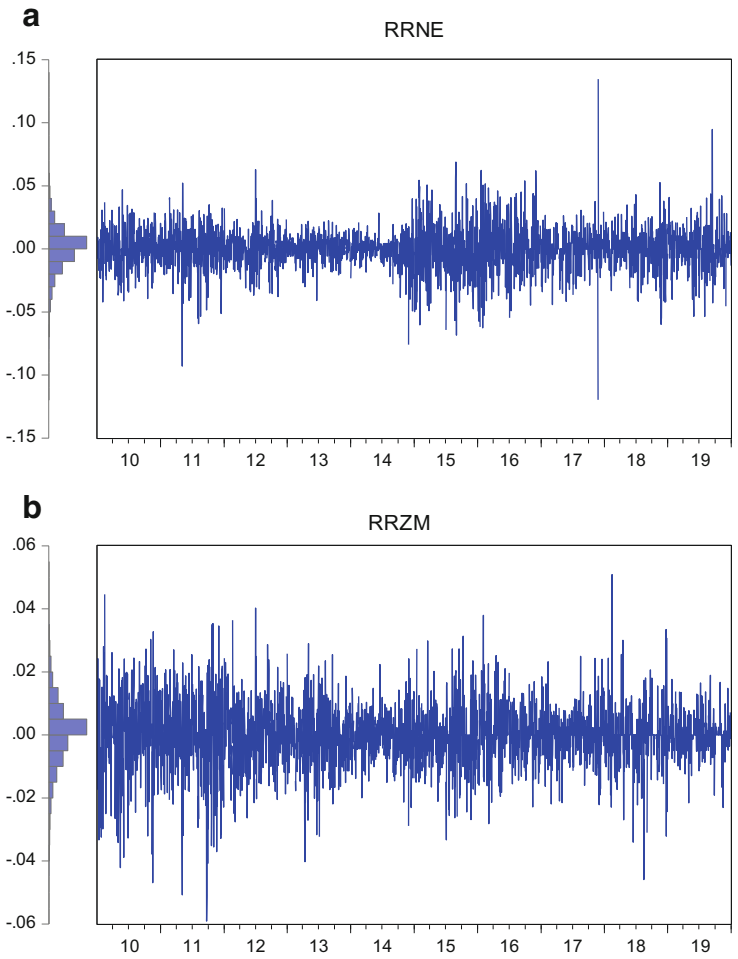

Fig. 5.2 (**a**) Histogram and return series of energy sub-index (RRNE)—(2010–2019). (**b**) Histogram and return series of metals sub-index (RRZM)—(2010–2019)

Table 5.3 Energy sub-index (RRNE)—PP and ADF unit root test results

	PP test	ADF test
With constant	−53.7627 (0.0001)[a]	−53.8744 (0.0001)[a]
With constant & trend	−53.7530 (0.000)[a]	−53.8642 (0.000)[a]
Without constant & trend	−53.7518 (0.0001)[a]	−53.8657 (0.0001)[a]

Source: Table data calculated by authors
[a]%1 Significant level

Table 5.4 Metals sub-index (RRZM)—PP and ADF unit root test results

	PP test	ADF test
With constant	−52.2467 (0.0001)[a]	−52.2660 (0.0001)[a]
With constant & trend	−52.2380 (0.000)[a]	−52.2572 (0.000)[a]
Without constant & trend	−52.2540 (0.0001)[a]	−52.2735 (0.0001)[a]

Source: Table data calculated by authors
[a]%1 Significant level

Table 5.5 Energy sub-ındex (RRNE)—Fourier ADF and KPSS test unit root test results

KPSS test		Fourier ADF test	
0.123746		ADF-stat	–53.9370[a]
Asymptotic critical values:		Fourier	2.0000
1% level	0.739		
5% level	0.463		
10% level	0.347		

Source: Table data calculated by authors
[a]CV (1%, 5%, 10%) –3.6900, −3.0500, −2.7100

Table 5.6 Metals sub-index (RRZM)—Fourier ADF and KPSS test unit root test results

KPSS test		Fourier ADF test	
0.071266		ADF-stat	–52.3029[a]
Asymptotic critical values:		Fourier	3.0000
1% level	0.739		
5% level	0.463		
10% level	0.347		

Source: Table data calculated by authors
[a]CV (1%, 5%, 10%) –3.6900, −3.0500, −2.7100

5.4.2 The Methodology

In this work, there are two major approaches used for the modeling process to investigate the financial interconnectedness across submarkets, i.e. commodity (metals) markets versus energy markets. Diebold and Yilmaz (2009, 2010, 2012 and 2013) develop the first method, i.e. DY Approach, which is based on spillover measurement in time-domain.

Barunik and Krehlik (2016, and 2018) develop the second method, i.e. BK Approach, which relies on spillover measurement in frequency domain. In this way, the contribution of each submarkets to the connectedness is determined both in time and frequency domains respectively.

5.4.3 DY Approach Based on Time Domain

The main feature of DY approach is that it employs variance decompositions based on time domain. Hence, Diebold and Yilmaz (2009, 2010, 2012 and 2013) define the

measurement criteria by assessing portions of forecast error variation in one variable due to a shock arising in another variable in the system. DY Approach relies on the generalized vector autoregressive (VAR) model (Pesaran and Shin 1998) and, generalized forecast error variance decompositions (GFEVD) that mitigates the case with the assumption of normality of the shocks.

This approach permits to determine the aggregate spillover effects across markets. It is possible with this approach to process a plenty of information into a single spillover measure, which is based on a common term of variance decomposition, connected with an *N*-variable VAR. *N*-dimensional VAR (p) model is shown at Eq. (5.1):

$$Y_t = \Phi_1 Y_{1-1} + \ldots \Phi_t Y_{t-p} + \varepsilon_t \tag{5.1}$$

where ε_t as a white noise and $\Phi_1 + \ldots \Phi_t$ coefficient matrices. Considering the fact that the process is causal and invertible, it is possible to transform Eq. (5.1) into a multivariate $M(\infty)$ representation with NxN matrices, A_h. Diebold and Yilmaz (2009) propose a measure for spillover, i.e. the H-step-ahead forecast as $P(Y_{t+H}|Y_t, Y_{t-1}, \ldots\ldots)$ at time t, and Eq. (5.2):

$$Y_t - P(Y_{t+H}|Y_t, Y_{t-1}, \ldots\ldots) = \varepsilon_t H + A_1 \varepsilon_t H_{t-1} + A_2 \varepsilon_t H_{t-2} \ldots + A_{H-1} \varepsilon_{t+1} \tag{5.2}$$

Diebold and Yilmaz (2009) calculation of spillover is based on the lower-triangular Cholesky factor and the final formula is shown at Eq. (5.3).

$$100 \times \frac{1}{N} \sum_{i=1}^{N} \frac{\sum\limits_{j \neq 1} \sum\limits_{h=0}^{H-1} (A_h L)_{ij}^2}{\sum\limits_{h=0}^{H-1} \left(A_h \sum_{\varepsilon} A_h'\right)_{ii}} = 100 \times \left(1 - \frac{1}{N} \sum_{i=1}^{N} \frac{\sum\limits_{h=0}^{H-1} (A_h L)_{ii}^2}{\sum\limits_{h=0}^{H-1} \left(A_h \sum_{\varepsilon} A_h'\right)_{ii}} \right) \tag{5.3}$$

Variance decompositions enable us to split the variances of forecast errors related to each variable into parts, which can be assigned to the diverse system shocks. More specifically, considering the sample data, it is possible to analyze what portion of the 1-step-forward error variance in forecasting RRZM is due to shocks to RRZM or shocks to RRNE. This is defined as "*own variance shares*" and "*cross variance shares or spillovers*" in DY Approach respectively (Diebold et al. 2017). This is called the "*variance decomposition matrix*".

5.4.4 BK Approach Based on Frequency Domain

Barunik and Krehlik (2016, and 2018) focus on the frequency responses of shocks instead of time domain. In this way, the authors determine the portion of the spectrum as counterpart of variance at given frequency that is attributed to shocks

in another variable. Moreover, they emphasize on the importance of correlation of the error terms in the size and spectral form of the connectedness (Barunik et al. 2017; Barunik et al. 2014; Barunik et al. 2015; Barunik et al. 2016; Barunik and Malinska 2016; Barunik and Vacha 2012; Barunik and Vosvrda 2012; Barunik and Zikes 2016).

Frequency domain is defined between $(\pi, -\pi)$ intervals. The generalized forecast error variance decompositions (GFEVD) on the frequency band, $d = (a, b) : a, b \in (\pi, -\pi), a < b$ is described in Eq. (5.4) as follows:

$$\left(\widetilde{\theta}_d\right)_{j,k} = (\theta_d)_{j,k} / \sum_k (\theta_\infty)_{j,k} \tag{5.4}$$

The frequency connectedness considering the frequency band d is shown at Eq. (5.5):

$$\mathcal{C}_d^{\mathcal{F}} = 100 \left(\frac{\sum \left(\widetilde{\theta}_d\right)_{j,k}}{\sum \left(\widetilde{\theta}_\infty\right)_{j,k}} - \frac{Tr\left\{\widetilde{\theta}_d\right\}}{\sum \left(\widetilde{\theta}_\infty\right)_{j,k}} \right) \tag{5.5}$$

In addition to Eq. (5.5), within connectedness on the frequency band d is defined at Eq. (5.6). Afterwards the authors define the *"directional connectedness table"* which is shown at Eq. (5.7) as follows:

$$\mathcal{C}_d^{\mathcal{W}} = 100 \left(1 - \frac{Tr\left\{\widetilde{\theta}_d\right\}}{\sum \left(\widetilde{\theta}_d\right)_{j,k}} \right) \tag{5.6}$$

$$\begin{array}{lccc}
 & x_1 & \cdots & x_n \\
 & \left(\widetilde{\theta}\right)_{1,1} & & \left(\widetilde{\theta}\right)_{1,n} \\
x_1 & \left(\widetilde{\theta}_{d_1}\right)_{1,1} \cdots \left(\widetilde{\theta}_{d_s}\right)_{1,1} & \cdots & \left(\widetilde{\theta}_{d_1}\right)_{1,n} \cdots \left(\widetilde{\theta}_{d_s}\right)_{1,n} \\
\vdots & & \ddots & \\
 & \left(\widetilde{\theta}\right)_{n,1} & & \left(\widetilde{\theta}\right)_{n,n} \\
x_n & \left(\widetilde{\theta}_{d_1}\right)_{n,1} \cdots \left(\widetilde{\theta}_{d_s}\right)_{n,1} & \cdots & \left(\widetilde{\theta}_{d_1}\right)_{n,n} \cdots \left(\widetilde{\theta}_{d_s}\right)_{n,n} \\
 & \mathcal{C}_{1\rightarrow\bullet} & & \mathcal{C}_{n\rightarrow\bullet} \\
\text{To Others} & \mathcal{C}_{1\rightarrow\bullet}^{d_1} \cdots \mathcal{C}_{1\rightarrow\bullet}^{d_s} & \cdots & \mathcal{C}_{n\rightarrow\bullet}^{d_1} \cdots \mathcal{C}_{n\rightarrow\bullet}^{d_s}
\end{array}$$

$$\begin{array}{c}
\text{From Others} \\
\mathcal{C}_{\bullet\rightarrow 1} \\
\mathcal{C}_{\bullet\rightarrow 1}^{d_1} \cdots \mathcal{C}_{\bullet\rightarrow 1}^{d_s} \\
\vdots \\
\mathcal{C} \\
\mathcal{C}_{d_1}^{\mathcal{F}} \cdots \mathcal{C}_{d_s}^{\mathcal{F}} \\
\mathcal{C} \\
\mathcal{C}_{d_1}^{\mathcal{F}} \cdots \mathcal{C}_{d_s}^{\mathcal{F}}
\end{array} \tag{5.7}$$

It is noted that the whole spectrum is the total of all frequency bands. The terms on the diagonal are the forecasted figures of the variance shares of the own shocks in Eq. (5.7). Hence, $\boldsymbol{C}$ at the bottom right is the total connectedness figure with its frequency decompositions. There is a "*sums of off-diagonal row and column*", namely "from" and "to" in the connectedness table provide information about the total directional connectedness measures.[6] The frequency bands indicates short-term and long-term dynamics. In our case, the short-term is taken as 5 days and long-term is taken as 5 days to infinity date.

In this respect, we obtain 2 *N* directional connectedness information in total and the composition of this is *N* "to others," or "transformed," and *N* "from others," or "received," for each of a set of *N* markets. In other words, we use DY and DK Approaches to have "pairwise and net pairwise directional connectedness", "total and net total directional connectedness" figures which are explained in the next section.

5.4.5 Empirical Findings

As the third stage, financial connectedness is analyzed for energy and commodity (metals) markets by using the return series from the Rogers International Commodity (RICI) Sub-Indexes based on DY and BK Approaches. These two approaches are estimated via related codes available in *R* Program. Since both of the Approaches depend on VAR model, the optimal *lag* length is determined with AIC as the first step by the "*optimal select*" code in the *R* program in 2020. In our case, the optimal lag is equal to three with constant.

5.4.5.1 Empirical Findings of the DY Approach (2012) with Time Domain

The connectedness is estimated based on both DY[7] methodology with "rolling windows=100[8]". The empirical findings of directional connectedness results and contribution of connectedness are given at Table 5.7, with correlation; Table 5.8, without correlation; Table 5.9, "pairwise", "to", "from", "net" and "overall" spillover with correlation; Table 5.10, "pairwise", "to", "from", "net" and "overall"

[6]Please note that the detailed information and proof of the connectedness measure is available at Diebold and Yılmaz (2009, 2010, 2012 and 2013) in time domain and, Barunik and Krehlik (2016, and 2018) in frequency domain.

[7]We estimate DY Approach based on both 2009 and 2012 versions and prefer to report the empirical findings on DY in 2012. Although empirical findings are not the same but slightly different from each other.

[8]Rolling window estimation approach is applied in order to capture the time varying nature of the connectedness.

Table 5.7 Directional connectedness results based on DY approach (2012) with time domain

With correlation			
	RRZM	RRNE	FROM
RRZM	89.70	10.30	5.15
RRNE	72.17	27.83	36.09
TO	36.09	5.15	41.23
(*n. ahead* = *100, no. corr* = *F*)			

Table 5.8 Directional connectedness results based on DY approach (2012) with time domain

Without correlation			
	RRZM	RRNE	FROM
RRZM	99.42	0.58	0.29
RRNE	78.07	21.93	39.04
TO	39.04	0.29	39.33
(*n. ahead* = *100, no. corr* = *T*)			

Table 5.9 Contribution of connectedness table based on DY approach (2012) with time domain

With correlation		
	RRZM	RRNE
Pairwise	−30.93	
To	36.08	5.14
From	5.14	36.08
Net	30.93	−30.93
Overall	41.23	
(*n. ahead* = *100, no. corr* = *F*)		

spillover without correlation in matrix form respectively. In this way, we find the estimated contribution to the forecast error variance of the Roger energy and metals sub-indexes.

According to the estimation results of DY (2012) Approach at Table 5.7, the 89.70% of the variability of Roger Metals Sub-index (RRZM) is caused by its own variability. On the other hand, 27.83% of the variability of Roger Energy Sub-index (RRNE) is caused by its own variability.

Considering the with correlation assumption at Table 5.7; the bottom-right corner indicates the total spillover index (TSI) is 41.23% (Tiwari et al. 2018: 559). This means that 41.23% of the "total forecast error variance" in two series comes from the spillovers proposing a significant interconnectedness of the chosen Roger energy and commodity sub-indexes.

The directional connectedness results at Table 5.8 give similar empirical results. Hence, TSI without correlation assumption is amounting 39.33% and, it still shows a significant interconnectedness of the indexes under study.

According to the estimation results of DY (2012) Approach at Table 5.9, the contribution of connectedness of each sub-index with correlation is estimated. The pairwise connectedness expresses that the Roger Energy Sub-index (RRNE) is the net "transmitter" of the variability and Roger Metals Sub-index (RRZM) is the

Table 5.10 Contribution of connectedness table based on DY approach (2012) with time domain

Without correlation		
	RRZM	RRNE
Pairwise	−38.74	
To	39.03	0.29
From	0.29	39.03
Net	38.74	−38.74
Overall	39.32	
(*n. ahead = 100, no. corr = T*)		

Source: Table data calculated by authors

net "receiver" of the variability with the amount −30.93%. Table 5.10 without correlation case can be interpreted in the same approach.

5.4.6 *Empirical Findings of the BK Approach (2012) with Frequency Domain*

The empirical findings of the BK Approach (2012) at frequency domain are estimated both for short term and long term regarding the Roger energy and commodity (metals) sub-indexes. The results are shown at Table 5.11, with correlation, short term; Table 5.12 without correlation, short term; Table 5.13, with correlation, long term; and Table 5.14 without correlation, long term respectively.

BK Approach enables us to estimate the connectedness both in short and long term. According to the connectedness results in short-term with correlation case at Table 5.11, there is a weak interconnectedness amounting 7.00% between two indexes. However, there is a significant interconnectedness amounting 44.26% in the long-term which is shown at Table 5.12. It is possible to make similar interpretations for the Tables 5.13 and 5.14 respectively.

These empirical findings provide valuable policy implications especially in the long-term. The empirical results of BK Approach show that variability in these two indexes under study have been more synchronized, where the trade integration between energy and commodity markets has contributed to the increase of volatility spillovers and therefore making systemic risks more global.

5.5 Conclusion

In this paper, the existence of financial connectedness between energy and commodity markets together with systemic risks is investigated by using DY (2012) and BK (2012) Approaches. Firstly, the DY Approach is used to obtain the directional connectedness results based on the generalized variance decomposition in time-domain. Secondly, the BK Approach is applied to further investigate the time–

Table 5.11 Connectedness results based on BK approach (2012) with frequency domain—short term

With correlation				
	RRZM	RRNE	FROM_ABSOLUTE	FROM_WITHIN
RRZM	1.00	0.19	0.10	1.18
RRNE	0.95	14.13	0.47	5.82
TO_ABSOLUTE	0.47	0.10	0.57	
TO_WITHIN	5.82	1.18		7.00

The spillover table for band: 3.14 to 0.79. Roughly corresponds to 1 days to 4 days. spilloverBK12 (n.ahead = 100, no. corr = F, partition = bounds < −c(pi+0.00001, pi/4, pi/10, 0))

Source: Table data calculated by authors

Table 5.12 Connectedness results based on BK approach (2012) with frequency domain—long term

With correlation				
	RRZM	RRNE	FROM_ABSOLUTE	FROM_WITHIN
RRZM	88.70	10.11	5.05	5.50
RRNE	71.22	13.70	35.61	38.76
TO_ABSOLUTE	35.61	5.05	40.66	
TO_WITHIN	38.76	5.50		44.26

The spillover table for band: 0.79 to 0.00 Roughly corresponds to 4 days to Inf days. spilloverBK12 (n.ahead = 100, no. corr = F, partition = bounds < −c(pi+0.00001, pi/4, pi/10, 0))

Source: Table data calculated by authors

Table 5.13 Connectedness results based on BK approach (2012) with frequency domain—short term

Without correlation				
	RRZM	RRNE	FROM_ABSOLUTE	FROM_WITHIN
RRZM	1.01	0.01	0.00	0.04
RRNE	0.59	17.27	0.29	3.10
TO_ABSOLUTE	0.29	0.00	0.30	
TO_WITHIN	3.10	0.04		3.14

The spillover table for band: 3.14 to 0.79. Roughly corresponds to 1 days to 4 days. spilloverBK12 (n.ahead = 100, no. corr = T, partition = bounds < −c(pi+0.00001, pi/4, pi/10, 0))

Source: Table data calculated by authors

frequency dynamics of connectedness by using the spectral representation of the generalized FEVD. In this way, short-term and long-term dynamics are estimated for the two markets under study. There is an asymmetric connectedness at the Rogers International Commodity Index (RICI) and its Energy Sub-index (RICI-E) and Metals Sub-index (RICI-M). It is concluded that the relationship between the financialized energy markets and commodity markets cannot be estimated by

Table 5.14 Connectedness results based on BK approach (2012) with frequency domain—long term

Without correlation				
	RRZM	RRNE	FROM_ABSOLUTE	FROM_WITHIN
RRZM	98.41	0.57	0.29	0.32
RRNE	77.49	4.65	38.74	42.78
TO_ABSOLUTE	38.74	0.29	39.03	
TO_WITHIN	42.78	0.32		43.10

The spillover table for band: 0.79 to 0.00 Roughly corresponds to 4 days to Inf days. spilloverBK12 (n.ahead = 100, no. corr = T, partition = bounds <− c(pi+0.00001, pi/4, pi/10, 0))

Source: Table data calculated by authors

standard approaches. In fact, such an asymmetrically connectedness is not affected by the economic conjuncture in general but has become a determinant. The increase in connectedness of energy and commodity markets is a systemic risk indicator for the world economy. Therefore, the connectedness between these two markets is an important source of impact, leading to the explosion of systemic risk.

It is a fact that the energy prices are the main determinant of supply side of economy. However, it can be stated that as a result of the change in energy prices towards commodity markets through the financialization of commodity markets, a cost element may arise from the financial channel. In general, it is seen that long positions in energy contracts are accepted as a result of frequency-based analysis. In this respect, it is concluded that fluctuations in energy prices can spread to commodity markets. Hence, a downward movement of energy prices can rapidly divert economies, especially the countries producing commodities within the Rodger International Commodity Index (RICI), to stagnation. It has been revealed that it is acceptable to use the RICI as an indicator in the global financial markets.

The financial connectedness in energy and commodity markets indicates changes in energy and commodity price correlations and volatility, which have intense implications for a broad range of topics, from producers' hedging strategies and speculators' investment strategies to energy and commodity policies of various countries. These implications are expected to continue so long as popularity of index investment strategies increase steadily among investors.

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Part II
Strategic Thinking in Business Ecosystem

Chapter 6
Business Strategy for Sustainable Development in the Digital Era: Green Management

Umit Deniz Ilhan

Abstract Technological developments in the historical process brought along transformations that have resulted in revolutions in industry. Starting with the First Industrial Revolution that took place in the second half of the eighteenth century, we have experienced revolutionary transformations, the driving forces of which were steam power (mechanisation), electricity (mass production), electronics and information technology (automation), and cyber-physical systems (digitalisation). Besides providing many opportunities and benefits for humanity, these transformations have brought many threats regarding social, economic, technological, and environmental aspects. The awareness of these threats encouraged the development of the awareness of the need to protect the environment in its broadest sense with a collective consciousness. The understanding of sustainable development has developed as a result of this collective consciousness and stands for not damaging the potentials of future generations to meet their own needs while meeting the needs of the present generations. In this regard, green management, which is all about implementing healthy, human, and environmentally friendly practices in business functions, has gained particular importance in digital era. Therefore, the future of green management appears promising for the sake of sustainable development. In this process, taking advantage of the opportunities offered by digital technologies will make it easier to achieve these benefits. Based on this framework, in this study, green management is examined as a business strategy for sustainable development in the digital era.

Keywords Green management · Sustainable development · Business strategy · Global climate change · Digital transformation · Environmentally friendly technologies

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6.1 Introduction

Since the industry has undergone transformations that have resulted in revolutions over the years, many forms of production have come to an end, some have just emerged, and some will emerge soon. In this ongoing series of revolution, technological developments have played a significant role both in industrial transformation and social development in each period (TWI2050 2019). In fact, the developments are expected to support human well-being in the long-term. However, in addition to providing opportunities and benefits for humanity, all developments brought unintended social, economic, technological, and environmental consequences as well (Scholz 2017).

One of the foremost—perhaps the foremost—vital and harmful consequence of industrialization that has been on the agenda recently is undoubtedly global climate change (Houghton 2009). Beginning with the second half of the eighteenth century, when the Industrial Revolution took place and people started to consume fossil fuels, human impact on the environment has reached global dimensions. Since then, besides the natural cycles, the human factor is also considered to have had a contribution to the changes in the composition of the atmosphere, which are likely to lead to climate change. Therefore, the earth has experienced increases in temperature, which have caused global warming due to the rapid increase in greenhouse gases, which are mainly caused by burning huge amounts of fossil fuels. Moreover, the greenhouse gas levels in the atmosphere, which have increased with the use of these fossil fuels since the Industrial Revolution, have resulted in changes in both global and regional climate patterns (Weart 2008).

Global climate change is widely considered to be a serious threat to places, species, and people's livelihoods. Therefore, awareness of the threats has encouraged the development of a collective consciousness of the need to protect the environment by considering it in a much more comprehensive dimension (Paula and Cavalcanti 2000). The understanding of sustainable development, which is being continued as one of the main discussion topics of the twenty-first century, is the result of this collective consciousness. Such an understanding stands for not damaging the potentials of future generations to meet their own needs while meeting the needs of the present generations. Indeed, issues such as the acceleration of industrialisation, the rapid growth of the population, common nutritional deficiencies, the depletion of non-renewable resources, and the deterioration of ecological balance are among the main areas of interest for sustainable development (Choi 2017).

In this context, today businesses have adopted or tend to adopt sustainable practices in all or part of their business functions. For instance, some organisations convert waste heat or water back into energy in their production processes; some others use 100% recyclable materials in their products; and some use environmentally friendly low-emission vehicles in their logistics (Russell et al. 2007). At this point, as the natural result of businesses' sustainable development strategies, the understanding of green management has gained importance. Green management

may be perceived as a business strategy aimed at changing entire business practices and operational processes to reduce the adverse impacts on the environment, to be healthy, human, and environmentally friendly (Simula et al. 2009).

On the other side, currently we are in the middle of a digital transformation that will fundamentally change our relationship with the environment and our work and lifestyle. As mentioned above, the same can be considered for the revolution caused by digital transformation, as all previous revolutions bring along big winners and losers (TWI2050 2019). In general, the digital transformation will have positive contributions, yet there will also be clear dangers and downsides. A thorough understanding and application of digitalisation is an important strategy phase for forward-looking businesses because of the great potential for advances in technology and digitalisation to drive society towards a sustainable future. Since it plays a vital role in balancing the natural environment and social development, the future of green management appears promising for each organisation in this era (Colglazier 2018).

Based on this framework, this study examines green management as a business strategy for sustainable development in the digital era. It is thought that this study, which is based on an international literature search, will provide a useful viewpoint for businesses. Applying and managing green management practices effectively may help businesses increase their efficiency and gain competitive advantage. Also, taking advantage of the opportunities offered by digital technologies in this process will accelerate these benefits.

The study was structured in three sections. In the next section, industrial revolutions were briefly overviewed within the historical process. Following this overview, digital transformation as a characteristic feature of today's industry was discussed in detail. In the third section, within the framework of the concept of sustainable development, a series of international conferences and initiatives that contributed to this concept was explained. This section further presented economic development, social development, and environmental protection as three components of sustainable development. In the fourth section, by focusing on the term *green*, the concept of green management was explained. Following this, the need for and the scope of green management were illustrated. Finally, in the conclusion, by referring to the discussed literature in these three sections, the relationship between digital transformation and sustainable development was handled, and the role of green management as a business strategy was revealed.

6.2 The Digital Era

6.2.1 Overview of the Industrial Revolutions

Industry, an important determinant of production and an essential source of income for the economy in general, has undergone transformations that have resulted in revolutions over the years. Production patterns have changed, and production

channels have diversified through these transformations. Before the industrial revolutions, which will further be discussed in detail below, everything was produced by the muscle power of either a human being or an animal. However, with these transformations, many forms of production have ended, some have just emerged, and some will emerge soon.

Although it is obvious that transformations will continue rapidly in the future, these transformations in the industry can be evaluated in four periods. The first significant period is the First Industrial Revolution (Industry 1.0), which took place in the second half of the 1700s, with the invention of coal-based steam machines and their subsequent use as an energy source in production lines. Industry 1.0 is considered the starting period for technological developments and the series of industrial revolutions that have been achieved ever since. In Industry 1.0, human and animal muscle power, as the main energy sources in previous periods, were replaced by a new energy source—machines operating with steam power (Herzberg et al. 1959). During this period, which was characterised by the transition from labour-intense production to machine-intense production, productivity and efficiency started to increase (Choi 2017). Industry 1.0 has paved the way for the Second Industrial Revolution (Industry 2.0). While the driving force was steam machines in Industry 1.0, in Industry 2.0, it was electrical power, which led to the increase in mass production capacity, the diversification of the products produced, and a decrease in costs. In practical terms, major differences between Industry 1.0 and 2.0 were the increased production capacities that sprang from the new machines used in production. Industry 2.0 was started in the second half of the 1800s and continued until the second half of the 1900s. Next, with the Third Industrial Revolution (Industry 3.0), the driving force became automation through electronics and information technologies (IT). Especially after the 1940s, ground-breaking innovations were seen in electronics and IT. After electronics and IT became the driving forces in production, much smaller and practical products entered our daily lives. In this process, the fact that the machines dominated not only working life but also our daily life caused the need for manpower to decrease (Schwab and Davis 2018). Finally, the Fourth Industrial Revolution (Industry 4.0), which started with the end of Industry 3.0 around 2010, is the name given to a total digital transformation through cyber-physical systems, covering many areas such as smart robots, fully autonomous systems, and virtual reality (Schwab 2017). Figure 6.1 below summarises this historical process:

When all these industrial revolutions, from Industry 1.0 to Industry 4.0, are taken into consideration, it is obvious that technology has played a very significant role in transforming from one period to another. Thus, there have been revolutionary transformations in production from steam-powered machines to electricity-powered machines and from automatic machines to digital machines and virtual environments that can communicate with each other. In this historical process, each period has a unique characteristic feature depending on the developments in technology, and each period removes the practical validity of the previous one on a large scale (TWI2050 2019).

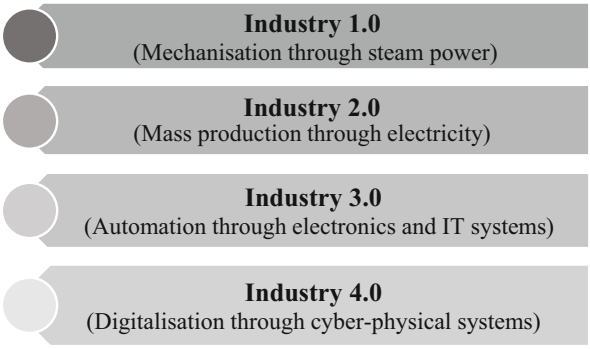

Fig. 6.1 The historical process from Industry 1.0 to Industry 4.0

Technological development, which has rapidly accelerated during the twenty-first century, continues to bring rapid change and transformation in all areas, especially with the widespread and effective use of developments in information and communication technologies (İlhan 2019). This current period, which is also known as the Digital Era,[1] is regarded as the period in which the most important socioeconomic and cultural developments have been experienced since Industry 1.0 (Nambisan and Baron 2013; Zaheer et al. 2019). In this period, information and communication technologies are developing complementary to each other and providing information flow more effectively, which catalyses this acceleration. Of course, the previous revolutions have created great social changes and opportunities, but the transformations we have experienced in this century are far more advanced than the previous ones in terms of the speed at which new ideas and technologies spread around the world (Schwab 2017). This has resulted in the effects of change and transformation covering all areas of life, from the economy to education and from working conditions to organisational culture (Nambisan et al. 2017; Yoo 2010).

In this industrial revolution process, although digital transformation, which will be discussed further in the following section, has reached its popularity very recently, its journey started in the middle of the twentieth century. It was just about the time when semiconductors, mainframe computing (in the 1960s), personal computing (in the1970s), and the internet (in the 1990s) became major digital drivers, respectively (Cortada 2012). From this perspective, digitalisation is not a new phenomenon. However, with the rise of smart, mobile, and artificial technologies, digital technologies have experienced a significant increase. In this sense, they have become an important part of the strategy of many businesses by moving from support processes to core processes (Yoo et al. 2012).

[1] Also known as the Computer Age, Digital Age, Information Age or New Media Age.

6.2.2 Digital Transformation

Digital transformation, which characterises Industry 4.0, is described and defined from different perspectives in the literature. To give certain examples, first of all, researchers describe digital transformation as a process (Agarwal et al. 2010; Loebbecke and Picot 2015), a strategy (Granados and Gupta 2015; Hansen and Sia 2015), or a business model (Stieglitz and Brockmann 2012). In addition, digital transformation is rather defined by emphasising its features, drivers, and impacts. For example, the features of digital transformation are defined as evolutionary (Westerman et al. 2014), radical (Berman and Marshall 2014; Granados and Gupta 2015), or disruptive (Janowski 2015; Loebbecke and Picot 2015). Moreover, the drivers of digital transformation are defined as digital technologies (Berman 2012; Setia et al. 2013), strategies (Bharadwaj et al. 2013; Matt et al. 2015), or a value chain (Tamm et al. 2015). Finally, the impacts of digital transformation are defined as value creation (Berman and Marshall 2014; Chen et al. 2014), competitive advantage (Matt et al. 2015; Schuchmann and Seufert 2015), or improved relationships (Bharosa et al. 2013).

Based on these definitions, in this study, digital transformation is defined as follows: An evolutionary process that uses digital technologies to create additional value for the business itself and the stakeholders, ultimately resulting in improved profitability. This definition can be broken down into four primary focuses: (a) Being an evolutionary process, (b) using digital technologies, (c) aiming to create additional value for the business itself and the stakeholders, and (d) improving profitability.

To further explain and clarify this definition, first of all, the feature of digital transformation is defined as an evolutionary process, since being an evolutionary process indicates that digital transformation continues for a certain period by integrating digital technologies into all functions of the business (Bharosa et al. 2013; Liu et al. 2011; Schuchmann and Seufert 2015). Next, the driver of digital transformation is defined as digital technologies because it is believed that digital technologies, which allow for digitisation and facilitates digitalisation, play a vital role in the digital transformation process by coupling other factors including business strategy, organisational culture, and a digitally-savvy workforce. As is highlighted by the literature, the best digital transformation results may be obtained when digital capabilities are combined with digital technologies (Berman and Marshall 2014; Loebbecke and Picot 2015; Matt et al. 2015). In other words, at the foundation of all technology-enabled organisational transformation efforts, there are technology-based systems (Besson and Rowe 2012). Furthermore, the impact of digital transformation is defined as creating additional value for the business itself and the stakeholders (Berman and Marshall 2014; Bharosa et al. 2013). Lastly, the result of digital transformation is defined as improved profitability. As for businesses, they cannot sustain their activities in the long-term without maximising their profit (Besler 2009).

Today, digital developments, such as connectivity, artificial intelligence, machine learning, robotics, and 3-D printing have been continuing to gain prevalence (Lee et al. 2015; Roblek et al. 2016). By favouring non-material and shared benefits, these developments are expected to play a key role in long-term social transformations and supporting human well-being. However, starting from Industry 1.0, all revolutions have resulted on one side in great winners and on the other side in losers as well. The digital transformation is also considered a double-edged sword with its winners and losers. In this sense, it reshapes the entire society, particularly by affecting the economy, workforce, energy resources, and carbon efficiency. It also reduces production costs and increases access to services (TWI2050 2019). But, in addition to providing such opportunities and benefits, it adds complexity, threats, and vulnerabilities to the different areas of society and the economy as well (Scholz 2017). In fact, generally, the main feature of industrialisation in a negative sense is that it causes an increase in technological, social, and environmental risks and crises. These risks and crises have arisen depending on the industrial activities of the businesses (Shrivastava 1995). They were initially excused for development, over time they ceased to be just local—they gradually became regional and then global. Therefore, the awareness of these threats has encouraged the development of a collective consciousness of the need to protect the environment by considering it in a much more comprehensive dimension and has created an environment for the birth of sustainable development (Paula and Cavalcanti 2000).

6.3 Sustainable Development

6.3.1 Concept of Sustainable Development

Sustainable development is one of the main discussion topics of the twenty-first century. Although the scope of it and the responsibilities of the parties continue to be discussed, the definitions are basically diversified within the framework of the following definition provided in the report published by the United Nations (UN)[2] World Commission on Environment and Development (WCED 1987: 16): '*Sustainable development is a development which meets the needs of the present without compromising the ability of future generations to meet their own needs*'. The definition consists of two key concepts: (a) Needs are not limited to economic needs only but to a wider scope and imply the essential needs of the poorest, to which priority should be given (b) by meeting present and future needs, equity among generations is targeted. Therefore, the idea of transferring ecological capital stock to future generations comes to the fore within the scope of this definition (Choi

[2]Founded in 1945, the United Nations (UN) currently comprises 193 countries. It aims to enable governments to solve problems arising from these challenges together by allowing member countries to express their views on the challenges facing the world.

2017). In other words, the concept of sustainable development expresses an ethical concern about the need to provide and maintain an appropriate ecological infrastructure both for present and future generations (Wiersum 1995).

Increasing awareness of environmental problems on a global scale mentioned in the previous section has stimulated policymakers to promote a series of international conferences and initiatives to discuss the potential ways forward. To begin with, in 1972, the UN Conference on the Human Environment (UNCHE),[3] held in Stockholm, focused on the need to develop a common perspective and common principles that will inspire and guide the world for environmental protection. This conference was important in terms of accepting the existence of environmental problems at a global level and revealing the necessity of seeking solutions. As a matter of fact, it is possible to say that great steps have been taken to combat environmental problems worldwide since then. Such that, following it, in 1983, the UN Environment Programme (UNEP) was established to find a solution to the environmental and economic problems that came to the fore in Stockholm. The commission carried out various studies worldwide and presented its final report to the UN General Assembly. In 1987, WCED published this report, 'Our Common Future', later referred to as the Brundtland Report. As mentioned above, the report has provided a definition that remains widely used for sustainable development even today. The Brundtland Report paved the way for developing a global action plan for sustainable development, addressing economic, social, and environmental issues. In 1992, the UN Conference on Environment and Development, also known as the Rio Earth Summit, was held. It was one of the largest environmental conferences ever held, and it brought together more than 100 heads of state. The World Summit on Sustainable Development (WSSD), held in Johannesburg, South Africa[4] in 2002, was another important step taken in this sense. The summit brought together leaders of civil society organisations, businesses, and other groups, especially heads of state and government. The main focus of the summit was again to direct actions to overcome the difficult challenges facing the world. More recently, along with the 2015 Paris Agreement, which has made all signatories a long-term goal to keep the global average temperature rise below 2 °C and below 1.5 °C if possible, in 2015, the UN adopted the 2030 Agenda for Sustainable Development, which is planned to be achieved by 2030. The 2030 Agenda includes 169 targets within 17 sustainable development goals to realise the desired future for human development.

Although not limited to the ones mentioned above, there are some other important international conferences and initiatives on sustainable development. The point reached with these is basically within the framework of the acceleration of industrialisation, rapid growth of the population, common nutritional deficiencies, depletion of non-renewable resources, and deterioration of ecological balance (TWI2050 2019). Such international conferences and initiatives on sustainable

[3] Also known as the Stockholm Conference.

[4] Also known as 'Rio+10' since it was convened 10 years after the first Earth Summit in Rio de Janeiro.

development have also led to the development of global standards and principles for businesses that want to operate within the framework of sustainability (Tokgöz and Önce 2009).

Returning to the emergence of a need for sustainable development, it was, as discussed before, the undesirable consequences of industrial revolutions and social developments. These undesirable consequences, which have come to the forefront as a threatening world problem, have become increasingly important and paved the way for sustainable development to be accepted as a common political goal by all countries (Shrivastava 1995). It is also because achieving more holistic successes as well as economic successes have become important in ensuring corporate sustainability and stakeholders have come to expect businesses to create social value. In this context, it has been an important requirement for businesses to carry out activities demonstrating that they care about all their stakeholders (Nunes and Bennett 2010).

In fact, the relationship between population growth, resource consumption, and environmental impacts and sustainability have been discussed since the 1950s. At first, according to the traditional management approach, it was not accepted as being among the responsibilities of businesses. Rather, the main responsibility of businesses was towards their shareholders just by focusing on profit and growth. Thus, many issues within the scope of sustainability were regarded and deemed as the responsibility of governments (Russell et al. 2007). Moreover, classical economists excluded environmental problems for a long time as they assumed that natural resources have unlimited availability. Over time, this understanding has gradually changed, and it has become a requirement for businesses to include not only their shareholders but also other parties that they influence during their operations (Young and Thylil 2008). Indeed, today, proponents of sustainability argue that it is unacceptable for businesses to continue their activities by ignoring this requirement (Marshall and Brown 2003).

6.3.2 Components of Sustainable Development

With the 2005 World Summit held in New York, more than 170 heads of state and government have come together. The summit identified components of sustainable development as economic development, social development, and environmental protection. It was also admitted at the summit that these components are interdependent and mutually reinforcing pillars thus, to achieve sustainability, they should be in balance and equal harmony. Such an understanding emphasises the importance of each of these three components and implies that an implementation cannot be completely sustainable unless all these three components are fully met (Casula and Soneryd 2012; Morelli 2011).

One more issue that needs attention in this regard is that sustainable development has a broad range of aspects: It could be considered in the (a) global context (Liu et al. 2011), (b) local context (Wagner 2014), or (c) organisational context (Beasley and Showalter 2015). This study focuses on the organisational context of

sustainability. Based on this framework, for instance, Hart and Dowell (2011) define a sustainable development strategy within the scope of these three components by drawing attention to the importance of the sustainability of eco-friendly production processes in the future. In another study, Torugsa et al. (2013) define a sustainability strategy in which economic development, social development, and environmental protection are integrated into a single strategy. Therefore, a sustainable business strategy may be represented as integrating the strategies regarding economic development, social development, and environmental protection into the organisation's goals, activities, and plans, to create long-term value not only for the business itself but also for its stakeholders. While preserving the natural resources that will be needed in the future and developing them by ensuring their sustainability, today sustainable development adopts strategies and activities to meet the needs of the businesses and stakeholders (Mustapha et al. 2017). Moreover, such a strategy recognises that the components of sustainability are not exclusive but rather reinforcing (Long 2019). Thus, we need to fully understand the dynamics of these components, which are further discussed below, to determine the integration between them.

6.3.2.1 Economic Development

Economic development means that the economic production of an economy can be supported at a defined level indefinitely (Costache et al. 2019). The potential for resource depletion has an important role in the economic dimension of sustainability. Due to this potential, sustainability has always been a core aspect of the economy regarding renewable natural resources (Vivien 2008). Therefore, resources must be used efficiently and responsibly to continue operating sustainably and consistently generate operational profit in the future.

As for businesses, they cannot sustain their activities in the long-term without gaining profit, and thus, the main purpose of businesses as an economic asset is to maximise their profits. Therefore, economic development is about evaluating opportunities that arise with economic, social, and environmental activities. In this regard, it can be considered as an approach that aims to be profitable while continuing activities that benefit society, such as creating value for stakeholders in the long-term (Besler 2009). In other words, it is to ensure that the current assets of a business continue to regularly operate effectively and efficiently over time (Moldan et al. 2012). Applications such as recycling energy and materials into raw materials, using less material in the provision of goods and services, and recycling of waste generated by production processes, consumers, or producers may be considered in this context (Vivien 2008).

6.3.2.2 Social Development

Social development emphasises meeting the basic needs of individuals in society. It covers issues such as social justice, social equity, health equity, community development, human rights, labour rights, social support, community resilience, and cultural competence. By covering these issues, social development includes the maintenance of physical, cultural, and social spaces that support social well-being and the provision of opportunities for people to benefit from them (Palich and Edmonds 2013). Moreover, it aims to ensure that future generations will have access to such social resources, at least, as much as the present generations. At this point, it is a positive understanding that supports strong social cohesion and equity in access to basic social services (Mak and Peacock 2011).

A sustainable work organisation would consider protecting the functional capabilities of its employees, stakeholders, and affected natural resources while trying to achieve its economic goals (Kira and Eijnatten 2008). Therefore, it can be inferred that socially sustainable businesses provide a good quality of working life for the employees and the stakeholders. In this context, businesses are expected to place value on human capital by considering the interests of the employees and the stakeholders while striving to be equitable and ethical. Further, businesses are expected to strive for long-term social sustainability regarding the ability to meet the basic needs of future generations (Mustapha et al. 2017).

6.3.2.3 Environmental Protection

Environmental protection is the ability to meet today's demands by not reducing natural capacity to ensure that everyone lives well in the future. In other words, it is a state that implies caring for meeting the needs of the future generations while meeting the needs of the present generations. In this regard, environmental protection may be defined as an effort to maintain ecological balance by adopting behaviours that can keep the environment in its most natural state (Morelli 2011). As a whole, it addresses the relationship of human beings with nature, considering that sustainability of environmental factors, which are vital for all living things, is essential for the continuation of life in the future (Goodland and Daly 1996).

Considering the above, businesses are expected to make responsible choices that will reduce any harmful influences of their facilities on the environment. However, such expectations are not only related to limited practices such as reducing the amount of waste or using less energy. They are also about developing processes that will make businesses fully sustainable in the future (Costache et al. 2019). That is, the main issue emphasised by environmental protection is the impact of whole business facilities on the environment. Therefore, environmental protection paves the way for businesses to review their environmental impacts, drawing attention to global environmental concerns. It also provides the opportunity to integrate

sustainability goals into business strategies, such as corporate social responsibility programs, with a broader perspective (Mustapha et al. 2017).

There are environmental management systems that include a range of processes and practices to enable businesses to reduce their environmental impact and increase their efficiency. They guide businesses to develop environmental policies, set goals and processes to achieve these policies, and adhere to the requirements of international standards by constantly improving their performance (García-Pozo et al. 2013). In this sense, businesses are expected to identify and manage any sources of environmental problems related to their operational activities taking the environmental management systems as a guide (Lemaire et al. 2014).

6.4 Green Management

6.4.1 Concept of Green Management

It is important to fully understand what the term *green* means before defining green management. In general, the use of the term indicates that something is healthy, human, and environmentally friendly (Alzgool 2019). Today, the term *green* in the operational sense has become frequently used in the context of referring to new technologies and new products that have a sustainable impact on nature and the environment (Simula et al. 2009). It also refers to the commitment to sustainability within business policy (Misso et al. 2018).

While sustainable development is examined within its three components as economic, social, and environmental, green management, which gained popularity in the 2000s, is handled in a way that covers all these components (Siegel 2009). In this sense, it may be defined as a business activity in the context of converting inputs such as raw materials and auxiliaries into outputs such as goods and services, focusing on the balance between economic, social, and environmental benefits (Raharjo 2019). However, it fundamentally refers to environmental practices. Thus, it is about implementing appropriate eco-friendly activities, which on the one hand improve the level of individuals' awareness for environmental protection and on the other hand minimise the businesses' negative effects on the environment (Rawashdeh 2018).

Some businesses consider simple actions, such as compliance with legal standards or reducing paper consumption, as green management practices. Beyond that, green management is a collection of green practices adopted by businesses requiring new corporate strategies, organisational restructuring, or a complete revision of production processes (Haden et al. 2009). In its broadest scope, it is the process of changing the organisational structure, individual responsibilities, directives, administrative practices, and operational processes to achieve organisational goals, especially by adding environmental variables to product and process development activities and reducing the negative effects of operational facilities (Molina-Azorin et al. 2009).

For businesses, green practices can be effective as long as individual green values are developed. Indeed, in achieving any organisational policy, individuals have always played an important role (Liu et al. 2011). Therefore, it is necessary to develop and enrich individual green values to make it easier for businesses to reach their targets in green practices (Edwards and Shipp 2007). In this context, since practices and policies in the workplace have a great influence on guiding employees' behaviour (Bissing-Olson et al. 2013), businesses can contribute to the development of individual green values with the green practices they put into practice (Shen et al. 2018).

6.4.2 Need for Green Management

As explained above, technological developments have contributed to an increase in productivity, efficiency, and profitability. However, they have brought along damages by contributing to the resource shortage and the ecological balance disruption. As a matter of fact, undeniable urgency has arisen to prevent this environmental damage (Haden et al. 2009). At this point, green management, which defends environmental awareness, has gained importance as a natural result of the sustainable development strategy of businesses (Simula et al. 2009).

Nature requires its users to have a more caring attitude so that resources could be preserved and utilised longer. The increasing utilisation of natural resources is gradually leading businesses to a serious situation that demands the urgent attention of all concerned parties. Businesses with increased environmental concerns are now required to act to avoid any harmful effects on the environment (Haden et al. 2009). This situation suggests behaving in a manner to help save natural resources (Alshuwaikhat and Abubakar 2008). Within every business, it is the responsibility of every individual, from the lowest level staff to the senior management, to perform business activities by using the minimum amount of natural resources; thus, individuals and businesses are required to act responsibly to apply green practices (Opatha and Arulrajah 2014).

Green management covers both business ethics and corporate social responsibility perspectives. From the business ethics perspective, it supports businesses in protecting the natural environment. From the corporate social responsibility perspective, it supports creating positive organisational environmental performance by satisfying stakeholders' needs and expectations. Therefore, both perspectives highlight the importance of green management practices for businesses to create and maintain environmental performance (Rawashdeh 2018). That is why green management has become a popular management strategy for businesses to achieve their goals effectively. Studies reveal that implementing green management practices successfully may help businesses improve their productivity and gain a competitive advantage (e.g., Roy and Khastagir 2016; Schniederjans et al. 2006; Yang et al. 2015). Therefore, businesses endeavour to build green practices over time to achieve productivity and increase their core competencies (Rawashdeh 2018).

Further reasons that trigger this change in an international context may be listed as follows: (a) Environmental legislation has increased exponentially and legal requirements have become widespread to include environmental concerns in product development issues (Haden et al. 2009), (b) a niche market with environmentally-friendly green consumers has emerged (Pujari 2006), (c) environmental organisations have created local awareness to act against environmentally harmful businesses (Claver et al. 2007), and (d) high environmental performance has started to be seen as an important competitive advantage for businesses (Porter and Van Der Linde 1995).

6.4.3 Scope of Green Management

Green management is a business strategy that aims to create positive business performance to support sustainable development. This strategy plays a vital role in developing more productive and competitive businesses while leading them to minimise their harmful effects on the environment (Alzgool 2019). In this context, green management practices regarding main business functions, such as green production, green marketing, green accounting and finance, green human resources, and green public relations, need to be discussed.

To detail these main business functions in terms of green management, it will be better to discuss *green production*. Green production is a business strategy that focuses on environmentally friendly business processes (Ali 2015). In other words, it is integrating preventive environmental management strategies into business processes to eliminate the risks of environmental damage (Büyüközkan and Vardaroğlu 2008). The primary factor affecting green production is using renewable energy sources. Moreover, many tools, such as environmentally friendly technologies and recycling methods, facilitate the expansion of green production (Yu et al. 2016). Another factor affecting green production is green innovation in which new ideas, attitudes, products, and processes will be developed and implemented to support sustainable development and to reduce environmental damage (Rennings 2000).

Green marketing is the next main business function in terms of green management. It includes all kinds of environmentally friendly marketing activities aimed at meeting consumer demands and needs. While meeting these demands and requirements, it draws attention to minimise damage to the natural environment. In this context, it may be defined as the realisation of the marketing process with the least harm to the natural environment (Crane 2000). Unfortunately, many people consider terms such as recyclable, refillable, phosphate-free, ozone-friendly, and environmentally friendly as the whole scope of green marketing and believe that it refers to the advertising of products with such characteristics. However, green marketing is a much broader practice in terms of developing unique strategies (Polonsky 1994).

One of the other main business functions in terms of green management is *green accounting and finance*. Changing environmental factors pose new responsibilities to accounting and finance professionals to develop innovative approaches to

incorporate environmental factors into their accounting and to develop products to finance the transition to a low-carbon and environmentally friendly economy (Şenocak and Bursalı 2018). The classification of the environmental activities of businesses and the arrangement of their ultimate dimensions in the balance sheet of the business are the focus of green accounting and finance. Therefore, green accounting and finance deal with creating new financial information and control systems to obtain more environmental benefits. In this sense, green accounting and finance involve the efficient allocation of resources for sustainable development. Besides, monitoring the sustainability performance of these resources is important for the protection of the environment (Ng 2018). Furthermore, as a result of technological advances, the economic transformation has rapidly taken place especially over the last 30 years (Ertuğrul 2020). Intangibles-based assets have dominated today's economy, which makes them the locomotive of economic wealth and growth (Lev 2000). This rapid transformation has triggered certain discussions on the recording and reporting of intangibles (Ertuğrul 2020). Those discussions should also include green aspects of the issue. This rapid transformation based on intangibles should also incorporate green accounting and finance practices not being limited to green investments or low-carbon orientation as in the tangible-based old economic system. In other words, concerns highlighted by Şenocak and Bursalı (2018) are also valid for the current economic system, which should develop green accounting and finance practices to improve the sustainability and competitiveness of the system.

Another business function in terms of green management is *green human resources management.* Green HRM involves the systematic and planned harmonisation of traditional human resources management practices with the sustainability goals of the organisation within the framework of the environmental protection component (Jabbour and Santos 2008). In this sense, green practices within the framework of the HRM function constitute systematic practices adopted to support the environmental sustainability performance of the organisation (Saeed et al. 2019). This approach means that all HRM practices, especially recruitment, training and development, performance management and evaluation, rewards and compensation, are aligned with the sustainability objectives with the focus on an environmental protection component (Haddock-Millar et al. 2016). Thus, employees will be able to adopt and implement policies and develop behaviours and learning processes to improve environmental activities such as reducing their carbon footprint, using natural resources rationally, and recycling. In this regard, green human resources play a central role in raising environmental awareness among employees and other stakeholders (Khurshid and Darzi 2016).

Finally, *green public relations* is one more business function in terms of green management. It provides advantages to businesses in managing company (or brand) image and developing relations with stakeholders (Khurshid and Darzi 2016). As known, a damaged company (or brand) image negatively affects both customer loyalty and employee commitment. It also threatens the financial well-being and sustainability purpose of the businesses (Argenti and Druckenmiller 2004). In this regard, it involves communicating about an organisation's corporate social responsibility or environmentally friendly facilities to the public. Such facilities, which will

be carried out in a realistic attitude, will contribute to the development of environmental awareness of stakeholders. On the other hand, these facilities will also contribute to the reputation of the company (Ahmad 2015).

6.5 Conclusion

In the twenty-first century, the world is witnessing the Fourth Industrial Revolution and the digital transformation, which is commonly known as Industry 4.0. Since the first Industrial Revolution in the eighteenth century, the world has been dealing with the challenges of producing more goods from limited natural resources to meet ever-growing consumption demands (Beier et al. 2018). In this ongoing process, technological developments have resulted in both negative and positive consequences. Technological developments have also been the tool to combat the negative consequences they have brought (Müller et al. 2018).

On the one hand, social development should continue and on the other hand, our responsibility to leave a livable world to the next generations has resulted in the search for a balance between social development and environmental protection (Bebbington and Larrinaga 2014). Sustainable development, as an approach, has emerged as a result of such need, and the concept was first proposed through the Brundtland Report by the WCED in 1987, which described sustainable development by focusing on not damaging the potentials of future generations to meet their own needs while meeting the needs of the present generations.

The 2005 World Summit identified three components of sustainable development. In this sense, first, economic development concerns long-term economic growth and suggests that the growth of economic capital should not be at the expense of a decrease in natural or social capital. Thus, economic growth should not ignore the balance in natural resources, ecosystems, social welfare, and distribution of wealth (Choi and Ng 2011). Next, social development is the process of recognising and managing the positive and negative business, environmental, economic, and technological impacts on people. Its ultimate goal is the creation of healthy and livable communities where everyone is protected from discrimination and has access to universal human rights and basic amenities such as security or healthcare (Dempsey et al. 2011). Third, environmental protection is mainly concerned with maintaining the equilibrium of the environmental system, the balance of natural resources consumption and replenishment, and ecological integrity (Glavic and Lukman 2007).

Recently, considering that the level of energy and material consumption has increased, which contributes to environmental damage and natural resource exhaustion, maintaining both environmental and social development by limiting negative impacts has become more vital (Ghobakhloo 2020). Therefore, awareness among businesses towards green management has gained importance. Green management, in general, refers to implementing environmentally friendly practices in business functions. The core value of green management is the priority of protecting the

environment in all its initiatives (Rawashdeh 2018). In this sense, it is a comprehensive phenomenon that has developed particular importance in this era. Green management is all about sustainable development for businesses without compromising the future needs since green practices aim to reduce pollution and try to prevent carbon emissions from causing the greenhouse effect (Scholz and Voracek 2016).

At this point, it is believed that the digital transformation will re-interpret the understanding of sustainable development by radically changing all dimensions of societies and economies. In this respect, it is claimed that digitalisation will be the driving force of a change that can break the barriers in front of sustainable development as well. Putting aside the potential threats of digitalisation, developing scientific, technological, and innovative road maps to better understand its benefits should be a priority for businesses (Colglazier 2018) For digital transformation to play a positive role in supporting sustainable development goals, the three components of sustainable development need to be implemented within the prerequisites and objectives of economic development, social development, and environmental protection. On the other hand, ignoring them may cause the financial structures and market shares of businesses to weaken over time.

Many studies show that businesses that gain comprehensive information about the contribution of digital technologies to the sustainability of their businesses and use this information to reshape their business strategies will be successful in the digital era (Steurer et al. 2005; Torugsa et al. 2013). Therefore, sustainable development in the digital era must be achieved by taking into consideration the dynamics of the digital transformation and the goals of the international meetings and the initiatives—more recently, the 2030 Agenda and the Paris Agreement—on sustainable development. Hopefully, the future of green management seems promising for organisations in this era as it plays a vital role in balancing environmental protection and social development (Colglazier 2018). In this process, making effective use of green management practices by benefiting from the opportunities offered by digital technologies will help businesses not only balance environmental protection and social development but also increase their efficiency and gain a competitive advantage.

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Chapter 7
Risk, Asset and Liability Management in Banking: Conceptual and Contemporary Approach

Adnan Guzel

Abstract The main determinants of bank profitability is the net interest margin. Although the net interest margin is an important component of bank profitability, it is also important to manage assets, liabilities and risks such as market interest rates, exchange rates, credit risk effectively and efficiently. Risk management (RM) requires an effective asset and liability management (A&LM). (A&LM) is the effective arrangement, planning and management of the bank balance-sheet in order to achieve the goal of maximum profitability, stable and sustainable growth by taking risk and liquidity principles in banking as reference. (A&LM) includes the management of assets and cash flows in order to meet the liabilities of the changing conditions in the economy and financial markets, and the distribution of funds realised from various sources to obtain the highest resource efficiency. It is a way of risk management, which aims to reduce banks' failure to fulfil their liabilities and to increase their profitability. Although RM in banks is not an (A&LM) but they complement each other in terms of increasing market value, sustainability and performance of banks. In this context, the aim of the study is to examine the risks (of credit, market, liquidity, operational) in the banking sector (A&LM), together with techniques used in (A&LM). In this regard, Basel III, developed by the Basel Committee for the purpose of helping banks in management of potential risks, and one of the most important regulations for banks' capital adequacy, planning of liquidity and reducing systemic risk and preventing or resolving financial crises in a systematic and conceptual approach would be explored.

Keywords Banking · Asset and liability management · Risk management · Derivatives · Basel III · Value at risk · CAMEL approach · Net interest margin · Funds transfer pricing · Break-even point

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7.1 Introduction

Financial intermediaries offer safe, highly liquid financial options of different sizes to savers directly or by providing them access to financial markets. It is not possible for savers to investigate the potential risks of corporate borrowers who issue financial assets they want to buy and make a sound judgment. Financial intermediary institutions constantly investigate, monitor, price and inform investors about the risks of such corporate borrowers. Meanwhile financial intermediaries intermediate or directly lend money to provide the funds to institutions in need. They do this with the funds they collect from savers and the resources they obtain from national or international markets rather than their equities (Selçuk and Tunay 2014).

The most important financial intermediaries are banks, and they are institutions that transfer capital from economic units with excess funds (savers) to economic units that need funds (loan users or securities issuers) for an economy to reach its potential growth rate. Banks borrow money from savers for a short term but with relatively low risk, in return they pay interest to savers. They earn interest income by investing the resources they collect from the savers in high-risk loans and various fixed and variable income securities in order to make profit. In this sense, the most important factors determining the profitability performance of banks are the net interest margin and net interest incomes connected to them (Maudos and Fernandez de Guevara 2004).

In terms of both ensuring the healthy functioning of the financial system and their own sustainable performance it is important to manage its own main banking risks (interest rate, exchange rate, liquidity, receivable risk and operational risks) effectively by accurately evaluating the risks of banks' assets and liabilities. Especially the credits and securities portfolios and derivative products based on them. Besides, deposits, other liabilities, potential investments, diversifying credit and investment portfolios, and spreading the resource structure to the base could help this management process (Francis and Siegel 2001).

The banking sector is the most important financial institution that functions as a financial intermediary in all developed and developing countries. Governments, firms and individuals also play an important role in the financial system. Governments regulate and audit the working principles of the financial system and insure individual savers' deposits. Thus, due to deposit insurance, depositors do not need a risk premium to deposit money into an insured institution. Deposit insurance is, in fact, like a subsidy provided to banks. However, by imposing a limitation on the amount of insurance, state deposit insurance institutions also restrict banks from taking excessive risk. On the other hand, states, which are economic units, resort to borrowing resources both to ensure the budget balance and to finance their other investments (Bradley and Crane 1975).

Firms are faced with many risks in production, carrying out sales and marketing activities, credit requests, liquidity and debt management, payment or collection transactions. In daily life, individuals also try to meet their infinite needs with limited incomes, make retirement plans, pay credit instalments, try to increase their savings

and to have various assets, and take interest or exchange risk while evaluating their savings. All of these economic units receive assistance from financial intermediaries (Saunders and Cornett 2011). All of these economic units sometimes need a strong financial intermediary in their relations with foreign world units, especially in international financing and payments (Saunders and Cornett 2001). Today, banks intermediate global fund flows, both nationally and internationally, and operate in all financial markets in the world. Although financial institutions assist all economic units in providing funds or evaluating their funds, they themselves operate in a much more challenging environment. The assets and liabilities of financial institutions, especially banks, are quite complex. Assets and resources cannot be considered disjointed from each other. Therefore, asset and resource management can be carried out with a long-term perspective (Saunders 1997).

Today, banks' most important assets are credits and their most important resources are their deposits. Securities and especially derivative products have an important function in asset and liability management. For example, the securitization or derivatizations of some revenue-generating assets are used as asset and liability management (ALM) strategy (Rose 1999).

Therefore, risk management and asset and liability management in banking are very important, both strategically and tactically. Risk management in banks is not asset and liability management. However, asset and liability management and risk management complement each other (Koch and Scott Macdonald 2009).

7.2 Risk Management in Digital Banking

Risk is the probability of occurrence of processes or events that may prevent a bank from achieving its strategic goals and cause a damage or financial loss. Risk and uncertainty are different. Uncertainty cannot be predicted, but risk is predictable and therefore risk can be managed. Risk refers to situations that are expected to occur but are not certain to happen. Risk management actually includes not only avoiding loss but also gaining positively (Santomero 1995).

Financial risk is the probability that the actual return deviates from the expected return. Banks' inability to diversify their portfolios sufficiently, concentration, insufficient liquidity and high risk-taking tendency are the most principal sources of risks in banking (Hull 2012). The profitability of banks is determined according to the relationship between risk and return.

7.2.1 Risk and Return Relationship in Banks

Banks are institutions that have a wide network of financial services and products, both nationally and internationally. The performance of banks depends on the risk and return relationship on the basis of service and product. Return on equity, return

on assets and even net interest margin represent the most important indicators of bank performance. The return that can be obtained from assets or equity may vary depending on the portfolio or operational risks. In other words, these risks have a significant effect on bank revenues, the profitability and determine how much capital they should keep. The most important portfolio risks in banking are market risk (risks arising from interest rates and foreign exchange rates), credit risk and liquidity risk. The management of risks arising from in-balance sheet and off-balance sheet activities in banks actually constitutes the essence of banking activities (Bradley and Crane 1975).

7.2.2 Defining Risk in Banks

The most traditional portfolio risks in banking are credit and liquidity risks (IIF 2007). However, as a result of the change in the international monetary system after the 1970s, the complete abandonment of the gold standard, and the increased freedom in international trade and fund flows as a result of financial globalization and financial liberalization since the 1980s, market risks arising from fluctuations in interest rates and exchange rates have been included in the most important risks category.

Risk, capital and profitability management have gained importance in banks with the increasing competition, financial liberalization, supranationalization and financial deregulation in the international arena after the 1980s. In this period, banks all over the world have been restructured in terms of capital and organization. Banks have started to use "securitization" and "off-balance sheet activities" along with the increasing product range. Therefore, besides traditional risk factors, market risk (risks arising from changes in interest rates and exchange rates) has become an important risk factor. Although there are many systematic and unsystematic risks faced by the banking system, the risk factors that affect the profitability performance and capital structures of banks mostly today can be considered as market risk, credit risk, liquidity risk and operational risks (Hull 2012).

7.2.3 Market Risk

Market risk refers to the risk arising from fluctuations in the market, especially in interest rates, exchange rates, stock and commodity prices (Çağıl et al. 2010). The most important of these are the interest rate and exchange rate risks arising from changes in in-balance sheet and off-balance sheet positions interest rates or exchange rates (Hou 2005).

Market risk may also arise due to other financial risks such as credit and market liquidity risk (Jorion 2001). For example, downgrading a credit rating of a bond issuer or selling a bond in high quantity by its owner can cause the reduction in

market price of that bond. Therefore, market risk is also affected by general market conditions and macroeconomic variables.

Changes that emerge with liberalization in financial markets cause significant fluctuations in interest rates, exchange rates, and prices of financial instruments. As a result of these fluctuations in the prices of financial instruments, the financial risks of banks also increase (Nelson and Schwert 2006). In this context, financial management in banks is essentially the management of risk, financial assets and resources. It is an important part of finance and risk management that decisions should be made systematically by taking into account the mixture, volume, nature, risk degree and interaction of financial assets and resources (Dowd 2005).

Since banks have financial assets and resources, they naturally include risks. These risks are generally interest rate, exchange rate, return and credit risks. There are two important issues in the financial management of banks (Tevfik and Tevfik 1997);

- Managing the difference between interest income and interest expenses namely the net interest margin.
- Managing the foreign currency position.

In the past, bankers traditionally viewed only the credit risk as the real risk factor. However, as a result of the financial crisis experienced in 2000–2001 in Turkey, many banks and financial institutions that could not adequately manage the interest rate and exchange risk had trouble and went bankrupt. Henceforth, interest rate and exchange risk, as well as liquidity risk, are concepts related to market risk that banks must carefully manage. Since the most important factor affecting the financial markets is interest rates, it is impossible for bank managements and even all financial managers to reach a sound financial settlement for the future without having sufficient information about why, how, on what purpose and when interest rates change.

Another factor affecting the financial markets is exchange rates. Exchange rates are affected by both the general economic situation of the country and the economic conditions of other countries. In addition, there is a close relationship between interest rates and exchange rates, as they directly affect each other (Barclays Bank 2012).

In banks, exchange risk management is actually the management of the foreign currency position. There are three types of foreign currency position management in banks (CPA 2008).

– There is a long foreign currency position management when foreign currency assets exceed foreign currency liabilities (foreign currency assets > foreign currency liabilities). Since the foreign currency assets of the bank are high, the bank will be able to make profit if the devaluation and foreign currency interest income is more than the borrowing cost of the local currency.
– There is a short foreign currency position when foreign currency assets cannot meet foreign currency liabilities (foreign currency assets<foreign currency liabilities). The bank has converted some of its foreign currency assets into local

currency. When the interest income to be obtained from the local currency is higher than the devaluation and foreign currency interest expense, the bank can earn income from this open position.
– If the foreign currency assets of the bank are equal to the foreign currency liabilities (foreign currency assets = foreign currency liabilities), the square foreign currency position is adopted. In this case, there will be no exchange risk.
– Banks manage their interest rate risks according to their expectations in interest rates in three ways:
– If the bank has an expectation that interest rates will increase; long-term assets are sold and converted into short-term, long-term resources are increased. For example, deposits are collected long term, loans are made available for short term, and selling long-term securities ensures positive gap.
– If the bank has an expectation that interest rates will decrease; long-term securities are purchased, loans are made available for long-term, assets are financed with short-term resources. For example, deposits are collected short-term; loans are made available for purchasing long-term securities insures long-term, negative gap.
– The bank can eliminate the interest risk by equalizing the maturity of its assets and liabilities. Since this is a breakeven position, there is no gap.

Therefore, understanding and interpreting fluctuations in interest rates and exchange rates, more precisely managing market risk are only possible by properly evaluating the factors affecting financial markets.

7.2.4 Credit Risk

Since delivering credit is the most basic and risky activity of banking, credit risk is also the most traditional, oldest and most important type of risk that banking is exposed to. For this reason, quite extensive legal arrangements have been made in this field in the historical process. Credit risk expresses the probability of financial loss that the bank may be subjected to when the person to whom the bank lends to (the debtor) goes into default by failing to pay the principal and interest of its debts in full or in part within the agreed terms and within the prescribed period for a reason such as a deterioration in his financial condition. This risk is both a loss of liquidity and income for banks. The default of credit debtor may lead to a situation in which a bank may not return its funds to its depositors (Güzel 2020).

In order for banks to eliminate this risk credit portfolios are limited on an individual or group basis, the credit amount that can be opened to a person or group is limited to a certain ratio of the banks' equity, diversified on the basis of the sector (Ong 1998). For example certain investments are limited to a certain ratio of the bank's equity, sufficient and highly liquid collaterals, real estate mortgage or sureties of third parties are requested from the debtors.

If the management of credit risk in banking is not done effectively, the credit loss or damage can be quite extensive (Ghosh 2015). Therefore, the purpose of credit risk management is to keep credit risk at an allowed level according to capital, to protect the solidity of assets and to provide a return proportional to the risk. Effective management of credit risk is essential for the long-term success of the bank.

7.2.5 Liquidity Risk

Liquidity risk is the failure of the bank to fulfil its monetary obligations on time, in the relevant currency and at normal cost without incurring significant losses, and the bank's loss of income and its capital. The bank's due debts, possible delays in fund inflow, transformation of off-balance sheet liabilities into credit risk for the bank (converting letters of guarantee into cash, etc.) are the most basic transactions that may cause liquidity risk (Matz 2002). This situation is defined as funding liquidity risk. Market liquidity risk, arising from the distortions in financial markets should also be considered within the scope of "liquidity risk".

While creating the structure for liquidity risk management by banks, meeting the daily liquidity needs and continuing the activities of the bank in a steady way during liquidity crisis periods that may arise from the market or banks are aimed. Assuming that it is impossible for global liquidity expansion to be continuous, it is considered that liquidity-oriented financial instabilities may be seen more in the coming years. In the event of shrinkage in global liquidity, the market-originated macro aspect of liquidity risk may affect banks more. Particularly, it makes the management of liquidity risk difficult and increases its importance in banks operating in countries where the private sector and public external debt burden is heavy, the need for foreign resources is high, and the financial markets are highly sensitive to the developments in national and international financial markets.

Liquidity risk is also closely related to the poor management of other risks. The most common liquidity risk phenomenon emerges when banks are unable to meet sudden and rapid withdrawals during financial or economic crisis periods. This situation may arise from fluctuations in market conditions, global fluctuations, funding imbalance peculiar to the bank's own financial structure or the realization of other risks. In fact, it is not always possible for banks to have liquid assets that can meet a high stress liquidity crisis (Matz 2003). The important thing is the ability to access liquid assets in times of crisis.

While it will be difficult to increase borrowing in a bank-originated crisis, it will be also difficult to borrow cost-effectively in a market-originated crisis. Therefore, the primary sources that fund under various conditions can be received and the amount of funding from these sources should be determined. Two approaches can be utilized to determine the optimal cash level. The model developed by Merton Miller and Daniel Orr is based on the assumption that cash flows may change negatively or positively and that the net cash flows will show a normal distribution. The lower and upper limits of the net cash flows of the enterprises can be determined and the cash

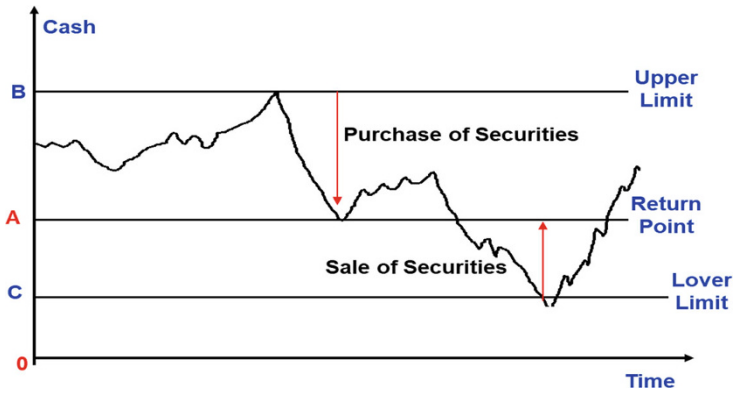

Fig. 7.1 Determining the optimum cash level in liquidity management. **Source:** Prepared by the author based on (Çankaya 2020)

movement is controlled within the determined limits (Woolridge and Gray 2008) (Fig. 7.1).

When the cash amount reaches the upper limit (B), the cash level is reduced to (A) level by depositing (A-B) amount of cash into securities. When the amount of cash falls to the lower limit (C), the cash amount is raised to (A) level by selling (A-C) amount of securities. Since the capital structure of the bank is an important factor in obtaining the liquidity it needs in times of crisis, it is also very important to operate with sufficient capital. Maturity mismatch risk between assets and liabilities (commitments) should also be considered within liquidity risk. They should identify the weak points of the bank regarding liquid assets, maturity and currency mismatches, unexpected liquidity liabilities arising from off-balance sheet transactions and funding concentrations in various maturities and keep the risks arising from them under control (Acharya and Pedersen 2005).

7.2.6 Operational Risk

It expresses the possibility of loss due to neglecting errors and irregularities resulting from disruptions in internal controls, deficiencies in business processes, failure or inability to act timely and appropriately to inaccuracies by bank personnel, errors in bank management, errors and failures in information technology systems, disasters such as earthquakes, fire and floods or terrorist attacks (Chaudhuri and Ghosh 2016).

Operational risks include the possibility of realization of rights lower than expected and liabilities higher than expected as a result of transactions that may be carried out by the bank based on insufficient or incorrect legal information and documents (Hull 2012).

It is the oldest and most basic type of risk faced by banks, and in general, all risks other than financial risks such as market and credit risks can also be defined as

operational risks. According to the internationally accepted definition, employees, information systems, business processes and external events constitute the four main sources of operational risks. Credibility risk and risk of not complying with regulations are also considered within this scope. Credibility Risk refers to the risk that may arise from loss of trust or loss of credibility due to failure in operations or not complying with current legal regulations; the risk of noncompliance with regulations refers to the loss that may arise as a result of not complying with the provisions of the legislation and legal obligations, and the loss of trust of the bank customers or market participants.

7.2.7 Other Risks

They include external risks such as inability to make money transfers, inability to collect debts due to management or legislative changes (country and transfer risk); inability of bank capital to cover all credit losses (risk of failure to pay), negative impact of changes in legal regulations (legal risk), transfer prevention due to new political formations or actions such as war, riot, expropriation (political risk), high inflation rates' adverse affect on investments (inflation risk) (Chaudhuri and Ghosh 2016).

7.3 Assets and Liability Management (ALM) in Banking

Asset and Liability Management is the strategic management technique aiming to maximize bank profitability while maintaining optimum liquidity and protecting the bank against market risk (interest rate risk, foreign exchange risk), liquidity risk, credit risk and operational risks (Dash 2013).

Below is an example of a simplified balance sheet of a commercial bank. A balance sheet is a financial report that shows the value of assets, liabilities and owner's equity of a commercial bank on a specific date, mostly monthly, quarterly or usually annually. Below is an example of a simplified balance sheet of a bank (Table 7.1).

Assets are shown on the assets side and resources on the liabilities side of the balance sheet. Assets included in the assets of balance sheet are ranked from the most liquid to the least liquid value according to the rate of conversion into money. In the liabilities side, there are resources from shortest-term foreign liabilities to longest-term foreign liabilities, then equity items of infinite maturity (Koch and Scott Macdonald 2009).

Assets and liabilities sides of the balance sheet become equal. However, if the total assets exceed the total liabilities, the bank makes a profit and the profit is included in the liabilities of the balance sheet. In case the bank makes a loss, the loss is shown in assets side or by deducting from the equity capital in the

Table 7.1 Simplified balance sheet of commercial banks

Assets (uses of funds)	Liabilities (sources of funds)
1. Cash and equivalents	1. Deposits
2. Short term financial assets (securities)	2. Funds borrowed
2.1. Government and other debt securities	3. Borrowed from money markets
2.2. Equity securities	4. Securities issued (Net)
3. Derivative financial assets	4.1 Bills
4. Loans	4.2 Asset backed securities
4.1. Commercial and industrial	4.3 Bonds
4.2. Real estates	5. Derivative financial liabilities
4.3. Consumer	6. Provisions
4.4. Other	7. Tax liability
5. Non-performing loans	8. Subordinated debt
6. Expected credit loss (−)	9. Other liabilities
7. Investments in associates (Net)	10. Shareholders' equity
8. Subsidiaries (Net)	10.1 Paid-in capital
9. Joint ventures (Net)	10.2 Capital reserves
10. Tangible assets (Net)	10.3 Profit reserves
11. Intangible assets (Net)	10.4 Profit or Loss
11.1. Goodwill	10.5.1 Prior periods' profit or loss
12. Other assets	10.5.2 Current period profit or loss

Source: Prepared by the author

Table 7.2 Simplified income satament of commercial banks

Revenue
1. Interest Income
2. Interest Expense (−)
3. Net Interest Income
4. Non Interest Income (+)
Total Revenue
Expense
5. Provision for Loan Losses
6. Non Interest Expense
Total Expense
7. Income Before Taxes
8. Income Tax Expense
Net Income

Source: Prepared by the author

liabilities (Barney 1991). Of course, it is also very important to manage the income statement: Income Statement shows the interest and non-interest income of the bank within a certain period, the interest and non-interest expenses (costs) within the same period and the net profit or loss resulting from them for the period (Table 7.2).

The income statement shows the results of the activities of the bank in a certain period, and the balance sheet shows the assets and resources of the bank at a certain moment. Apart from the balance sheet and income statement, some banking activities are accounted differently as off-balance sheet transactions. These liabilities consist of guarantees and sureties (non-cash loans, letters of guarantee, guarantees,

aval, acceptance and endorsements), letter of credit commitments, security issuance purchase guarantees, repo and reverse repo commitments, forward foreign exchange transactions, money and interest swaps, futures contracts, money and interest options. Liabilities that are not in the balance sheet are also included in the asset and liability management activity and have significant risks (Mishkin and Eakins 2011).

Asset and liability management is mainly the controlling of the bank balance sheet in order to increase bank profitability and market value. In order to achieve this goal, the following components must be actualised (Romanyuk 2010):

- Managing liquidity,
- Increasing the net interest margin and related net interest income,
- Increasing the efficiency of loans and ensuring the repayment of loans on time,
- Controlling non-interest expenses and striving to achieve the goal of meeting non-interest expenses with non-interest income,
- Defining, measuring and managing the risks of the bank,
- Ensuring and maintaining capital adequacy.

Banks try to manage their asset and liability in accordance with BASEL rules. BASEL's aim is to ensure that banks operate in accordance with international standards and in a solid structure. Basel is a committee formed with the participation of central banks and banking audit authorities of developed countries. Basel proposes that the ratio of capital to risky assets (Capital Adequacy Ratio) of banks should not be less than 8% (BIS, Bank of International Settlements 2010).

The main purpose of Asset-Liability Management in Banks is to ensure the continuity of profitability by measuring the risks in the bank balance sheet; capital adequacy, asset quality, income and expense structure, liquidity, profitability and growth as the most important performance indicators in asset and liability management (Choudhry 2007, 2012).

7.3.1 Asset Management

Asset management involves transactions aimed at maximizing the income of the bank's income-generating assets such as loans, securities, etc., by making effective risk management through hedging (Ferreira et al. 2018).

The main objective of banks is the maximization of market value and profit. For this, they aim to obtain the highest asset return with the lowest resource cost. Profit is the positive difference between the bank's total yield and total resource cost. The most important assets in banking are loans. Loan portfolio is the most important source of income for a bank as it earns more interest income than it pays for deposits. Banks strive to create a loan portfolio with low risk and high return as much as possible. In the sector where competition is most intense, loan marketing and analysis gain importance to create a loan portfolio of this nature (Selçuk and Tunay 2014).

The second largest assets after loans are securities. Treasury bonds are the securities that generally have the largest share in the securities, and usually called as secondary reserves because of their high liquidity since these bonds can be sold quickly in the secondary market. Securities have an important place in the portfolio every period, especially in a period when loan rates are low as government bonds are assets that provide risk-free alternative returns for banks. Since the loans provided by banks generally contain collaterals such as mortgages and automobiles, they can be sold through the issuance of asset-backed securities, namely securitization. This situation allows banks to provide more loans. Income from banks' assets consists of interest income, commission and service income, dividends and trading income. The share of interest generating assets in total assets is higher in banks. The high share of interest generating assets in total assets is a preferred structure for asset and liability management and is important. Returns from loan and securities portfolio comprise "interest incomes", fees and commission earned from banks' products and services (transfer, insurance, brokerage, negotiable instruments such as checks, bills and letter of credit transactions, foreign exchange trading, regular payments, etc.), the commission earned from the trading intermediary pursuant to capital market legislation, the dividend income or "non-interest income" obtained from the subsidiaries and affiliates. Although all these transactions in banks yield income, they carry high risks. Loan and securities investments carry market risk such as interest rate; foreign exchange rate, liquidity risk and receivable risk, while banking services carry low operational risk. Therefore, the efforts of banks to manage their loan and securities portfolios by considering the risk and return balance can be defined as asset management (Selçuk and Tunay 2014).

7.3.2 Liability Management

The liabilities (resource) side of the balance sheets of banks are divided into two groups as debts and equity. Debts are bank customers' deposits or borrowed funds from other sources to finance banks' income-generating assets. Deposits are also different from other debts even though banks owe their customers, because customer's depositing to or withdrawing from deposit account is not determined by a contract, but is generally at the discretion of the depositor (Brigham and Gapenski 1990).

The capital put into a bank by owner or owners of the bank or right arising from the values they give as capital are called as equity. A bank's equity comprises of the positive difference between its net asset amount and its debts. Equity includes paid-in capital, provisions, and undistributed profits. If there is any loss of the bank, equity is reduced by the amount of loss while calculating equity. After the Second World War, due to the rapid expansion of the world economy, households and firms' savings also increased rapidly. These became most important funding sources for banks' (cheap and long-term deposits). However, the collapse of the Bretton Woods system after the 1970s, the economic recession, oil crises and financial crises in some

developing countries, the stagflation process in which inflation coexists with unemployment, limited funding sources and increased resource costs in the 1980s especially, the volatility of interest rates and exchange rates brought significant risks. In this period, resource costs increased, profit margins decreased, increased competition lowered the prices of bank services and products, and bank bankruptcies were realized in many countries as a result of banks' turning to riskier placements. Therefore, the strategies implemented by banks with a sustainable liquidity structure to eliminate maturity mismatches of assets and liabilities, to control resource costs, to manage funds received from deposits and other financial institutions, in addition to protect against changes in interest rates and exchange rates, include "liability management" activities (Dempster et al. 2002).

7.3.3 Management of Bank Profitability

Banks have to make profit in order to sustain their assets, to grow or to maintain their current positions. Therefore, profitability management is the primary purpose of asset and liability management for banks. The portfolio structures of banks, the level of competition in the national or international arena, funding costs affect the profitability of banks, on the other hand, profitability has an important effect on banks' having a strong financial structure, taking risks and ability to compete (Dilmaç et al. 2015).

Profitability primarily shows the capacity of a bank to generate enough income to cover its total (fixed and variable) costs. It is known that liquidity, interest and exchange rate risk also affect Net Interest Margin, Return on Asset and Return on Equity. The rates of Return on Assets (Net Profit for the Period/Average Total Assets), Return on Equity (Net Profit for the Period/Average Equity) and Net Interest Margin (Net Interest Income/Total Return Assets) are used as the measure of profitability in banks, (Demirgüç-Kunt and Huizinga (1998).

(a) Return on Assets (ROA) = Net Profit (Loss)/Average Total Assets

This ratio shows how efficiently bank assets are used. It is calculated by taking the difference between the interest income obtained from the banks' total assets and the interest expenses paid to the resources or the difference between the average rate of the interest-yielding assets and the average rate of the resources for which interest is paid. The most important interest-yielding asset items in banks are loans and fixed income securities in the securities portfolio. The most important interest paid sources on the balance sheets of banks are deposits and non-deposit borrowings obtained in return for interest.

(b) Return on Equity (ROE) = Net Profit (Loss)/Average Shareholder's Equity

Equity profitability is determined by ratio of the period net profit of the banks to their equity and shows the return of the bank shareholders from their investments. In other words, it shows how well the bank management uses its assets to generate profit. However, there are criticisms that banks focus on borrowing by

keeping their own funds low in order to show high ROE and this situation increases the risk in banks, but this risk factor is not taken into account in the calculation of ROE. Therefore, it is recommended to use RoRWA (Return on Risk-Weighted Assets) instead of ROE in measuring the bank's return on equity (Financial Times 2020).

According to Morgan Stanley; besides the return on equity, the cost of equity should also be evaluated; even the difference between ROE and COE should be taken into account. It is stated that there is a 92% correlation between the difference between the ROE of banks and the cost of equity (the return that investors expect from a company's shares) and the price to book value ratio (Financial Times 2020).

(c) Net Interest Margin (NIM) = Interest Revenue – Interest Expenses/(Average Earning Assets)

Interest margin is the difference between interest revenue and income-generating assets; and interest expenses paid to total resources. It is more appropriate to examine the net interest margin in order to measure the income-expense performance of the bank more accurately. The net interest margin is calculated by ratio of the difference between interest incomes and interest expenses to the average income-generating assets. Briefly, it shows the net return from interest-yielding assets. The net interest margin enables a better comparison of performance among banks. In other words, the price difference (spread) on income-generating assets.

In terms of asset and liability management, in addition to the criteria stated above in measuring the profitability performance, the following ratios are also used in some country practices.

(d) Spread = (Interest Income/Interest-Yielding Assets) – (Interest Expenses/Interest Paid Liabilities)

The price difference is closely related to the net interest margin and is a ratio utilized in measuring profitability performance.

(e) Net Profit Margin = Net Profit/Total Revenue

The profit margin shows how much profit the bank makes from each transaction on a cost basis. This ratio is mostly used for internal performance measurement.

(f) Cost-Income Ratio (C/I Ratio) is an important financial criterion in determining the profitability of banks and indicates whether a bank can meet its operating expenses with its operating income. A lower C/I ratio means a bank is operating more profitably, while a higher C/I ratio indicates that the bank's operating expenses are very high (Hess and Francis 2004).

Although these ratios are useful for evaluating the bank's financial strength and efficiency in using resources, it is very important to measure and evaluate them comparatively with respect to their competitors in the market and sector averages. Additionally, while evaluating the profitability of banks, the scale structure should also be taken into account. Differences in bank scales can either offer banks advantages or disadvantages.

7.4 Risk and Asset and Liability Management Techniques

Asset and liability management refer to the strategies and techniques that must be applied in order to obtain maximum profit from the total assets and total resources of banks in line with the principles of reliability, efficiency and operability with adequate liquidity and capital structure and minimum risk level (Hull 2012).

The management of bank assets and resources is closely related to risk management. ALM is not risk management, but combining ALM and risk management techniques is essential for maximum return. Traditional and modern ALM techniques and risk management strategies are examined together below in a systematic approach (Dalessandro 2013).

7.4.1 Traditional Asset and Liability Management Techniques

The most traditional asset and liability management techniques are the management of;

- Break-even point analysis,
- Fund transfer pricing,
- CAMEL analysis,
- Liquidity management and
- Capital adequacy.

7.4.2 Break-Even Point (BEP) Analysis

For a business, bank or a project, the breakeven point refers to the amount of revenue required to cover the total fixed and variable expenses incurred in a given period. In short, it shows the business volume where there is no profit or loss, and fixed expenses can be covered by the sales profit. Briefly, it is the point where incomes can cover expenses. The breakeven point of a business, which is an important reference point, helps developing long-term business plans, making revenue or profit plans, product pricing, managing debt service and other operations. The break-even point for businesses is calculated by dividing total fixed costs by gross profit margin (Fixed Costs/Price-Variable Costs) formula.

Banking is also a service business, and break-even analysis is an important analysis in both pricing and performance measurement. The liabilities of banks consist of equity, deposits and other liabilities. There is an interest cost for liabilities other than equity. Operating and personnel expenses should also be added to the resource cost. On the other hand, some of the collected resources cannot be placed,

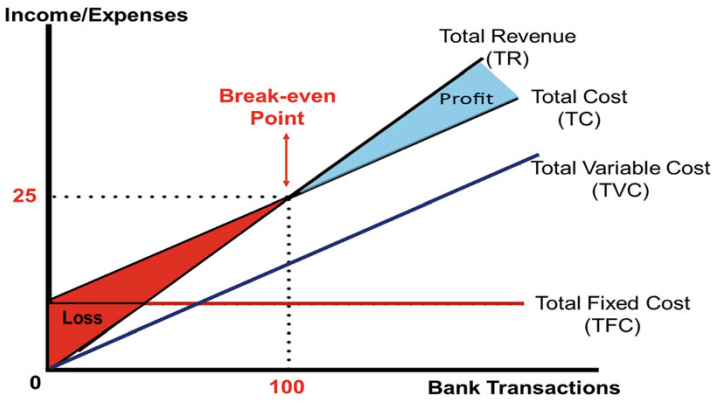

Fig. 7.2 Break-even point in banking. **Source:** Prepared by the author based on https://toughnickel.com/business/Breakeven-analysis

invested in non-income generating assets or set aside for provision. Therefore, these factors should also be evaluated in the placement cost and pricing behavior of bank resources. Break Even Point (BEP) can be used as a tool to measure the cost and income relationship of banks, as well as helping in measuring the past performance of the bank and determining its future need. In banks, as in other businesses, total expenses consist of fixed and variable expenses. The most important variable expense in banks is interest expenses. Operating and administrative expenses such as personnel expenses, software, electricity, rent and stationery constitute fixed expenses, in other words, non-interest expenses of banks (Vadrale and Katti 2018).

The breakeven point in banks can be calculated using the following formula (Selçuk and Tunay 2014):

$$\text{BEP} = \frac{\text{Interest expenses} + (\text{Non} - \text{interest expenses} - \text{Non} - \text{interest income})}{\text{Income generating assets}}$$

The sum of net non-interest expenses and interest expenses shows the total costs in banks, and the breakeven point of the bank is calculated by dividing the total cost by income generating assets.

As seen in the Fig. 7.2, the point of intersection where total revenues equal total cost is the bank's break-even point. This point shows the point where Marginal Revenue equals to Marginal Cost (MR=MC) in banks. When the total revenues exceed the total cost, the profitability of the bank increases, and if the total revenues are below the total cost, operating loss emerges. The break-even analysis in banks is the most used analysis in determining the pricing policy in banks, as it also shows the amount of loans and deposits to meet the fixed expenses and targeted profitability.

7.4.3 *Funds Transfer Pricing (FTP)*

Significant increases occur in the funding and costs of banks during financial crisis. This situation was evident during the global financial crisis that started in 2008. Before the last financial crisis, banks were generally using single rate FTP system, which was relatively simple. The single rate FTP systems application, implementing in this period, is insufficient to measure the profitability performance of bank branches after the change in the world monetary system after the 1970s, following fluctuations in exchange rates and interest rates, and it does not allow profitability measurement on product basis. Profitability calculation is not made regarding deposits and loans, which are the basic products of banking (Güzel and Karakaş 2019).

FTP collects funds given to a bank's Fund Management units (Treasury Department of the Bank) in central accounts and then redistributes them among business units, balances fund surpluses and fund needs, centrally manages liquidity, if the fund total is more than the fund demand, collects funds from money or capital markets. Otherwise, if the funds collected exceed the fund demand, lends the excess funds to other banks or the government in the financial markets. The main purpose of FTP is to determine the funding cost, to ensure pricing of funds and fees, to manage the interest rate risk and net interest margin centrally and effectively. In the last 10 years, the FTP application has become the issue that banks attach importance to. Mostly for balance sheet management (management of liquidity mismatch due to the short maturity of deposits and long maturity of loans), risk management (transferring interest rate and liquidity risk to the centre and monitoring and managing them centrally), profitability (centrally control of net interest margin, determination of interest and fee-based income targets and strategies) and liquidity measurement and management (funding of liquidity mismatches at optimum cost, central distribution of liquidity), and risk-return-based pricing of products and services.

The difference between Funds Transfer pricing and traditional single rate FTP System is specified below:

7.4.3.1 Single Rate FTP System

Bank branches both accept deposits and provide loans. Fund surplus occur in the branches whose deposits are more than the loans they provide. Fund deficit occur in the branches whose deposits are less than the loans they provide. In this case, as in the operation of the financial system, funds are transferred from units with fund surplus to units with fund deficit by the Treasury department of the bank. However, the said fund transfer of the bank must have a price as in the operation of the financial system. This price is interest, and the treasury department of the bank takes interest for the funds provided and pays interest for the funds purchased from the branches (Fig. 7.3).

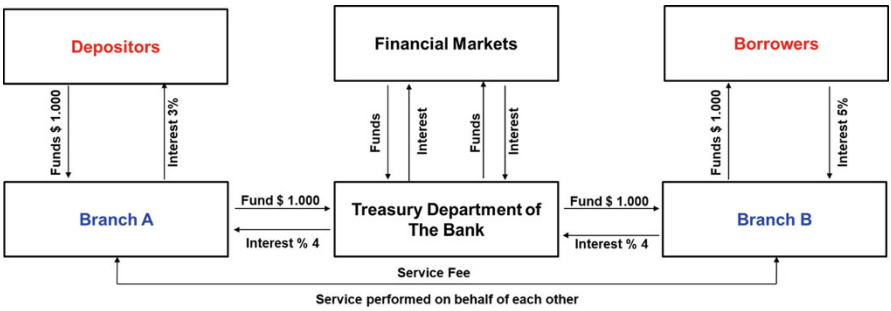

Fig. 7.3 Single rate FTP system. **Source:** Prepared by the author

Bank branch A received $1000 deposit at an interest rate of 3% to finance a loan of the same amount and paid 3% interest to the depositor. The bank branch sold the collected funds to the treasury department of the bank (funding centre) at 4% interest.

Branch B also gets funds with an interest rate of 4% from the treasury department of the bank for the loan to be extended to the loan customer with an interest rate of 5%. In this case, the net interest margin of the treasury department of bank is zero. However, the net interest margin of both A and B branches is 1%, and a total interest margin of 2% is distributed among bank units. This application does not measure the profitability performance of branches, and does not allow profitability measurement on product basis. Profitability calculation cannot be made regarding deposits and loans, which are the basic products of banking. Since the maturity of loans is always longer than the deposit interest, the Treasury department of bank (funding centre) has interest rate and liquidity risk. This situation led banks to new researches leading to the evolution of Fund Transfer Pricing application. It is aimed to manage the bank profitability of the product pricing to be realized in accordance with the purpose of realizing the targeted bank profitability by taking into account the effect of liquidity and interest rate with Fund Transfer Pricing (FTP).

7.4.3.2 Fund Transfer Pricing Systems (FTP)

FTP is calculated for both assets and liabilities. Bank units yield return via liability items while bearing the FTP cost for the assets in the balance sheet. Branches receive interest from the customer for the loan they provide and pay FTP interest for this resource borrowed (assumed) from the bank treasury. While interest is paid to the customer for the resource (deposit) received, it receives FTP interest in return for this resource transferred (assumed) to the bank treasury. Finally, the real profitability performance of the branch shows.

In this system it is calculated that bank profitability = (Interests from Loans + FTP Income received for Deposits + Non-Interest Incomes + Service Incomes +

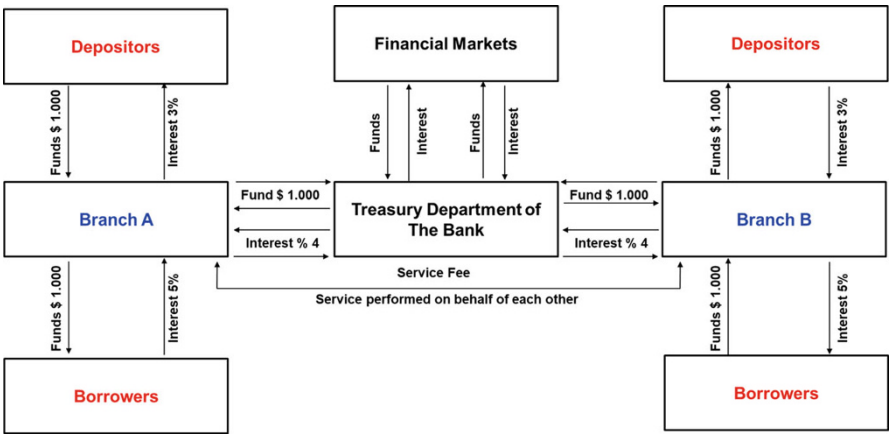

Fig. 7.4 Fund transfer pricing system. **Source:** Prepared by the author

Other FTP Incomes) – (Deposit Interest Expenses + FTP Expense Paid for Loans + Non-Interest Expenses + Service Expenses + Other FTP Expenses).

In the functioning of the FTP application, FTP rates are determined by taking into account factors such as liquidity risk for assets and liabilities, market risk, credit risk and other risks, market interest rates, the bank's resource cost, growth target in deposits and loans. Multiple FTP applications for assets and liabilities are shown in the Fig. 7.4. With the FTP application, the risks arising from both interest rate changes and liquidity management are transferred to the Treasury department of bank (funding centre).

With the FTP application, how much profit is made on loans, deposits and other assets and liabilities can also be accurately measured. The FTP application enables accurate calculation of the income of bank units and products, centrally monitoring and managing risks such as liquidity, market (currency and interest) and credit risk that may occur in the balance sheet in the treasury unit, and measuring the performance of the units on the basis of profitability. Besides, branches are directed in line with bank policies via the FTP application. Therefore, Fund Transfer Pricing is used as an important tool to ensure asset-liability management efficiency and to reduce resource cost.

7.4.4 CAMELS (Capital Adequacy, Asset quality, Management, Earnings, Liquidity and Sensitivity) Approach

CAMEL analysis is an important method used to measure the financial adequacy of banks. It shows the important components for banks such as Capital Adequacy (C), Asset Quality (A), Management Proficiency (M), Profitability (E), Liquidity (L) and

Sensitivity (S). Auditing and regulatory authorities also perform bank audits in a sense, using the CAMEL model to evaluate the bank's performance and financial solidity (Ishaq et al. 2016).

7.4.5 Capital Adequacy (C) Management

The capital structure of banks is not the same as the capital structure of other non-monetary enterprises. Capital structure is very important in banks. The solvency of banks, capital and financial solidity of the banking sector are too important to be left to the decision of the sector itself. A failure in the banking system may adversely affect the entire economy. Since banks are the financial institutions that contribute the most to the development of economic growth and social welfare, if the banking system goes into crisis or goes bankrupt, the whole economy will soon enter into a major economic crisis that will require payment of individual funds lost through the deposit insurance fund. On the other hand, the increase in bank capital or equity has a positive effect on bank profitability. High capital of the bank reduces the cost of capital, reflects positively on the profitability of the bank, provides protection against bank losses, prevents excessive risk taking, and protects creditors in case of bankruptcy. However, banks' equity is not only composed of cash capital amounts. Capital reserves such as revaluation funds, securities value increase gains, which are included in the equity of banks can be used as auto-financing in cases of no new fund inflow to the bank and this will reflect positively on the bank profitability (Marques and Santos 2003).

The amount of equity of banks is the most basic factor taken into account in determining the amount of loans that banks can extend. The most important share in equity is the amount of capital. The capital levels of banks are also an important indicator of their financial solidity (Mishkin and Eakins 2011).

In recent years, financial crises or fluctuations have become more frequent and difficult to manage. Therefore, a bank must have sufficient capital to fulfil its obligations against sudden shocks due to credit, market and operational risks. Considering how much leverage financial institutions use in their activities, the importance of capital adequacy in banks can be understood more clearly. Both the Basel Committee and the banking regulation and supervision authorities of each country determine the minimum capital adequacy ratios for banks (Hempel et al. 1994).

The Capital Adequacy Ratio (CAR) in banks shows the ratio of a bank's capital to its risk-weighted assets and current liabilities. Banks generally hold more capital than the rate specified in regulations. If the CAR is sufficient to cover potential losses, the risk of the bank's falling into insolvency and losing depositors' money will be lower (Gup 2004).

The main funding sources of banks are deposits, borrowing and equity. As equity is a risk-free funding source in banks, as well as constituting an important guarantee for crisis periods, banks have to keep equity at least a portion of their total funding.

The regulation known as Capital Adequacy is calculated by proportioning the legal equity to risk weighted assets. While borrowing resources are costly and due in term, and should be paid back or turned after a certain period of time, there is no obligation to repay equity. Banking authorities and Basel standards require banks to have a certain amount of equity in their funding sources (BIS, Bank of International Settlements 2011).

$$\text{CAR} = \frac{\text{Tier I Capital} + \text{Tier II Capital} + \text{Tier III Capital (Capital funds)}}{\text{Risk weighted assets}}$$

Tier 1 (Core) Capital = (Issued and fully paid common stocks + non-cumulative perpetual preferred shares + disclosed bank reserves + irredeemable noncumulative perpetual preferred shares + minority interest in equity accounts of consolidated subsidiaries + retained earnings) − (Goodwill + increase in equity capital resulting from a securitization exposure).

Tier 2 Capital = (Cumulative perpetual preferred stocks + Undisclosed bank reserves + hybrid (debt and equity) capital instruments + supplementary capital + asset revaluation reserves + general loan loss provisions + subordinated short-term debt) + (although engaging in banking and financial activities financial affiliates non-consolidated with the bank).

Tier 3 Capital consists of Short-term subordinated debt. Tier 3 capital is used to support market risk, commodity risk and foreign exchange risk (Chincarini 2018).

Pursuant to Basel I and Basel II, banks must have a CAR of not less than 8% of which 4% is Tier 1 capital. While 100% capital is required for a highly risky asset, cash and cash equivalents are required to hold capital at 0% for a risk-free asset (BIS 2006).

Capital adequacy ratio (CAR) is affected by changes in legal equity and risk-weighted assets. The asset growth of banks, the increase in subordinated loans and their profitability contribute positively to both equity and capital structure (BIS 2015).

However, legal equity can increase with the positive contribution from new capital entry and profitability. Due to the fact that almost all debt instruments such as subordinated debt is in foreign currency and are included in the legal equity, exchange rate increases may sometimes increase the legal equity although it may be limited. Risk weighted assets, on the other hand, are increasing due to the increase in average risk weights and the increase in total asset growth. In periods when the exchange rate increases the risk-weighted assets of banks increase because the TL equivalent of the banking sector's total asset amount also increases. In total, when the exchange rate increases, the increase in risk-weighted assets is far above the increase in legal equity. It is affecting in this situation that the share of foreign currency assets in risk-weighted assets is higher than the foreign currency in legal equity. Therefore, CAR may move down in periods when TL depreciates (BIS, Bank of International Settlements 2011).

In banks, all risks, especially credit risks, are not evaluated at the same rate in the CAR account. The CAR rate is determined or calculated by using the weighted risk system, so banks may be better prepared to meet the probability of a negative outcome and the effects of such an outcome on the profitability and solvency of the bank.

7.4.6 Asset Quality (A)

Asset quality is one of the most important factors in determining the general condition, financial structure and credibility of a bank. The largest asset in the bank balance sheets is the loans extended. The first indicator of asset quality in the banking sector is the ratio of loans to total assets; it refers to the share of loans in banks' assets. The second asset quality measurement tool, which is the indicator of whether the bank fulfils its loan provision function adequately, is the ratio of deposit conversion to loan. The deposit conversion to loan ratio is calculated by the ratio of the total loans provided by banks to the total deposit. The higher this ratio, the higher the deposit conversion to loan ratio will be. Being above 1 of the value of this ratio, which is used to monitor the intermediary function of the sector, indicates that other resources are also used in financing the loans (Swamy 2012).

The most common measurement for measuring the asset quality of banks is non-performing loans. Transferring loans to areas where the return is not provided, deterioration of credit quality may be an important problem for banks, especially in times of financial crisis. This ratio, also defined as the Credit Risk is the failure of a bank loan debtor to pay the loan interest, instalment or principal amount or to fulfil its obligation as specified in the loan contract. Failure of the loan user to fulfil his obligations may have resulted from insolvency due to general economic conditions, loan provision conditions, loan costs or loan term (Kittu and Aruna 2018).

As an indicator of credit quality (risk), it is calculated by proportioning non-performing loans to total loans and receivables. It can be evaluated as another indicator of asset quality, which is the ratio of total devaluation provisions to total assets (Bofondi and Ropele 2011).

The purchase of securities (bonds, financing bills, etc.) issued by companies, non-cash commitments, letters of guarantee, letters of credit, acceptances, swaps, options and other futures are both credit and important type of assets. These assets also contain interest and receivable risk. Concentration of risk in banks, extending too much credit to certain sectors or firms, or substantial investment in the securities of a firm or a group should also be considered within the scope of credit risk. Other items that may affect asset quality are real estates, affiliates, and subsidiaries, fixed assets, off-balance sheet items and other assets. In asset quality assessment in a bank, all other risks that could affect the market value of the bank and its assets should also be taken into account as well as issues such as the magnitude of the credit risk, the probability of default, whether the provision for credit losses is sufficient or not (Bhattacharya and Roy 2008).

Low profitability, low liquidity and low asset quality are the most important risk groups for banks that needs to be managed. In order to manage the asset quality of financial institutions, more attention should be paid to having an operational loan portfolio, placing an upper limit on loans to be extended to a company or a group, and allocating and extending loans.

7.4.7 Management Quality (M)

It generally indicates the management's ability to identify and manage the bank's risks. Since banks operate in the service sector, the quality of management and correspondingly the quality of human resources are important. In the evaluation of the bank management; the management's educational background, experience, high capabilities of recognition and perception of risks related to bank activities, measuring, monitoring and controlling, ensuring safe and effective operation of the institution in accordance with applicable laws and regulations, and management are taken into account. This situation will also make a positive contribution to the bank in terms of total risk management (FFIEC 2011).

7.4.8 Earnings (E)

Banks generally generate income through loans, securities and fees and commission from banking services. In the performance measurement of banks, these three areas should be monitored and followed separately. The most important earning indicator for the bank is the return on equity (Charles-Cadogan 2011).

On the other hand, followings are also important factors that a bank can continue its activities effectively and efficiently, growing, increase its market value and competitive power. As the efficiency rate it is calculated as;

$$(\text{Personnel expenses} + \text{Other operating expenses})/(\text{Net interest income}$$

$$+\text{Total non} - \text{interest income});$$

It measures the ability of the bank to turn its resources into income. The low level of this ratio, which measures whether the bank is managed efficiently or not, indicates that the bank is profitable and its high level indicates inefficiency of the bank.

7.4.9 Liquidity Management (L)

It shows the ability of a bank to meet its short-term liabilities. Liquidity risk will arise if a large number of customers of the bank simultaneously withdraw cash from their deposit accounts with the belief that the financial situation of the bank is bad or may deteriorate. If the liquidity is not managed well in this period, it will be inevitable for the bank to go bankrupt. For this reason, banking regulation and supervision authorities require banks to have sufficient liquidity for such periods and audit whether they have the necessary funds (Dincer et al. 2011).

There is an important relationship between liquidity, risk and return in the asset and liability management of the bank. It was conspicuous in the 2000–2001 in Turkey crisis how liquidity problems lead banks to bankruptcy. Therefore, liquidity management depends on the bank's asset and resource structure, general economic conditions, developments in financial markets, and liquidity management strategies and plans determined by bank managers. In terms of the success of liquidity management, it is important that the bank portfolio is sensitive to interest and exchange rate risk and includes assets that can be converted into cash in the short term.

The following ratios should be followed closely regarding liquidity management.

- Liquid Assets/Total Assets ratio; demonstrates the bank's ability to withstand sudden financial shocks.
- Short Term Funding ratio = Liquid Assets/Deposits + Debts ratio shows the bank's strength of ability to pay its short-term debts with its liquid assets. This ratio is expected not to be less than 10% and more than 30%.
- Loan – Deposit Ratio = Loans/Deposit ratio shows how much of the bank credits are met by deposits.
- Foreign Currency Liquid Assets/Foreign Currency Liabilities ratio shows the position of the bank regarding the values in foreign currency.

7.4.10 Sensitivity (S)

It is the determination of how the risks that may arise from interest rates; exchange rates, securities prices or liquidity will affect the bank. The effects of following factors on the profitability of the bank are analyzed; loans provided to certain sectors, credit concentration, market risks, risks that businesses are exposed to (Dincer et al. 2011).

7.5 Contemporary Asset and Liability Management Techniques

7.5.1 Net Interest Margin Analyses

Interest income in banking consists of assets such as loan deposits, interbank money market, bonds and treasury bills. Interest margin in banking refers to the difference between interest income from income-generating assets and interest expenses payable on assets. However, net interest margin is used as a criterion in terms of both profitability and management efficiency in order to determine exactly whether the income-expense performance is effective or not (Busch and Memmel 2015).

Net Interest Margin is calculated by dividing the difference between interest income and interest expenses by income-generating assets. In other words, Net interest margin refers to the interest income earned for one unit of asset (Brummelhuis and Zhongmin 2019).

$$\text{NIM} = \frac{(\text{Interest incomes} - \text{Interest expenses})}{\text{Earning assets}}$$

Since high net interest margin will positively affect the profitability of the bank, it is actually a performance indicator for the bank management. Therefore, since the net interest margin in banking is an important indicator of both profitability and management efficiency, well management of the net interest margin is one of the most important functions of asset and liability management (Demirgüç-Kunt and Huizinga 2000). It is observed that interest margins are lower in economies with low inflation and intermediation costs, and higher in countries with high inflation, intermediation costs and low savings (Gunter et al. 2013).

Although the high net interest margin increases the profitability of banks per loan or deposit they collect, it may disrupt economic growth and financial stability because high deposit and loan interest rates will reduce the demand for loans in the long term (Doliente 2005).

7.5.2 Duration Analysis

Duration Analysis; is an analysis used to calculate how much the price of financial assets with different maturity structures and interest rates will change in response to changes in interest rates (the level of risk) in the risk management process in banks. It is a tool generally used in evaluating the price volatility of a fixed income security (DeYoung 2003).

Since the interest rate is one of the most important determinants of a bond's value, duration measures the sensitivity of the bond's value to changes in interest rates. The higher the interest rates, the higher is the possibility of the falling of the value of a

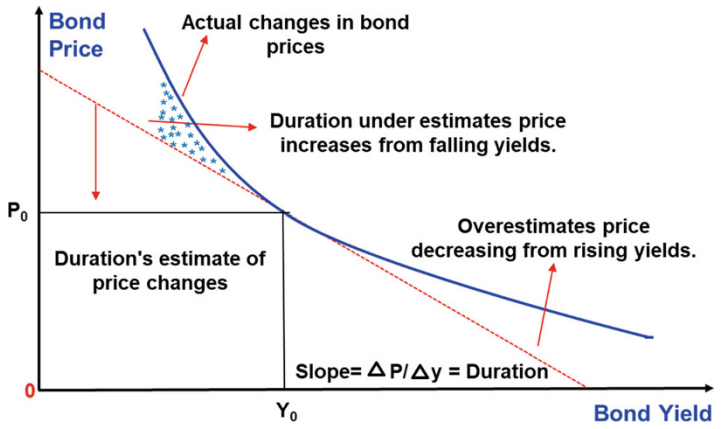

Fig. 7.5 The relationship between the yield of a bond and its price. **Source:** Prepared by the Author

bond. Duration is widely used in the management of a portfolio of fixed income financial instruments and risk. The fluctuations in the value of the bond are directly proportional to the maturity and inversely proportional to the amount of the interest payments. The duration of the bond is a common risk measure that includes these two factors measuring the variability in the bond value. Bond duration is defined as the weighted average of the interest and principal repayment times (Ongena and Smith 2001) (Fig. 7.5).

The duration of a bond that does not pay coupon interest is equal to its maturity. Therefore, the duration of a bond that pays coupons will always be less than maturity, and when the nominal interest rate increase, the duration gets shorter. In other words, zero-coupon bonds with the longest maturity are the bonds exposed to interest risk most (the zero-coupon bonds with the longest duration are affected by the interest risk). Short-term bonds with large coupon payments are the bonds with the lowest interest risk when the duration is shorter. The calculated duration of a bond is used to measure the volatility of the bond price against interest rate changes. Volatility reflects the percentage change that a 1% change in interest rates will create in the bond price.

$$\text{Volatility } (\%) = -\text{Duration} \times \text{Interest Rate Change} \times 100$$

For example, if the market interest rate increases by 2% to 8%, a 7.34% decrease in the bond price is expected.

$$\text{Change in bond price (VOLATILITY)} \ (\%) = -3.67 \times (0.02) \times 100 = -7.34\%.$$

In banks, loan maturities are generally longer than the maturity of deposit sources. For this reason, duration analysis in banks tries to match the average maturity of loan accounts with the average maturity of deposit accounts. For this purpose, the average

maturity of the assets included in the assets of the bank's balance sheet and the resources in its liabilities is determined and equalized. Attempts are made to avert the risk of changes in interest rates and causing loss to the bank (Selçuk and Tunay 2014).

7.5.3 Stress Test, Simulation

Stress test is a comprehensive analysis with the help of statistical tools to measure how the financial solidity of a bank may be affected or the losses that may occur during adverse periods such as macroeconomic recession or financial crisis (Blaschke et al. 2001).

Stress test is especially an integral part of market risk management process, and banks use scenarios based on historical data set of market risk factors or prospective scenarios when selecting their scenarios. The main purpose is to evaluate the market risk factors exposing the bank and the effects of changes in financial status. For this reason, scenarios that may cause significant losses, even if their realization probabilities are low, are also taken into account (Schuermann 2014).

The stress test, which is used to detect events that may significantly affect banks, is one of the most important elements in evaluating the capital adequacy of the bank. Banks are required to have a comprehensive and rigorous stress-testing program to meet the capital requirement for market risk (BIS 2009).

Scenario analysis is a method used in the stress test process. Stress test depends on scenarios to be created about market conditions. Scenario analysis and stress test evaluate effects of abnormal changes regarding the market risk (price, interest rate, exchange rates) and changes in non-market risk factors such as maximum cash inflows and outflows and fluctuations in market liquidity (liquidity risk) and the default of counter party (credit risk) on net interest income, net interest margin, return on assets and return on equity. Scenario analysis based on maturity and repricing is one of the most used approaches in analyzing the effect of interest rates and exchange rates on bank performance or determining risk management strategies and making managerial decisions in banking. However, for the success of this model, it is of great importance to make assumptions regarding the asset and liability subject to scenario analysis and their prices properly (Selçuk and Tunay 2014). Simulations help forming the risk-return profile of the banking portfolio.

7.5.4 Value at Risk

The amount of risk that can be taken according to the capital in banks is measured with Value at Risk (VaR) or Capital at Risk (CaR) model. Value at Risk (VaR) can be defined as the maximum loss that can occur in the value of a financial asset or a

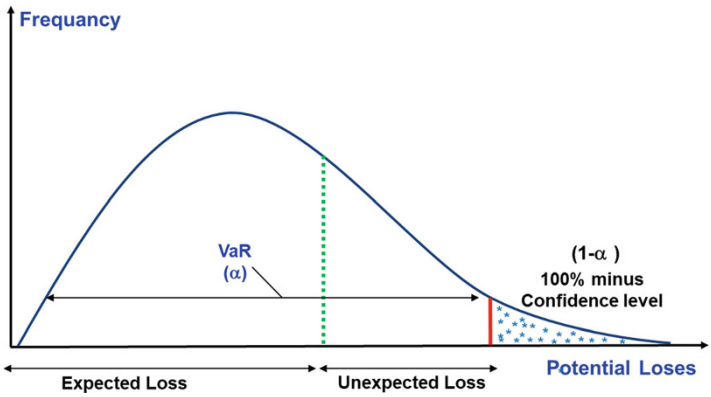

Fig. 7.6 Expected and unexpected VaR loss of risks. **Source:** Created by the Author based on (Alexander 2009; BIS 2015)

portfolio of financial assets in a specified period, with a certain probability and a certain confidence interval (Lin & Shen, 2006).

Value at Risk is the Maximum value loss estimated to occur within a certain probability due to fluctuations in risk factors such as exchange rate, interest and price from the value of a portfolio held for certain maturity (Chu-Hsiung and Shen 2006). For example, if a bank portfolio has a daily VaR of $50 million at a 95% confidence interval, it means that the portfolio will lose 50 million in a day with a 5% probability. In other words, the first 5% is the minimum amount the portfolio will lose in 1 day in the worst case, the first 95% is the maximum amount that it may lose in the best case. VaR is used to measure the maximum impact that possible risk factors will create on the value of the portfolio. VaR offers a significant advantage to banks or other financial institutions to identify the highest acceptable loss and avoid potential risks (Hou 2005) (Fig. 7.6).

In the calculation of the value at risk, first the holding period, the probability distribution of portfolio returns, and the desired confidence interval are determined, then the VaR value is calculated as the maximum loss that can occur in the said confidence interval.

$$\mathrm{VaR} = \mathrm{Pv} \cdot \alpha \cdot \sigma.$$

Pv: Portfolio value
α: Constant confidence factor
σ: Standard deviation (volatility)

The standard deviation value for days more than one is calculated by multiplying the calculated standard deviation value for 1 day by $\sqrt{T}$ (holding period).

$$\text{VaR} = \text{Pv} \cdot \alpha \cdot \sigma \cdot \sqrt{\text{T}}.$$

In a simple way, VaR calculation can be calculated as follows:

When the VaR value of a bank's $100 million bond position at 99% confidence interval is taken as 0.020% of the daily volatility of the bond price;

Pv = 10,000,000
α = Fixed confidence factor corresponding to 99% confidence interval = 2.33
σ = 0.00020
VaR = 10,000,000 · α · σ
= 10,000,000 * 2.33 * 0.00020
= 46,600 USD

According to this calculation, the amount of loss that can be encountered during 1 day will not exceed 46,600 USD with 99% probability.

Considering that the same position is held for 10 days, the VaR value shall be calculated as;

$$\text{VaR} = \text{Pv} \cdot \alpha \cdot \sigma \cdot \sqrt{\text{T}}$$

$$= \quad * \quad * \quad * \quad ==$$

VaR calculation is calculated by several statistical methods such as variance, covariance and standard deviation. Banks benefit from VaR analysis together with the stress test. Banks, can be protected from financial risks as long as they can make correct VaR measurements, which are also recommended by BIS (Bank for International Settlement). However, making these calculations for a diverse portfolio is quite complex.

7.5.4.1 Variance: Covariance Method

In this method, VaR value is calculated by multiplying the α value corresponding to the confidence level and the standard deviation (σ) by the market value (P) of the portfolio. It is one of the most widely used methods in VaR calculation as it is easy to apply. However, since options have non-linear returns, they are not considered suitable method in portfolios with options (Bolgün and Akçay 2003).

7.5.4.2 Historical Simulation Method

In this approach, the potential future profit and loss or VaR amount of the portfolio is calculated by using historical changes in market prices and rates. The model is based on the assumption that the income distributions of financial assets in the past will also be valid in the future. Although it is a model with low margin of error, especially

for non-linear portfolios, its assumption that the risks will remain the same over time constitutes its negative side (Philippe 2001).

7.5.4.3 Monte Carlo Simulation Method

It is the most comprehensive and powerful VaR calculation tool, as it includes both non-linear relationships within the portfolio and the effects of possible future changes (Wang 2012). Monte Carlo simulations are used to model the probability of different outcomes in an unpredictable process for the current portfolio by generating improvised prices and rates (Glasserman 2013).

7.6 Risk Management Techniques in Digital Age

While the parties freely determine the quality, quantity, price, delivery place and maturity in forward contracts, the quality, quantity, maturity and delivery place of the product subject to purchase and sale have been standardized with futures contract. The only variable in the futures contract is the price of the contract and it is determined at the time of purchase and sale in the exchange. The standardization of contracts and the collateral system led to the entry of speculators (investors) into the market (Dowd 2005).

Spot markets are markets in which a certain amount of goods or assets and their corresponding money change hands on the clearing day after the transaction. Although developed spot markets allow rational price formation, the prices formed are instantaneous. It is not possible to predict what the prices will be in a minute. It is inevitable that marketers will be affected positively or negatively from future price changes (Alexander 2009).

Unlike spot markets, futures markets are markets where the agreement is concluded from today and the liabilities are fulfilled in a future term. Forward contracts, future contracts; options contracts and swap contracts are common instruments in the futures markets. Futures markets have two main functions: It is Risk management for the future price formation. Prices formed according to supply and demand in traditional markets are valid at the moment. Prices in the spot market also serve as a reference for calculating future prices. Risk can be defined in its simplest form as 'the possibility of the bank to incur a loss' (Castrén et al. 2009).

Due to the nature of their activities, banks are faced with numerous sectoral, macro and micro risks. The risks to which banks are exposed are classified basically as credit risk, market risk, liquidity risk and operational risk (Saunders and Cornett 2005). Credit risk is the oldest of the exposed basic risks and is the failure of the borrower to fulfill its obligations regarding principal or interest payments in a timely and completely manner. Market risk is the risk of loss that may be caused by fluctuations in interest, exchange rates and stock prices on the bank's in-balance sheet and off-balance sheet assets and liabilities. Liquidity risk consists of the

subtitles of interest risk, exchange rate risk and stock and commodity price risk. Operational risk refers to all risks other than credit risk and market risk (Saunders and Cornett 2005).

Risk management in banking refers to the allocation of resources or capital against the possibility of loss that may occur as a result of the risk undertaken. Therefore, there is a positive relationship between the risk undertaken and the expected return in banking. This relationship also affects the amount of capital in banks (Bessis 2002).

7.6.1 Forward

Forward are the transactions that are contracted by determining the maturity, price and quantity of any goods that will be delivered at a future date. Forward can also be defined as a hedging technique against exchange rate fluctuations (Aksoy 1998; Gupta 2006).

Forward transactions are the transactions that are contracted by determining the maturity, price and quantity of any goods that will be delivered at a future date. Buyers and sellers form the parties in forward contracts. They agree, on the date of the agreement, on the amount, price and money change date (maturity). Forward transactions are carried out between banks—banks, banks—businesses or individuals. Forward transactions are generally divided into two as foreign currency and interest futures. Forward exchange transactions are contracts concluded from today for the purchase or sale of foreign currency against the local currency, on the condition of delivering at a certain date in the future (Jarrow and Oldfield 1981).

Forward interest contracts are contracts in which the parties agree on the interest rate to be applied to a certain amount of principal at a future date for a certain period of time. The forward contract is shaped according to the customer's request. (Maturity, amount, subject financial product can be freely determined). Money swap does not occur on the day of the transaction; the parties fulfil their liabilities to buy or sell at the previously agreed price on the maturity date. Forward transaction is binding on both parties (Chambers 2009).

Forward agreements are the agreements called as over the counter (OTC). Over-the-counter derivative transactions are considered as loans by banks. Therefore, in forward transactions, collateral is taken according to the maturity and amount of the transaction. ABC Company will pay $10,000,000 import price after 90 days. In order to avoid the exchange rate risk, the company carried out a foreign exchange purchase forward transaction of $/₺7,9925 (since the firm will close the import price by buying foreign currency) while the spot rate was $/₺7,6500 (Fig. 7.7).

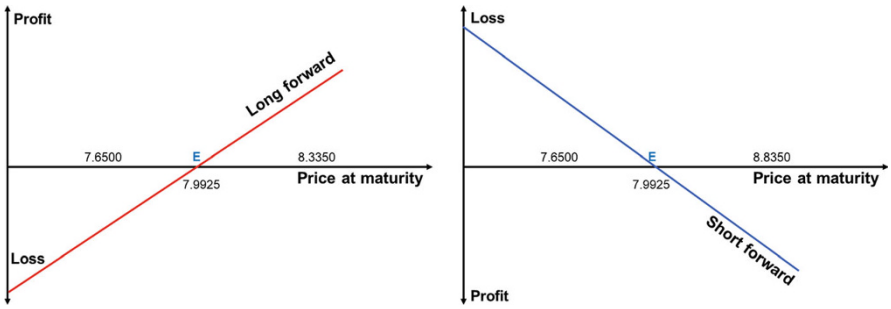

Fig. 7.7 Forward Agreement. **Source:** Prepared by the Author based on http://www.investorsoftware.net/

$$\text{Set exchange rate} = \text{Spot exchange rate}\frac{1 + (\$\text{ Sales interest} \times 90/360)}{1 + (\$\text{ Purchase interest} \times 90/360)}$$

$$= 7.9925.$$

$$\text{Forward sales rate} = 7.6500\frac{1 + (0.20 \times 90/360)}{1 + (0.02 \times 90/360)} = 7.9925.$$

The firm fixed the forward rate on the transaction date. It has committed to receive ten million $ by paying 79,925,000 TL on the maturity date. There will be no cash movement during the term. Regardless of the spot rate on the maturity date, both parties fulfil their liabilities at the rate they have agreed upon before. When the transaction is made, money clearing happens according to the determined $/₺7.9925 forward rate.

7.6.2 Future Contracts

Futures Contracts are the financial instruments that create obligations to buy or sell an economic or financial indicator, capital market instrument, commodity, precious metal or foreign currency at a future date, with a predetermined price, amount and quality (Aksoy 1998; Chance and Brooks 2009).

Two types of positions can be taken in the futures contract. It could be long or short. In the futures contract, the long party is the party that has the right and obligation to accept the underlying goods, and the short party is the party that is obliged to deliver it. Long position is defined as a trade in the buying direction, short position is defined as getting position in the selling direction, reverse position (position closing) is making transaction in opposite way of the present position and the number of long or short positions that are not closed by reverse operation are defined as open position (Hull 2005).

For example, if there are 10 units EUR/USD at maturity February 2021 foreign currency long position contracts, 10 units EUR/USD at maturity February 2021 foreign currency contracts must be sold to close this position.

7.6.2.1 Functioning of Futures Markets

Long position was taken when the price of EUR/TRL futures contract with a term of June 2021 with a contract size of EUR 100,000 was 9.4300. The rate of security to be deposited is determined as 20% per contract (Fig. 7.8).

After placing the purchase order by depositing the initial security to the brokerage firm for this transaction, the brokerage firm executes the order in the stock exchange. While the purchase is usually made on the same day or within the clearing period in the spot market, delivery and payment will be made on the maturity date in the futures market.

Profit/loss amount over USD 100,000 until the end of maturity is revaluated according to the prices at the end of each day and reflected in the accounts. At the end of each day, the profit amount obtained as a result of revaluation may be withdrawn from the account. In case of loss at the end of the day, the loss amount will be deducted from the security balance. If the security amount falls below 75% of the initial security, additional security will be requested to be deposited. If the investors' security balances are deposited in cash in futures exchanges, they are evaluated under daily market conditions and interest income is deposited into the relevant accounts. It is possible to open position with buying or selling transactions in futures markets, while one-way transactions are made in the spot markets either buying or selling. While it is required to have the asset to be traded in the spot

EUR/TRY.0621		
Number of Shares	4	EUR/TL 100,000 EURO transaction was made.
Contract Amount	100,000	
Range	Floating	Margin : 20,000 TL
Stopping Levels	0	
Base Currency	TRY	Price: 9.4300 TL
Counter Currency	TRY	Price Step: 0,0001
Calculation	Term Swap	New Price: 9.4301
Tick Size	0.0001	
Tick Value	0.10000	Initial Investment Amount: 100,000 EUR x 9.4300 = 943,000 TL
Initial Margin	20,000	Value of Investment: 100,000 EUR x 9.4301 = 943,010 TL
Maintenance Margin	20,000	Profit = 10 TL

Fig. 7.8 An Example of a future transaction on EUR/TRY. **Source:** Prepared by the Author based on Altaş, A. https://www.youtube.com/watch?v=Q-DBRtuGmWg

market, it is possible to make purchases or sales in futures markets by depositing security.

7.6.2.2 Differences Between Futures Contracts and Forward Transactions

- Futures contracts are financial instruments that can be bought and sold in organized markets. Forward contracts are over-the-counter transactions arranged specifically between banks and companies or individuals instead of organized markets.
- Futures contracts are standardized in terms of trading principles, contract amount and specifications. Forward contracts are determined according to the needs of the parties.
- While forward contracts are used for risk management purposes and generally used for speculation, forward contracts are generally used for hedging purposes.
- Futures contracts are quite liquid compared to forward contracts. Futures contracts cannot be transferred to others.

7.6.2.3 Hedging with Futures Contracts

In general, derivatives have an important place in the management of various financial risks such as currency, interest rate, commodity, for banks and other financial institutions (insurance companies, asset management companies, investment funds), businesses, individuals and public enterprises. A very important part of derivative transactions are carried out for speculative purposes. Speculators due to their leverage opportunity prefer derivative transactions (Chance and Brooks 2009).

Banks effectively use them to protect the assets and liabilities of their balance sheets from interest and foreign exchange risks. The biggest resources of the banks are their deposits and the biggest assets are the loans they provide. Banks earn income from the "net interest margin"which is the difference between the interest income from loans and receivables and the amount of interest they pay for deposits and other resources (Durbin 2006).

Banks purchase futures contracts to control their income and expenses, especially to avoid adverse effects on their profitability and incomes from fluctuations in interest and exchange rates. Indeed, rapid changes in interest rates or exchange rates have led to the bankruptcy of many banks. On the other hand, banks operate in derivatives markets in order to generate income. The second function of banks is to intermediate in trading and to earn fee and commission income.

7.6.3 Options

Options are contracts that give the buyer the right of buying (call) or selling (put) a certain number of financial assets or goods at a predetermined price within a specified period of time. Option contracts are the contracts that provide the buyer with the right of buying or selling the underlying asset (money, property, security, economic indicator) subject to the option at a certain price at a specified amount in the future until or at a certain date. In option transactions, two types of positions can be taken as call and put positions. In every call or put option transaction, there are two parties whom are buying or selling the option (Aksoy 1998; Kolb and Overdalh 2006).

7.6.3.1 Call Options

An option contract type that gives the holder the right to buy (buy call) a certain amount of goods, precious metal, precious mine, money or capital market instrument (without imposing any liability), which underlies for the option, at a certain price in return for a premium paid to the investor selling the option (Hull 2005).

The investors who believe that the price of the underlying asset subject to the option will increase in the future, in order to be protected from future risk or to gain profit by fixing the price as of today, prefer this option. The seller of the call option is under the obligation to sell the asset subject to the option contract on the predetermined date and at a determined price. Since the party selling the option has the expectation that the price of the underlying asset subject to the option will decrease in the future, it aims to obtain a premium by selling an option (sell call). The purchase of call options is defined as long call, while the selling of call option (writing) is defined as short call (Strong 2002).

Let's explain the call options in general with an example:

An investor purchased a call option contract with a strike price of 8 TL, written on XYZ stocks with a market price of US $7, and paid an option premium of 5% for this. Let's suppose this contract is a European type option that allows the right to buy or sell only at the end of the maturity. In the call option, the profit-loss situation for the buyer is shown in Fig. 7.9a below and the profit-loss situation for the seller is shown in Fig. 7.9b.

If the price of the stock is US $9; the call option will generate 9 – 8 = 1 US $ revenue for the buyer, and a US $0.6 net profit will be realized since he has paid a US $0.4 premium (Fig. 7.9a). In this case, the call option seller will make a loss of US $1, as he collects a US $0.4 premium amount he will make a US $0.6 net loss (Fig. 7.9b).

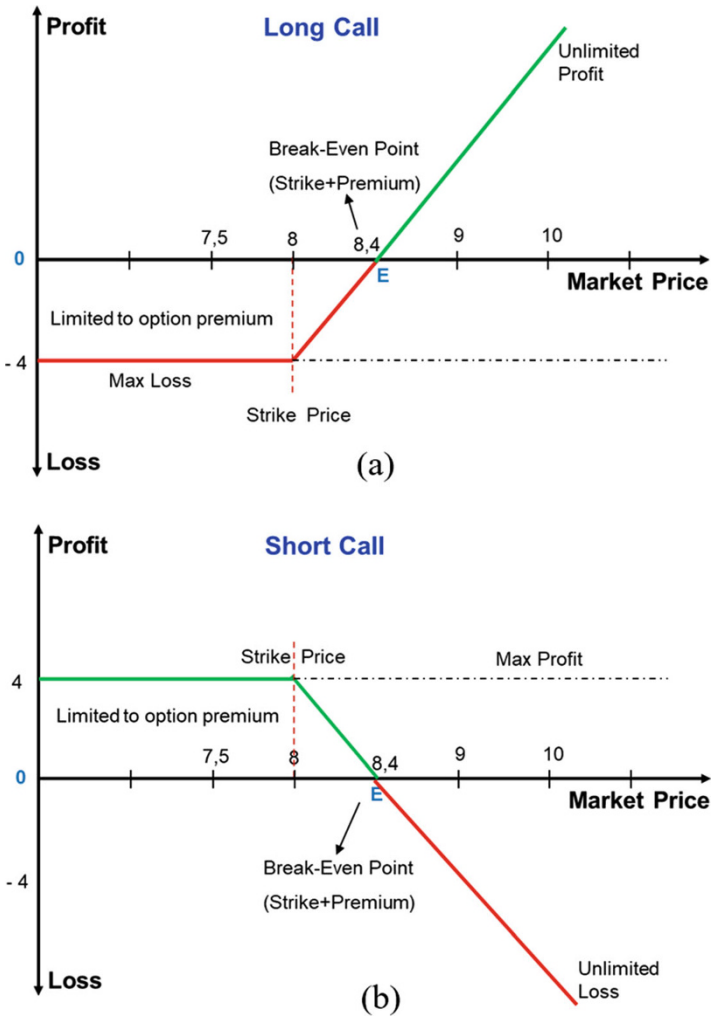

Fig. 7.9 Profit-Loss Situation for Buyer and Seller in Call Option. (**a**) Profit and loss for buyer in call option; (**b**) Profit and loss for the seller in call option. Source: Prepared by the Author based on https://www.optionsbro.com/

$$\text{Call option profit/loss} = \text{Market price at maturity} - (\text{Execution price} + \text{Premium paid})$$

$$\text{Call option profit/loss} = 9 - (8 + 0.4) = \text{US } 0.6$$

If the price of the stock is US $8.4, there will be no profit or loss for both parties, if the stock price is US $8 and below, the buyer cannot not use the right of option, so the call option buyer makes a loss of US $0.4 premium, the option seller earns a

profit of US $0.4 in premium. In the call option, the profit for the seller is equivalent of option premium (US $0.4). The option seller makes this profit only if the buyer does not use the option when the price at maturity is below the execution price. The loss of the option seller, on the other hand, can occur in different amounts (unlimited) depending on the market price of the stock at maturity.

7.6.3.2 Put Option

An option contract type is the kind in which the right to sell (buy put) for the holder is sold for a certain amount of goods, precious metal, precious mine, and money or capital market instrument (without imposing any liability). This underlies for the option, at a certain price in return for a premium paid to the investor selling the option (Aksoy 1998; Strong 2002).

The seller of a put option is obliged to buy (sell put) a certain amount of goods or financial instruments underlying the option, at a certain price upon the request of the investor buying the put option until a certain maturity or at maturity (Kolb and Overdalh 2006).

Investors who think that the prices will decrease in the future and therefore do not want to make loss from this price decrease or want to make a profit when the prices decrease prefer buying put options. On the other hand, since the party selling the put option has an expectation that the prices will rise in the future, he thinks that the party purchasing the option will not use its right in the future and therefore he will earn profit as the premium as collected. The purchase of call options is defined as long call, while the selling of call option (writing) is defined as short call (Whaley 2006).

Let's explain put options in general with an example: In the put option, the profit-loss situation for the buyer is shown in Fig. 7.10a below and the profit-loss situation for the seller is shown in Fig. 7.10b.

An investor purchased a call option contract with a strike price of 8 TL, written on XYZ stocks with a market price of US $9, and paid an option premium of 5%. If the market price of the stock is US $9, he will not use his right to sell at US $8 as he can sell at US $9 in the market. In this case, he can sell at US $9 in the market and make loss for 0.4 premium.

$$\text{In put option profit} - \text{loss} = (\text{Execution price} - \text{Premium paid}) - \text{Market price at maturity}$$

$$\text{It turns out to be in Put option that profit} - \text{loss} = (8 - 0.4) - 7 = 0.6.$$

If the stock price is US $8, the buyer does not use the option and again makes a loss of US $0.4. US $7.6 of the price is break-even point, the buyer uses his right to sell but neither profit nor loss occurs. If the price is US $7, the buyer uses the option and makes a net profit of US $0.6. In other cases, the loss of the option seller may arise limitlessly.

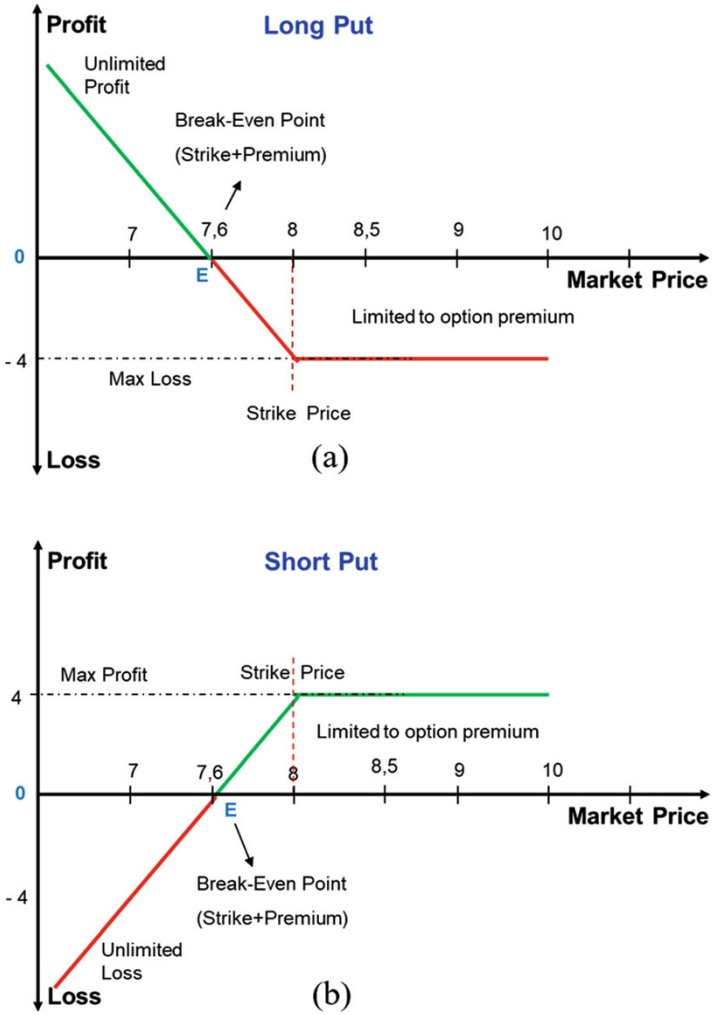

Fig. 7.10 Profit-Loss Situation for Buyer and Seller in Put Option. (**a**) Profit and loss for buyer in put option. (**b**) Profit and loss for seller in put option. **Source:** Prepared by the Author based on https://www.optionsbro.com/

7.6.3.3 Other Specifications of Option Contracts

The option contract provides the buyer with a right in return for the premium paid, and imposes the seller under liability for the premium received (Table 7.3).

Options are arranged in two types in terms of the usage time of the right subject to the option. If it is included that the option buyer may use the right to buy or sell the product or the financial instrument subjected to the contract only at the end of maturity, this type of option is known as "European Type Option". The options

Table 7.3 Option parties

	CALL	PUT
Option buying party	Right to buy (pays premium)	Right to sell (pays premium)
Option selling party	In the event that the party buying the option uses its right in the term, selling is mandatory	In the event that the party buying the option uses its right in the term, selling is mandatory

Source: Prepared by the author

that allow the option buyer to use its contractual right to buy or sell at any time, they are called as "American Type Options". Options can be arranged in various ways according to the products they are subject to, such as stock options, index options, foreign currency options, interest options, options written on futures, exotic options, and so on.

7.6.3.4 Use of Option Contracts in Banks' Asset and Liability and Risk Management

Banks generally use futures contracts for the purpose of trading or risk management. Banks use futures contracts for trading purposes; especially use options to bring buyers and sellers together and to gain difference from the option premium. Banks buy the right to buy or sell interest and foreign exchange options by paying premiums in order to protect themselves from fluctuations in interest and exchange rates. Thus, they protect their portfolios from fluctuations in interest rates or exchange rates with a limited premium. In other words, banks are protected from unlimited losses with a limited expense (Stoll and Whaley 1993.

7.6.4 Swap

Swap is a transaction between two parties to exchange cash flows connected to one or more forward contracts at a predetermined future date. In swap transactions, there are spot and futures or two forward transactions with different maturities in addition to spot transactions (Aksoy 1998; Flavell 2010).

Due to the change and liberalization in the World Finance and monetary system after the 1970s, it is a structure that countries have effectively put into practice since the 1980s to prevent money outflow. Interest rate and exchange rate risk created by the fluctuations in rates are the most important fields of activity of banks and even business and public administrators. Swap transaction is an income-generating activity for banks through trading as well as being a risk management technique used to reduce resource costs and foreign exchange risk in international borrowings. Although there are many types of swap transactions such as Currency swap, Interest

Rate Swap, Cross Currency Interest Rate Swap, Forward Start Swap, Delayed Start or Deferred Swap, Plain Vanilla Swap, Swaption, Commodity Swap, Equity Swap, Zero-Coupon Multi-Legged Swap, the most common swap transactions in financial markets are currency swap and interest rate swap transactions. Although both transactions show some differences, the most distinctive specification is that the parties make mutual cash exchange transactions.

7.6.4.1 Interest Rate Swaps

With the swap agreements, banks aim to replace fixed-rate resources in order to avoid interest rate risk of the variable-rate resources in their balance sheets. In this respect, swap agreements also contribute to the reduction of both the interest rate risk and the resource cost of the bank.

They are over the counter derivative transactions in which mutual interest changes are made and can also be subject to the change of principal carried out by the companies in order to protect their balance sheets against the interest risk arising from the interest rate changes on their current loans, which can be made in a single foreign currency or different foreign currencies depending on the amount subject to interest;

- from fixed interest to variable interest
- from variable interest to fixed interest
- from fixed interest to fixed interest
- from variable interest to variable interest

Interest rate swap is a swap transaction made in the same currencies. In this type of interest rate swap transaction, the principal amount of the loan is not changed, it only forms the basis for the calculation of payments (Campello and Matta 2012).

Cross currency swap is an interest rate swap transaction made in different currencies. Unlike the interest rate swap transaction; the principal amounts are also changed at the beginning and end of the maturity. Considering the changes in today's market conditions, companies use interest rate swap transactions intensively in their long-term loans, especially in project finance loans (Das 2006).

If a company borrowing with variable interest rates reasons that interest rates will rise in the future and this may affect its balance sheet negatively, it would want to exchange its loan with a fixed rate by making an interest rate swap transaction to ensure protection against interest increases. However, if a company that used a fixed interest loan thinks that interest rates will decrease in the future and this will affect its costs, it makes interest rate swap transaction in order to change its debt with variable interest to benefit from interest decreases (Flavell 2010).

The interest rate swap transaction (from variable interest to fixed interest) is carried out as follows: The Firm used a loan of € ten Million with a 1-year grace period of principal, 3-year maturity, and once in a 6-month EUROBOR + 3.5 interest payment (Table 7.4).

Table 7.4 Credit swap

Payment dates	Interest start date	Interest end date	Number of days	Principal	Principal repayment	Fixing dates	Variable interest rate (Eurobor)	Principal + interest payments	Interest payments
02.01.2020	01.07.2020	02.01.2020	185	10,000,000	0	29.06.2019	1.777	271,179.2	271,179.2
02.07.2020	02.01.2020	02.07.2020	182	10,000,000	0	29.12.2019	2.06	281,088.9	281,088.9
02.01.2021	02.07.2021	02.01.2021	184	10,000,000	2,500,000	28.06.2020	2.204	2,791,537.8	291,537.8
01.07.2021	02.01.2021	01.07.2021	180	7,500,000	2,500,000	28.12.2020	2.33655	2,718,870.5	218,870.5
02.01.2022	01.07.2022	02.01.2022	185	5,000,000	2,500,000	27.06.2021	2.89789	2,656,681.8	156,681.8
01.07.2022	02.01.2022	01.07.2022	180	2,500,000	2,500,000	30.12.2021	2.88373	2,579,796.6	79,796.6

((Eurobor + 3,5) * Principal base for Interest * Number of Days)/360 Total 11.299.154.7 1.299.154.7

Source: Prepared by the authors

Table 7.5 Credit and swap transaction

Bank A	10 mm EUR	Company Z	6% Eur interest	Swap bank
	→		→	
	←		←	
	Eurobor + 3.5		Eurobor + 3.5	
Credit transaction		Interest rate swap transaction		

Source*:* Prepared by the authors

Table 7.6 The firm's payment to swap bank at fixed interest with 6% interest rate

Payment dates	Interest start date	Interest end date	Number of days	Principal	Principal repayment	Sabit interest amount
02.01.2020	01.07.2020	02.01.2020	185	10,000,000	0	308,333.33
02.07.2020	02.01.2020	02.07.2020	182	10,000,000	0	303,333.33
02.01.2021	02.07.2021	02.01.2021	184	10,000,000	0	306,666.67
01.07.2021	02.01.2021	01.07.2021	180	7,500,000	0	225,000.00
02.01.2022	01.07.2022	02.01.2022	185	5,000,000	0	154,166.67
01.07.2022	02.01.2022	01.07.2022	180	2,500,000	0	75,000.00
					Total	1,372,500.00

Source: Prepared by the authors

The Firm wishes to fix its Eurobor + 3.5 interest-paid loan at EUR interest. In this case, the interest rate swap transaction and the loan transaction are considered as two separate transactions (Table 7.5).

The firm receives Eurobor + 3.5 from Swap Bank and pays the loan interest at Eurobor + 3.5 to Bank A from which it borrowed a loan, and pays to Swap Bank 6% fixed interest (Tables 7.6 and 7.7).

In case of a decrease in interest rates, loan users will want to close their loans early, and banks will want to reduce their loan amounts or extend shorter-term loans. In this case, banks will prefer options based on swap agreements. Swap option transactions, also known as swaption in the literature, are futures traded in over the counter markets and give the option purchaser the right to enter interest swap transactions by using the right to buy or sell in the interest swap transaction, in the underlying swap transaction, at a maturity determined on the transaction date, and impose the option seller obligation for this subject. In a swap option transaction, the bank that purchases the call option buys the right to enter into an interest agreement under certain conditions and at a certain time in the future. On the determination day, if the party that sells or buys uses the option right, the parties will enter an interest rate swap transaction and the operation of the transaction will continue as an interest swap transaction.

Table 7.7 Variable interest payments of Swap Bank to the Firm

Payment dates	Interest start date	Interest end date	Number of days	Principal	Principal repayment	Fixing dates	Variable interest rate (Eurobor)	Variable interest amount
02.01.2020	01.07.2020	02.01.2020	185	10,000,000	0	29.06.2019	1.777	271,179.2
02.07.2020	02.01.2020	02.07.2020	182	10,000,000	0	29.12.2019	2.06	281,088.9
02.01.2021	02.07.2021	02.01.2021	184	10,000,000	0	28.06.2020	2.204	291,537.8
01.07.2021	02.01.2021	01.07.2021	180	7,500,000	0	28.12.2020	2.33655	218,870.5
02.01.2022	01.07.2022	02.01.2022	185	5,000,000	0	27.06.2021	2.89789	156,681.8
01.07.2022	02.01.2022	01.07.2022	180	2,500,000	0	30.12.2021	2.88373	79,796.6
							Total	1,299,154.7

Source: Prepared by the authors

7.6.4.2 Money or Foreign Currency Swaps

These are the transactions in which the parties swap/exchange two different foreign currency amounts at the agreed rates and conditions on the date of the transaction and exchange the relevant currencies back at the agreed rates and conditions on the maturity date of the transaction (Flavell 2010).

In the foreign currency swap transaction, there are two parties that are the bank and the bank's customer. An agreement is reached between the bank and its customer on the date the transaction is made, on the amount, swap point and maturity date. Foreign currency swap transactions are binding on both parties as of the day they are made and there is no right of withdrawal. Cash flow occurs at the beginning and end of the maturity. Currency swap is a derivative transaction performed in the over the counter market. As over-the-counter derivatives are transactions that are considered as loans, a certain percentage of the transaction amount must be obtained as collateral depending on the maturity and amount of the transaction. Obtaining collateral is implemented as a priority to reduce bank risk (Kolb and Overdalh 2006).

Since the foreign currency swap transaction is the swap of two currencies in a certain period, the parties return their principal money at the end of the maturity with a certain cost (together with the interest corresponding to the swap period). In fact, companies produce the money they need by making use of the money they have. With the foreign currency swap transaction, companies can control their prospective costs, regulate their cash flows, hedge against exchange rate risk and find funds with lower costs (Whaley 2006).

For example, Firm A is required to pay a loan of ten million USD today. However, it does not have this amount of USD in its cash flow today, but it is expected to generate ten Million USD income 30 days later from the previous export transaction. Since the company will make the loan repayment in USD, it will have to sell its TL and buy USD, and after 30 days, it will have to convert the earned USD to TL. In this case, the firm that wants to avoid exchange rate risk makes foreign currency swap transactions (Table 7.8).

In foreign currency swap transactions, money is exchanged twice, at the beginning and at the end of the transaction. The company gives the TL it owns to the bank based on the exchange rate specified in the swap agreement, receives the foreign

Table 7.8 Foreign currency swap

Transaction day *The Bank Customer pays 80,000,000 TL to the bank and buys 10,000,000 USD in return. Spot USD/TL rate 8.0000*	**During term** *There will be no cash movement during the term.*	**Transaction day** *The customer of the Bank gives the bank the USD 10,000,000 it bought at the beginning of the term and receives 82,000,000 TL in return. USD/TL rate at maturity 82,000*
USD → **BANK CUSTOMER** **← TL**		**USD ←** **BANK CUSTOMER** **→ TL**

Source: Prepared by the author

currency it needs in return, no other cash movement occurs during the maturity, the company returns the foreign currency received at the beginning of the maturity to the bank, and the bank returns to the company TL and swap point payments over the exchange rate agreed at the beginning of maturity.

In recent years, swap transactions have been carried out between the central banks of two countries that need each other's money and two different banks or financial institutions that want to exchange money. The most important advantage of foreign currency swap transactions for banks is that they can easily convert their resources between different currencies, which makes it easier to access the fund resources requested by their customers. However, foreign currency swap transactions are frequently used for speculative purposes, apart from the function of exchanging fund resources in terms of the required currency. For this reason, both the banking regulatory and supervision authorities of the countries and the management of the banks may determine some limitations.

7.6.5 Securitization

One of the most important trends observed in banking in the digital age is the tendency to securitize By gathering together in the balance sheet of the bank some loans and receivables of similar nature especially those that are asset-backed or secured by mortgage, issuing securities based on this pool of receivables by itself or through an institution established for this purpose (special purpose entity) and financing the payments by repayments of the receivables in this pool (Aksoy 1998; Altunbaş et al. 2009).

In this transaction, the loan interest and principal amounts obtained from the receivables that are the guarantee of the security are paid to the securities owners. Since the receivables collected in this credit pool and securitized are mostly removed from the assets of the banks, this transaction is essentially a "risk transfer" transaction (Dionne and Harchaoui 2003).

Since a significant portion of banks' assets comprise of loan receivables, banks acquire the opportunity to open credits again with the funds obtained from the securitization of their receivables, their liquidity increases, and they can find funds with lower costs. While there may not be a direct relationship between the credit worthiness of the receivables used as collateral in securitization and the credibility of the creditor, the credit risk of the receivable pool and the credit risk of the bank are also differentiated from each other (Agostino and Mazzuca 2008).

However, when low-risk receivables are sold instead of high-risk receivables in order to demonstrate the pool of receivables in higher quality, the quality of the balance sheet of the bank deteriorates and since the securities issued also constitute the debt of banks, it requires holding a certain amount of equity in terms of capital adequacy. For example; during the 2008 global financial crisis originating from the USA; the problems experienced in the return of risky mortgage loans caused

deepened the crisis of securities created based on the receivables of these loans (Kara et al. 2016).

7.7 Analysis of Basel Capital Accord and Risk Management in Banking

The Committee on Banking Regulations and Supervisory Practices was established in BASEL, Switzerland in 1974 by central banks of G-10 countries within the Bank for International Settlements (BIS) in order to discuss the status of the international banking system, to ensure international cooperation in the supervision and control of the banking system and to establish common standards despite it being legally nonbinding, to guide national supervisory authorities and to contribute to ensuring financial stability. A series of regulations have been made by the BASEL Committee to help the banking system manage various potential risks such as credit risk, market risk, liquidity risk and operational risk (BIS 2001).

7.7.1 Basel I

"The International Convergence of Capital Measurements and Capital Standards", known as Basel I, was issued in 1988. This regulation made the systems implemented with different norms in many countries uniform increasing the resilience of international banking systems against crises and financial fragility. It has also helped strengthened their financial structure, developed international competition and ensured financial stability. Market risk calculation was included in the regulation in 1996 (Balin 2008).

Basel—I criteria suggested that banks apply certain principles when providing credit and their risk taking coefficients should not be above a certain value and international standards have been determined for banks' capital adequacy. Accordingly, a minimum 8% bottom limit has been set for the ratio of Capital to risk weighted assets (Aksoy 2010; Arslan 2007).

$$\frac{\text{Total capital}}{\text{Risk} - \text{Weighed assets for credit, operational and market risk}} \geq 8\%.$$

The bank is required to keep 8 units of capital for every 100 units of credit risk, either cash or non-cash. In other words; a bank can take risk maximum 12.5 times of its capital. Banks that reach this risk coefficient but want to increase their total credits should increase their capital (Arslan 2007).

Total capital is calculated by deducting capitalized expenses and financial subsidiaries from the sum of Tier 1 Capital, paid-in capital (issued and fully paid

ordinary shares/common stock) and undistributed profits (non-cumulative perpetual preferred stock), Tier 2 supplementary capital provisions, reserves and funds (undisclosed reserves, revaluation reserves, general provisions, general loan loss reserves, hybrid debt capital instruments), and subordinated debts (subordinated term debt) used only for market risk (BIS 2001).

In BASEL I, the credit risk to which the bank is exposed is calculated by multiplying the coefficients of the separation of the bank's assets and off-balance sheet items into different risk classes and the risk weights corresponding to each class 0% (cash and gold held in the bank and treasury bonds), 20% (claims on municipalities) 50% (residential mortgages) and 100% (all other bond, equities, real estate, plant and equipments). For example, in the provision of 100,000 TL unsecured or when a firm's bond is purchased, the risk weight will be 100%, so RWA is 100,000 and the minimum capital requirement will be calculated as 8000 TL. Due to the use of only four different risk weights, Basel I's risk sensitivity is low.

Basel accord defines three types of credit risk, which are the on-balance-sheet risk, the trading off-balance-sheet risk (interest rates, foreign exchange, equity derivatives and commodities), and the non-trading off-balance-sheet risk (general guarantees, such as forward purchase of assets or transaction-related debt assets) (Balin 2008).

However, the rapid development and diversification of financial markets and financial instruments, economic and financial crises experienced, not taking into account other risks such as operational risks other than market risks, depending on risk measurement to a single measure (capital), not being able to diversify in the classification or lending of businesses, and banking crises in the 1990s required a new regulation, in 2004, A Revised Framework on International Convergence of Capital Measurement and Capital Standards agreement, known as the Basel—II criteria, was accepted (BIS 2015).

7.7.2 Basel II

Basel II is a market-based supervision and regulation for the minimum capital requirement in banking, and has been prepared to create a sound and effective banking system and contribute to financial stability by meeting the market, operational and credit risk and adapting to the securitization of bank assets (BIS 2015).

Basel II tries to eliminate the gaps in Basel I and provide more precise measurement of the bank's risk-weighted assets. Banks' minimum capital adequacy requirements are calculated to cover all of the bank's subsidiaries and affiliates, thus banks are prevented from hiding risk taking by transferring their assets to other subsidiaries (Balin 2008). Credit rating grades are used to make classifications such as Corporate, commercial, retail, SME and to determine the risk weight in providing credit (BIS 2001).

Basel II criteria are generally stated below:

Table 7.9 Rating grade and risk weight

Rating Grade	AAA/AAA-	A+/A-	BBB+/BBB-	BB+/BB-	Below BB-	Unrated Debt
Risk Weight	% 0	% 20	% 50	% 100	% 150	% 100

Source: (BIS 2015)

In a bank's loan provision, the value after the bank's client's equity divided by the sum of credit risk and market risk must be equal to or greater than 8% of the bank's capital. Otherwise, any credit will not be provided to the company (Aksoy 2007; Arslan 2007).

The basic method used in credit risk calculation is the Standard Approach, and the ratings of the counterparty obtained from authorized institutions is used as the basis for determining the risk weight (Table 7.9).

They are weighted as follows; 0% if the debt is between AAA and AAA–; 20%—if rated between A + and A–, 50% if rated between BBB + and BBB–; 100% if rated between BB + to BB–; if rated below B– it takes 150% weight when rating assigned to a government debt instrument by the rating agency. Debts without a rating grade are weighted as 100% (Balin 2008).

For bank debt, either one degree below the country rating, for example, if the country rating is AAA, the bank's risk weight is taken as 20%; or direct risk weighting is taken as 20%, for example 20% for AAA to AAA- debt, 50% of debt A + to BBB-, unclassified debt weighs 50% (Balin 2008).

Housing Mortgage Loans are subject to 35%, commercial real estate mortgage loans are subject to 100% risk weight. However, in countries with efficient and developed real estate markets, it is subject to 50% risk weight.

The methods for receivables from banks are valid for receivables from public institutions. Individual and small business loans with certain conditions are 75%, of loans amount not secured with collateral whose repayment is delayed more than 90 days, after deducting the special provisions allocated, they will be subjected to different risk weights.

All other assets will be subjected to 100% risk weight. Off-balance sheet transactions; of derivatives, commitments and non-cash loans equivalent loan amounts are determined by using the Credit Conversion Factor (CCF) and the transaction risk is weighted according to the counterparty risk.

In Basel II, the scope was expanded compared to Basel I, and market risk and operational risk were included in the calculation of capital adequacy and three methods were proposed. The first method is the Basic Indicator Approach, and it is suggested that banks have capital equal to fifteen percent of the average gross income earned in the last 3 years. In the Standard Approach method, to determine the amount of cash that the bank should hold to protect against operational risk it is weighted according to the relative amount of the assets that the bank should hold within the total assets of the bank. For example; the reserve target is proposed as 12% for retail banking with low operational risk and 15% for commercial banking. In the third method, the Advanced Measurement Approach, banks are required to

develop their own reserve calculations for operational risks and apply after the approval of the regulatory authority (Aksoy 2010; Balin 2008).

Within the framework of Basel II, the probability of loss due to fluctuations in financial asset prices, i.e., market risk (interest rate and volatility) is measured. When Basel II assesses market risk, banks can develop their own calculations to determine the reserves needed to hedge against interest rate and volatility risk for fixed income assets on a position basis. The regulatory authority approved the risk measurement model called "Value at Risk" (VAR).

The banks that do not adopt VAR models to protect their fixed income assets against fluctuation or interest rate risk recommend holding reserves between 0% and 12.5% of an asset's reserve value to be protected against movements in interest rates, depending on the maturity of the fixed income asset. For example, 0% reserve is kept for assets with less than a month to maturity, 1.25% if the maturity is 1 year or less, 7.5% if the maturity is less than 20 years, and 12.5% if the remaining term is more than 20 years (BIS 2009).

Basel II also proposes risk weighting depending on credit risk ratings in order to avoid the risk of fixed income assets in bank portfolios that may occur in interest rates and foreign exchange rates volatility. 8% risk weight is assigned to nonrated assets.

VAR or scenario analysis is used to calculate the required reserves, or banks develop their own models and allocate reserves by weighting according to the specifications such as the type and maturity of the financial asset to provide protection against market risk for assets (stocks, currencies, etc.) other than fixed income assets traded in financial markets that may be affected by market risk (BIS 2006).

According to Basel II regulation; the capital adequacy required to hedge against a bank's market, receivable and operational risk may be calculated as;

$$\begin{aligned}\text{Reserves} = {} & 0.08 * \text{Risk weighted assets} + \text{Market risk reserves} \\ & + \text{Operational risk reserves}\end{aligned}$$

$$\begin{aligned}\text{Reserves} = {} & 0.08 * \text{Risk weighted assets} + \text{Operational risk reserves} \\ & + \text{Market risk reserves}\end{aligned}$$

7.7.3 Basel III

Basel III is an additional regulation that complements the shortcomings of Basel II observed in the 2008 financial crisis and is made to support the ability of banks to endure financial crises by strengthening the capital and liquidity structure in the banking sector. In fact, Basel III does not bring much change in the calculation of capital adequacy. Basel III has made new regulations on issues such as the creation of an additional capital buffer to be used in equity and capital adequacy calculations

depending on the nature of the capital and periodicity, liquidity adequacy and non-risk-based leverage ratios (BIS 2015).

Basel III was announced on September 12, 2010 and does not abolish Basel II, changes have been made in increasing the minimum capital, increasing or decreasing the amount of capital required according to the cyclical periods of the economy, minimum liquidity ratios, capital adequacy for trading books and calculating Counterparty Credit Risk in order to increase the resilience of the banking system against financial and economic shocks and to improve corporate governance and risk management practices.

Basel III regulations are specified below:

7.7.3.1 Regulations about Capital (Equity)

- The scope of the equity included in Basel II has been changed; the elements in the principal capital (Tier 1) and with high loss-recovery potential have been defined as the core capital (common equity) (paid-in capital, undistributed profits, profit/loss for the period and other items or values to be deducted in the income statement) (Balin 2008).
- The provision in the present regulation that the contribution capital (Tier 2) cannot exceed 100% of the main capital and the application of the third generation capital (Tier 3) were abolished.
- In Basel III, the minimum core capital ratio (Core Capital/Risk-Weighted Assets (RWA)) is gradually increased from 2% to 4.5%, and the ratio of first-tier capital (other items to be included in the core capital and main capital) is also increased from 4% to 6%.
- With Basel III, banks are required to add a capital protection buffer of 2.5% points on core capital, first-tier capital and total capital.
- It is aimed to prevent rapid loan growth by increasing and decreasing the circular capital buffer depending on the growth rate of the economy.

7.7.3.2 Regulation of Counterparty Risk

It is aimed that banks hold additional capital for counterparty risk, which they will calculate based on stress scenarios and historical data.

7.7.3.3 Leverage Ratio

A simple, understandable and non-risk-based leverage ratio supporting capital ratios is calculated by dividing first-generation capital (principal capital) by the sum of off-balance sheet items taken into account with certain conversion rates and assets (principal capital/assets + off-balance sheet items).

7.7.3.4 Circularity and Systematic Risk

In order to fill the shortcomings of Basel II, which was criticized for not paying enough attention to circularity, a circular capital buffer application varying between 0% and 2.5% has been imposed depending on the country conditions and preferences. The said buffer need to be separated from core capital or other capital components capable of covering the losses fully.

7.7.3.5 Liquidity Ratios

Basel III introduces two ratios about liquidity, which are Liquidity Coverage Ratio, and Net Stable Funding Ratio. The liquidity coverage ratio (LCR) will be calculated by dividing the liquid assets of a bank by the net cash outflows that will occur within 30 days. Banks need to keep the ratio above 100%, which theoretically demonstrates that they can meet their maturity liabilities. Since this ratio indicates that the bank may have difficulty in meeting net cash outflows with liquid assets when it is less than 100%, it should not be less than 100%. Net cash outflow is the difference between cash outflows within 30 days and cash inflows within 30 days (BRSA 2010).

The net stable funding rate is a liquidity standard that requires banks to have sufficient stable funding to meet the financing period of their long-term assets. Banks must maintain 100% rate for this. However, implementation has been delayed in many countries.

7.8 Basel III and Risk Management in Banking

The financial crisis emerging as a result of the fluctuations in the housing markets in the USA in 2008 and spreading all over the world demonstrated that many banks had been operating with insufficient capital and liquidity. Banks try to achieve the highest return on equity by operating with the minimum amount of equity. However, operating with far lower than required or insufficient capital and liquidity ratios may cause banks to go bankrupt as a result of possible losses from loan defaults or other investments such as securities. Therefore, the main purpose of Basel III regulation and criteria is to increase the resilience of all banks in the global arena against financial crises by bulwarking them in terms of capital and liquidity (BCBS 2009).

The most important benefit expected from the higher capital and liquidity ratios announced by the Basel Banking Committee is to reduce the likelihood of financial crisis (Mawutor 2015). Despite the contribution of financial globalization to the development of the international financial system, it may also have negative aspects such as rapidly spreading of weakness in the financial system of a country to other countries. Since banks use high leverage rate despite their low equity level, they have

a high level of debt, this condition indicates that there is not enough liquidity to cover loan defaults and investment losses. For example, before the bankruptcy of Lehman Brothers, it was clear in their last annual financial statements that despite its own equity of 22 billion, it had assets of 691 billion dollars, which meant it used approximately 31 times leverage (Mamun and Parvez 2011).

Basel III has made broad and clear regulations about the management of credit, market and operational risks. In addition, in order to strengthen the short-term liquidity stability of banks, a 30-day liquidity coverage ratio (LCR) has been proposed.

7.9 Conclusion

Banks are the most important institutions in both economic development and financial intermediation process. Banks lend funds they collect from the people and the resources they obtain by lending to those in need of funds or invest in securities. In this respect, banks generate income by making borrowed funds available to those who need resources rather than their equities. The main purpose of banks is to maximize market value by reaching a sustainable profitability structure.

The bank's funds are on the liabilities side of the balance sheet. Fund sources of the bank, in the context of Turkey, consist of Turkish lira and foreign currency deposits, loans obtained from domestic or foreign financial markets, issued securities and equities. The assets side of the bank balance sheet demonstrates how the resources on the liabilities side are used. The most important assets of the banks consist of loans and securities portfolio. The basic principle of banking is to use resources in the most efficient (highest return) and lowest risk areas as possible.

Banks are faced with various risks in this process like interest rate risk that could arise due to possible decrease or increase in interest rates, exchange risk that may arise from changes in foreign exchange rates or possible changes in cross rates, liquidity risk that may arise from insufficient liquidity management, credit or receivable risk arising from the probability of debtors' inability to repay loan principal and interest at maturity. Banks try to manage these risks by changing their positions subject to risk and the structure of their financial assets and resources. They may also do so in accordance with the changes emerging in market conditions, measure their sensitivity to interest rate and exchange rate changes. Banks benefit from derivatives markets in this risk management process and operate in organized or over the counter markets.

In terms of managing the capital losses that may arise in the future, banks are required to provide and maintain a minimum capital structure suitable for their value at risk. In this context, management of assets and resources in banks is not analogous with risk management, but they complement each other. Effective and efficient management of assets and resources requires an effective risk management.

It is important in banking to use assets and resources in an integrated manner in accordance with the purpose of profitability and sustainable growth as well as risk

management, and to organize and manage the bank balance sheet effectively. Asset-liability management monitors and tries to manage risks for banks comprehensively. Within the scope of asset-liability management, value at risk, net interest margin, capital adequacy, liquidity management and risk management have become absolutely essential for banks to achieve their growth targets.

This study has comprehensively dealt with traditional and modern techniques in asset liability management and risk management processes in banks and have explained them systematically.

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Chapter 8
Artificial Intelligence in Internal Audit and Risk Assessment

Sezer Bozkus Kahyaoglu and Tamer Aksoy

Abstract In this study, the effects of artificial intelligence applications, which have gained importance recently, on internal audit and risk assessment are analyzed. Internal audit and risk assessment are critical for the early detection of risks that arise in the processes of businesses that are becoming more complex and exposed to external factors due to digitalization. With the internet of things that are generally accepted all over the world, there are significant differences in the way businesses do business. This situation also forces companies to differentiate internal audit and risk assessment, which is a strategic and integral element of management processes. In this context, this study focuses on the challenges and opportunities faced by internal audit and risk assessment because of digitalization, big data analysis and artificial intelligence applications depending on the rapidly developing digital work environments. Accordingly, the study includes in-depth analysis to contribute to the particularly relevant literature and to develop policy recommendations for audit and risk management professionals.

Keywords Internal audit · Artificial intelligence · Machine learning · Risk assessment · Early detection of risks · Digitalization · Big data analysis · Deep learning · Data processing · Digital literacy

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8.1 Introduction

Studies on artificial intelligence (AI), which started with Alan Turing (1950), have taken their place in the literature among the most important developments and innovations accepted recently. In this context, it can be stated that AI has entered every area of our lives, or, if it has not yet entered, there is little time left for it to enter (OECD 2019). This situation is beginning to deeply affect the whole society, all countries, the way international trade is done, and all the institutions and essentially all businesses.

This approach can be expressed as a "macro" perspective that includes the whole economy and trade. Looking into the details of this macro perspective, it is important to consider the meso and micro perspectives as well. From the meso and micro perspectives, it is necessary to examine the effects of the AI issues discussed here on social life, as well as the business processes of individual enterprises, even the employee profile (Commander et al. 2011).

In this context, this study reveals how internal audit and risk assessment activities, which have an important place in businesses, are affected because of the rapid development of AI applications. It explains what the internal audit and risk assessment structure needs to do in order to maintain its "seat at the table" in the face of global developments and to fully meet its status as a "trusted advisor". Opportunities and threats are revealed based on the change in business processes, workplaces, and workers experienced with internal audit and digitalization (Bresnahan et al. 2002; Capitani 2018). AI requires a very important change and transformation to take place in organizations. In this context, issues that the internal audit must keep up with are examined. Besides, the implications of the ethical dilemma with AI on internal audit and risk assessment are also discussed (Sambamurthy and Zmud 2017).

The finance sector has a special place and importance among the sectors where digital transformation and AI applications are taking place at the highest speed. In this respect, financial technological developments are shortly defined as "Fintech". Due to the structure of financial markets, trade operations, transactions, and their vulnerability to financial crises in the global competitive environment, the supervision, audit, and risk assessment of financial markets are also critical. New techniques developed in this respect are generally referred to as "Regtech", like Fintech (Arner et al. 2016).

8.2 Understanding the AI to Adapt Changing Audit Universe: Macro Level Analysis

It is a fact that AI has entered all areas of our lives. An example of this is "speech recognition", "language processing", "machine learning", "deep learning", "market algorithms", "computer vision", and more (Porter and Heppelmann 2015). This structure differentiates the decision-making mechanisms, job descriptions, and

Fig. 8.1 List of top ten companies with the largest market capitalization. Source: https://en.wikipedia.org/wiki/List_of_public_corporations_by_market_capitalization

strategic goals of the enterprises. As a concrete example of this, looking at the ranking of the ten largest companies with the highest market capitalization in the world in the past 10 years to present (2006–2019) provides important information. Because the fields of activity of the biggest ones have shifted to the business lines defined as "network economy" with the effect of new technological developments, specifically AI.

In this kind of network economy, there will be mostly "virtual teams" who have a work culture that is based on across time, space, and corporate boundaries to collaborate taking advantage of digitalization (Wilson et al. 2017).

As can be seen in Fig. 8.1 that explains this situation, it is observed that the top ten companies have a quite different and flexible organizational structure from the conventional business lines of the last decade. It can be stated that the basis of this difference and flexibility is big data analysis, AI, and digital business models (Andjelkovic 2015; Vasarhelyi et al. 2015).

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Fig. 8.2 Gig economy as future of work. Source: Stafford (2018). The Future of Work & The GIG Economy—Rural (slideshare.net)

(Johnson et al. 2008). This is defined as the "power of the network economy" in the literature (Kandeh and Alsahli 2020). On the other hand, sometimes this situation is called "gig economy" as well to indicate the future of work (Fig. 8.2).

The gig economy is based on a flexible work environment with people who have specific experience, high technical skills, and soft skills, respectively. In this way, both people and companies generate "high value" (Strafford 2018).

It is expected soon to experience "driverless cars", "robots in the factories", and "chain stores without cashiers" reminds the visions of a jobless future for many people. This is since "automation", "digitalization" and AI implementations, in general, are ongoing processes that will be eliminating some jobs. This may be a difficult situation for those who are not adapting to the new work environment and technological innovations at all. Rather, it they do so, they will have the opportunity to work at new jobs in a digital work environment. In this context, it should be noted that the changing nature of work increases the returns on soft skills and digital skills (Wodechi 2019).

It is important to differentiate between tasks that are routine, and non-routine. Because non-routine tasks mean that they are open to the replacement and require more "resilience, productivity, creativity, problem-solving, and good communications" that will provide sustainable jobs (Westland 2020).

Manyika et al. (2017) and Bughin et al. (2018) from the McKinsey Global Institute (2017), like Frey and Osborne (2013) prepare the detailed occupational task descriptions. These authors divide tasks at work into seven broad buckets. Hence, they basically estimate the distribution of all work that is performed across these seven groups. Among these seven groups, there are three task groups that have high potential for automation (Fig. 8.3a):

1. "predictable physical work" (81% automatable).
2. "data processing" (69% automatable).
3. "data collection" (64% automatable).

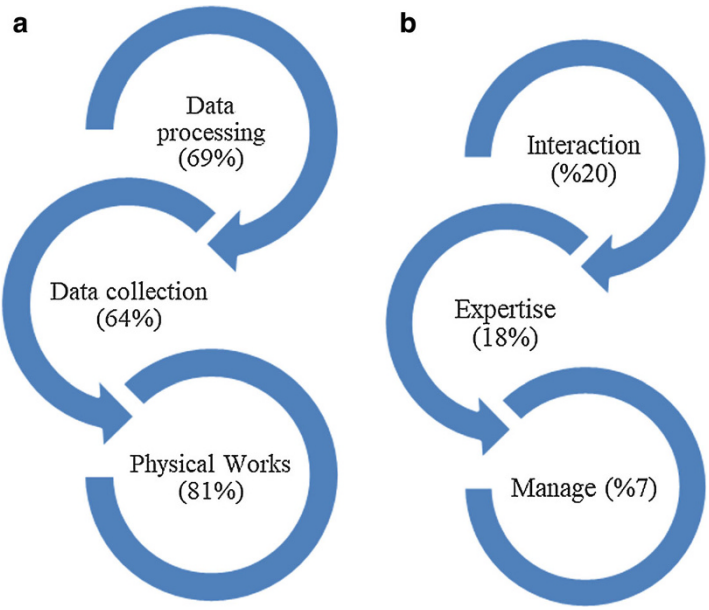


Fig. 8.3 (**a**) Tasks with high potential for automation. (**b**) Tasks with low potential for automation. Source: McKinsey Global Institute (2017)

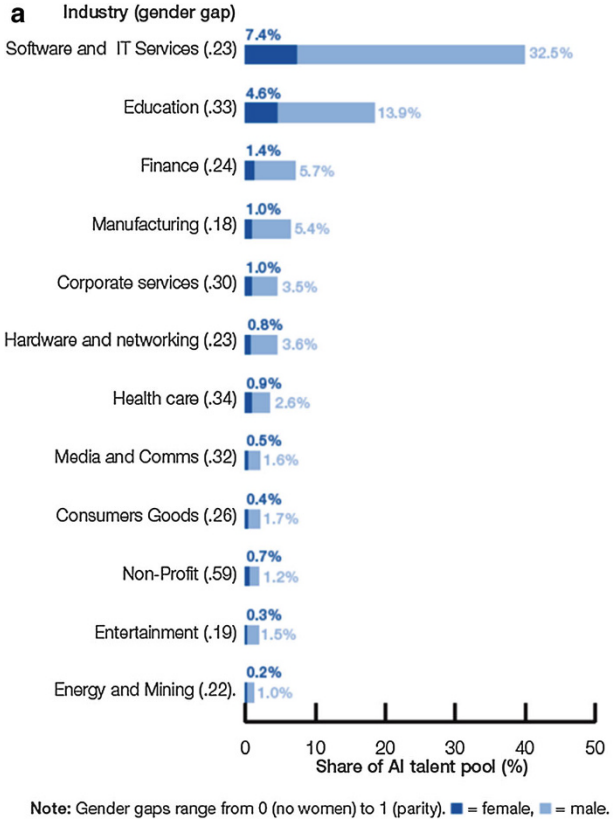
It should be noted that these works jointly account for more than half (51%) of all performed work hours, according to their estimates.

According to these authors, in contrast to the three tasks mentioned in Fig. 8.3a, the other four task groups have lower automation potential which is presented in Fig. 8.3b respectively.

These are as follows:

1. "unpredictable physical work" (26% automatable).
2. "interface-personal interactions" (20% automatable).
3. "expertise, including decision making, planning, and creative" tasks (18% automatable).
4. "manage, including managing and developing people" (7% automatable).

This situation may also adversely affect the distribution of female and male labor force in the business world and trigger an increase in the gender gap (World Economic Forum 2018). According to the research conducted by the World Economic Forum (2018), if the development of AI applications in the top 20 countries of the world continues at a similar pace, it is estimated that the balance between men and women may deteriorate further, i.e. gender gap increases in time (Fig. 8.4a). According to LindkedIn (2019) findings, which conducted a similar research study, it is emphasized that the effects of the gender gap will become more pronounced in the future, as technical competencies related to artificial intelligence are less in women when viewed based on professions (Fig. 8.4b).



b

Country Rank, AI skills	Country	Female (%)	Male (%)	Remaining gender gap (f/m)
1	United States	23	77	70
2	India	22	78	72
3	Germany	16	84	82
4	Switzerland	19	81	76
5	Canada	24	76	69
6	France	21	79	73
7	Spain	19	81	76
8	Singapore	28	72	61
9	Sweden	20	80	76
10	United Kingdom	20	80	74
11	Netherlands	21	79	73
12	Poland	16	84	81
13	Australia	24	76	68
14	Brazil	14	86	84
15	Italy	28	72	61
16	Turkey	24	76	68
17	Belgium	19	81	77
18	South Africa	28	72	62
19	Mexico	15	85	82
20	Argentina	17	83	79

Fig. 8.4 (**a**) Share of AI Talent Pool. Source: LindkedIn (2019). (**b**) Gender Gap for Country and Industry Rank. Source: World Economic Forum (2018)

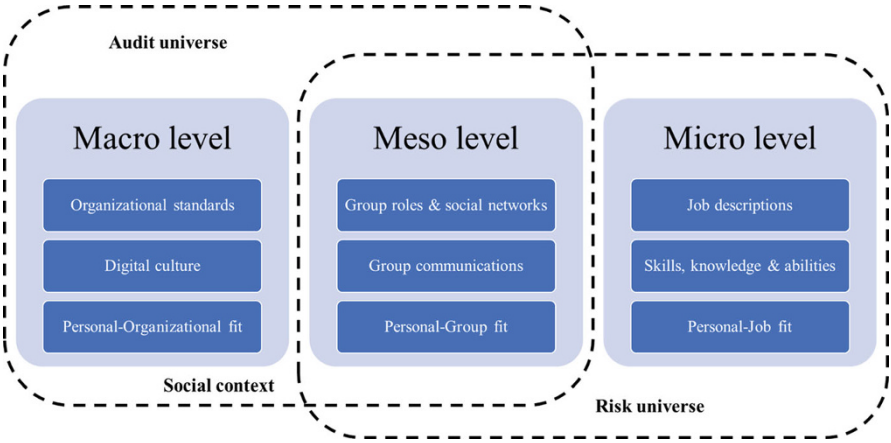


Fig. 8.5 The Effects of AI on Internal Audit at Macro, Meso and Micro Levels. Source: Adapted from Buettner (2014)

It should be noted that basic "digital literacy" will be essential in almost all jobs in the future. In this respect, internal auditors should get ready for high levels of demand predicted both for technical skills—to develop, enforce and operate with new technologies—and for social skills such as responsible leadership, teamwork, and social interaction (Bughin et al. 2018).

On the one hand, individual willingness to learn new technical and social skills is important, business executives highlight the need for public policies to provide guidance and financial supports to those jobs may be at risk from automation shortly.

In this case, those who take part in internal audit and risk assessment processes must pay attention to these developments expected in the business world regarding the gender gap. Because most of the audits are based on monitoring human behavior to determine internal control weaknesses in the processes and sub-processes of the organization and preventing possible misconduct cases, they must know the predictions of the employee profile. In this respect, they should determine the audit universe and risk universe accordingly.

After discussing the general effects of artificial intelligence from a macro perspective, related to this, the meso and micro-level perspectives are discussed below. When considered as a macro-level global perspective and "big picture-audit universe", the meso level refers to intergroup relations and social networks in the new working environment. Micro-level is used to describe individuals (Fig. 8.5).

In this context, it is important to restructure internal audit and risk assessment activities and to use audit tools and techniques suitable for the new working culture. Therefore, first, information is given by explaining what has changed, how and why. It should be noted that the meso and micro level contain the "risk universe" which is essential to assure for value-added audit approach.

8.3 Understanding the AI to Adapt Changing Risk Universe: Meso and Micro Level Analysis

Another change due to AI implementations that is as important as the gender gap is the future of work expectations about the "responsible leadership profile". Leadership approaches should have the characteristics of responsible leadership and internalize ethical decision-making processes while demonstrating ethical behavior (Ireland and Webb 2007).

Due to the increasing use of advanced technology in the business world and the fast, remote, and flexible working style of the employees, changes occur in decision-making processes. With this change, besides legal regulations, legislative compliance and control activities, ethical codes gain importance. The most important reason for this is that it is the ethical indispensability to manage anomalies caused by artificial intelligence applications.

Work, workplace, and workers are changing, and, in this case, it is necessary to analyze group relations through individuals and social networks to effectively control potential operational risks arising from various AI applications (Bozkus Kahyaoglu 2019; Bresnahan et al. 2002; McKinsey Global Institute 2017; Susskind and Susskind 2015). This is aimed to be solved with the responsible leadership approach that replaces the traditional management style of businesses.

It can be stated that an organization that internalizes ethical decision-making processes and does business according to corporate governance standards, ethical principles and values has a stronger brand image and competitive advantage. This is defined as the best practice and heavily discussed in the literature as technological change is not enough and the corporate culture must also change to adapt to digitalization and AI implementations (Westland 2020). Priority is given to the establishment of the infrastructure of digital culture by changing and adapting the corporate culture.

Manyika et al. (2017) claim that four factors are important in affecting the impact of technological innovation and AI implementations on future job growth, namely "economic factors", "the costs of technology", "labor market dynamics and skills", and "the regulatory and social acceptability of new technologies". It is a fact that each of these factors has the potential to speed up or slow down the adoption of a specific technological innovation and AI implementations which will impact on the number of jobs that will be lost or created in the future.

The point to note here is that AI is not perfect either. In the research, it has been determined that AI applications may tend to make non-objective decisions. This situation raises the concern that "AI biased" systems may trigger operational risks (Wodechi 2019). A study has been initiated, especially within the EU (2020), to prevent problems arising from artificial intelligence applications and biased decisions. Because, if the algorithms do not produce the expected results, there may be additional risks for businesses, and may also lead to deviations from strategic goals.

Such a situation should be noted as the development that internal audit and risk assessment activities should take care of and follow. In essence, it works based on

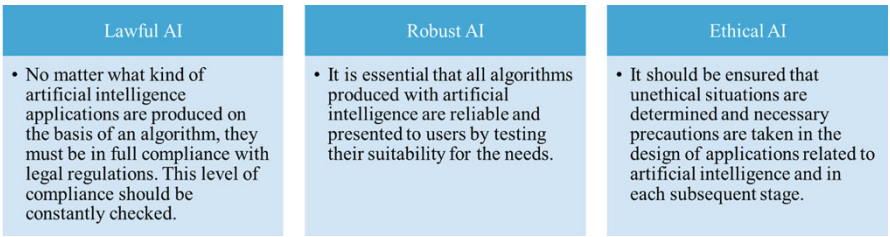


Fig. 8.6 Explanations of Lawful, Ethical and Robust AI. Source: EU (2020)

artificial intelligence algorithms and ensures the continuity of the system by producing its software autonomously. If these self-reproducing algorithms produce biased information, all processes, sub-processes, and all decisions taken here may give erroneous results (Susskind and Susskind 2015; Wodechi 2019).

Based on the studies carried out by the EU, it is to eliminate the concerns arising in this direction and to provide the expected benefit from artificial intelligence without any malfunction. For this purpose, artificial intelligence has been handled in three dimensions and extensive studies are being conducted on it. These can be defined as the ethical dimension, legal dimension, and explanatory power (robust) dimension of artificial intelligence, respectively. The explanations of these three key dimensions of AI are given in Fig. 8.6.

It is expected that the importance of ethics audits will increase especially among other key audit types. Ethics audits are the areas that are as important as financial audits in internal audit and risk assessment activities in the digital era. Hence, it is recommended to primarily audit, monitor and report ethical issues related to AI implementations (Bozkus Kahyaoglu et al. 2020).

8.4 New Tools and Techniques in Internal Audit and Risk Assessment Based on AI Practices

Along with AI implementations and digitalization, important changes are experienced in professions that include internal audit and risk assessment activities, as in all professions. Activities related to internal audit and risk assessment must develop their digital competencies so that they can offer reasonable assurance in line with international standards and stakeholders' needs and expectations (Ramamoorti and Siegfried 2016; RIMS 2012; Westland 2020). This situation is of great importance for internal audit departments not to question their reasons for existence and to protect their reputation within the organization.

In the digitalized audit universe, faster, agile, and flexible audits are required. Risk-based audit plans prepared for medium and long term with a traditional approach are no longer needed. It is necessary to carry out an audit and risk assessment with a structure that is constantly updated and rapidly adapts to changes

in the digital control environment (Hedman and Kalling 2003; Hess et al. 2016; Hinssen 2010).

However, the job of internal auditors is not that easy. Because internal auditors can generally produce work depending on the maturity level of the organization they serve (Rajterič 2010). When the level of organizational maturity is low, internal audit should give priority to advisory activities in general and in this context guide management to strengthen the AI system infrastructure. In order to achieve this, they must constantly renew themselves in line with the due professional care based on IIA (2017) and RIMS (2012) standards.

With Industry 4.0, it is possible to express the development of audit tools and techniques that try to adapt to this as Audit 4.0 (Bozkus Kahyaoglu 2019; KPMG 2020; Westland 2020). Accordingly, it is necessary to work on the use of advanced measurement techniques in audit field work and risk assessment and to report regularly and systematically to the management. Computer-aided audit techniques and tools include techniques, software, tools and instruments developed for more effective auditing and risk assessment in the context of artificial intelligence, machine language and the examination of all big data (Aksoy 2006).

Among many new approaches and tools used in auditing and risk assessment, the major tools and techniques including big data analysis, artificial intelligence algorithms and CA/CM (Bozkus Kahyaoglu et al. 2020; Vasarhelyi 2002; Vasarhelyi et al. 2012; Vasarhelyi and Halper 1991; Vasarhelyi and Kuenkaikaew 2010; Vasarhelyi Miklos et al. 2004) alert and early warning systems produced with robotic applications and anomaly detection are most frequently used. It should be noted that it is not enough to know these applications, since new tools and techniques are constantly changing (KPMG 2013, 2020). Therefore, internal audit and risk assessment professionals are expected to closely monitor such innovations and quickly integrate them into their business processes.

It should be taken into account that business processes are carried out in digital ecosystems, platforms and network structures through the virtual environment. In this context, possible cybersecurity issues should be included in the audit and risk assessment processes (COSO 2019; Kahyaoglu Bozkus and Caliyurt 2018). It should be kept in mind that some of the AI algorithms may contain malicious software leading to fraud cases.

Furthermore, according to the risk assessment component of the COSO internal control framework, the risks in the digital ecosystem, including digital fraud and corruption risks, are to be evaluated within the scope of all risks of the organization. All interested parties, including internal auditors, management and employees, should be aware of the assesment of these digital risks and know what to do when these risks arise (Aksoy and Saglam 2020). For this reason, internal auditors and risk professionals should develop their digital skills to capture fraud cases that may affect their organizations through this channel.

8.5 Conclusion

It is a fact that science still relies on Euler and Einstein. The major reason for building up AI exponentially is the technology and data processing capabilities. Considering that AI applications appear in all areas of life; you can imagine how many different scenarios similar biases can be raised as operational risks arising from AI. For example, using historical data to inform decisions about whether a person will receive a mortgage, the type of health insurance coverage will be recommended, or just a visa application of a person approved or not, and the long list goes on. Similarly, it is possible to add issues regarding many sectoral data analyses and criteria based on internal audit and risk assessment to this list.

In this new digital business world, it is important for professionals involved in internal audit and risk assessment to constantly update their digital competencies. It is also recommended that they add more ethics to audit plans than ever before. In the new digital world order, internal audit and risk assessment process owners have important duties to transform the developments emerging in the sane environment into social benefits and added value.

In this chapter, the effects of AI on internal audit and risk assessment are discussed at macro, meso and micro levels. It should be noted that this new digital structure offers a virtual platform and network economy that radically impacts the work, the workplace, and the workforce. In this digital environment, traditional audit and risk assessment understanding, structure, mindset, culture, tools, and techniques will be insufficient. Therefore, the internal audit universe and risk universe should be updated with a perspective suitable for new approaches. Accordingly, an agile working style, in which digital audit and risk assessment tools and techniques, are used should be adopted.

The finally to be stated here is that artificial intelligence is not perfect at all. There may be some aspects of AI implementations that are open to improvement. Internal audit and risk assessment should be considered the most important and strategically positioned mechanism to detect these aspects open to improvement and to assess potential risks as early as possible. This will be the case, at least until the robots do this task.

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Chapter 9
Evaluation of Renewable Energy Resources for Business Investments in Turkey by Using Fuzzy Multi-criteria Decision-Making Methods

Yavuz Selim Ozdemir

Abstract Energy is the main resource that countries need for economic and social development. As a result of increasing population, global growth and industrialization, energy needs are increasing day by day. In recent years, fossil fuels used to meet the increasing demand are declining due to environmental issues. Therefore, the importance of the energy obtained from alternative energy sources has come to the fore as a necessity. Turkey is a country, rich in diversity and potential of renewable energy sources. In addition, due to its geographical location, it receives a large amount of solar and wind energy. Turkey is also one of the few countries worldwide in terms of solar and wind potential. It is imperative that our country uses its renewable energy resources to its advantage by virtue of its strategic position in the World. Therefore, it has become necessary to conduct studies that evaluate the renewable energy source alternatives of our country and reveal the best options. In this paper, renewable energy potential and usage data of the Earth and Turkey has examined firstly, then fuzzy multi-criteria decision-making methods have been resorted to with a view to selecting optimal plant sites in terms of criteria classed as land, social, and financial criteria for business investments. This research is a guide for business and enterprises that intend to make investment for renewable energy.

Keywords Renewable energy · Multi criteria decision making · Location selection · Fuzzy logic

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9.1 Introduction

The concept of energy is the ability to do work with its most general definition. People need energy to survive because energy is essential for the continuation of the human species (Şeker 2010). In the earth, there are two main sources of energy. The first of these, renewable energy, is theoretically accepted as unlimited and is essentially a type of energy obtained from natural resources. The second is the energy obtained from consumable resources, which also exist in nature, decreasing as used or requiring a long time to renew themselves. Today, fossil fuel reserves meet most of the energy needs. That being said, it is anticipated that fossil fuel resources may be depleted within a very long period of time. The decrease in fossil fuels, the high cost, the damage to the environment and the increase in foreign dependency of the countries create the need for alternative energy sources. This has led to increased awareness of renewable energy sources and in this context, the use of renewable energy sources is of great importance.

The use of renewable energy sources for a sustainable energy plan is important in terms of directing the energy and economic policies of the countries. Renewable energy sources are very important for the future of countries in terms of being domestic, renewing themselves faster than the rate of exhaustion, providing energy supply security, low fuel cost, no negative effects on the environment and being within the scope of international agreements such as Kyoto (Cayir Ervural et al. 2018b). After the Industrial Revolution in the late eighteenth century, the world has changed in many stages. It is getting more and more difficult to meet the ever-increasing energy needs of our world with fossil fuels that are decreasing day by day. This situation prevents the continuity of energy. Considering the last 25 years, the energy need of the Earth has increased so much that the necessity to take environmental factors into consideration has been born for the continuity of life.

Energy consumption for the continuity of the consumption-oriented economic system has reached the maximum level with the development of technology globally and owing to the unplanned population increase. The use of renewable and sustainable energy sources has come to the fore in the recent years, led by developed and industrialized countries. Especially in developed and developing countries, the global population growth, industrialization, and urbanization phenomena, increasing trade opportunities and the ever-developing technology becoming an indispensable element in human life increase the demand for energy every day (Erkan et al. 2016). The main reason behind many conflicts, wars and invasions, which were justified by discourses such as liberation of the people of the region, and bringing democracy to the very region, is actually the idea of maintaining energy supply by controlling the energy basins. The main motive of energy wars is that energy resources are situated in different geographies around the world and that these resources are not evenly distributed among these geographies. Therefore, in recent years, the subject of energy has become one of the main topics of strategic importance for countries. Energy sources exist in different regions and amounts in the world. While some countries have reserves rich in energy resources, some countries are quite unlucky in

this respect. Countries that are not rich in energy resources need to use their existing resources effectively and efficiently in order to reduce their foreign dependency. Turkey constitutes a good precedent for this situation. Although there are regions where the world's richest reserves of fossil fuels are found, Turkey does not have the reserves of fossil fuels to meet their own needs. However, our country has a great potential in terms of geography and the potential for renewable energy sources exists in this respect.

The International Energy Agency (IEA) estimates that developed countries will account for 93% of the increase in energy demand between 2010 and 2035, and its cost will reach 30 trillion dollars (Ünlüsoy et al. 2017). These non-renewable resources are expressed in terms of reserves, which means that sooner or later these resources will be exhausted. The option of sourcing from other countries is far from being a reliable and sustainable option due to ongoing power balance changes in the world. In addition to these, environmental awareness increased by means of communication, fossil fuels have a negative impact on natural resources on a global level, and concerns about the future are developing, in this context have the search for alternative sources in electricity generation to renewable energy sources has emerged. Turkey, which obtains a large portion of its energy needs from outside, it is possible to reduce the dependence on foreign energy field with the scientific studies. Geographical location and climatic characteristics that can be benefit offer a great potential in terms of renewable energy sources in Turkey. In this context, the utilization of renewable energy sources to the maximum level will provide significant advantages for Turkey. Turkey's distribution of installed capacity by resources as of the first half of 2019; 31.4% hydraulic energy, 29% natural gas, 22.4% coal, 8% wind, 6% solar, 1.5% geothermal and 1.7% other sources (Republic of Turkey Ministry of Energy and Natural Resources 2019). 2023 Turkey's energy strategy is planned to increase the share of renewable energy in electricity production to 30% in this direction in line with the aim "To use all of our country's hydroelectric potential." (WWF 2020). With today's technology it is possible to achieve this goal.

Wind energy is a resource that is indigenous, externally independent, natural and inexhaustible, can be supplied at the same rate in the future, does not cause acid rain and atmospheric heating, does not emit CO_2 emissions, does not have a negative impact on natural vegetation and human health, does provide fossil fuel savings, has no radioactive effects, is a fast-growing, foreign exchange-earning resource, it can also be commissioned in a short time and dismantled in a short time. In addition to all these positive contributions, there are some disadvantages such as noise, visual and aesthetic pollution, bird deaths, causing interference to radio and TV receivers within an area of 2–3 km (Güler 2005). In Turkey's current conditions, the technical potential of wind power 88,000 MW and the economic potential is estimated to be around 10,000 MW (Dünya Enerji Konseyi Türk Milli Komitesi 2014).

The sun, one of the billions of stars in the Milky Way galaxy, is our greatest source of energy. It is the radiant energy released as a result of the fusion process in the solar core. This energy is released by the conversion of hydrogen gas into helium gas. While the intensity of solar energy is approximately 1370 W/m^2 outside of the Earth's atmosphere, it reaches our Earth 0–1100 W/m^2 due to the atmosphere's

protective ability. Even a small part of this energy coming to the earth is many times higher than the energy consumption of humanity. Solar energy plays a role in the formation of all kinds of energy other than nuclear energy. After the 1970s, the efforts to utilize solar energy have accelerated and efforts are continuing to accelerate today. The radiation that covers a wide range from the long red sub-wavelengths from the sun to the short ultraviolet wavelengths is called solar radiation. Solar radiation is directly proportional to the efficiency from solar power plants. In the phase of setting up a solar power plant, regions with high solar radiation should be selected (Akçay and Atak 2018).

As a result of Turkey's sustainable energy requirements, considering its great renewable energy resource potential, optimal site selection study for both wind and solar energy has been analyzed by using Fuzzy AHP and ELECTRE, which are multi-criteria decision-making methods, in the perspective of climatic, land, environmental, social and financial criteria.

9.2 Literature Review

Multi-Criteria Decision Analysis (MCDA) methods have become increasingly popular because of complexity of optimal choice making problem in decision-making for sustainable energy. The majority of studies in the literature is using different methods for the evaluation of renewable energy sources and the selection of the most suitable ones. In this context, Yazdani et al. proposed an integrated COPRAS-AHP methodology to choose the best renewable energy project and compared the proposed model with five MCDM tools (Yazdani-Chamzini et al. 2013). As an outcome of the paper, capability and effectiveness of the proposed model is demonstrated. Wang et al. reviewed the criteria selection, criteria weighting, evaluation and final aggregation methods in different stages of multi-criteria decision-making for sustainable energy, summarized criteria of energy supply and classified weighting methods in various aspects (Wang et al. 2009). Uyan reviewed suitable areas for installing solar energy plants in Konya, Turkey with Geographical Information System (GIS) and Analytical Hierarchy Process (Uyan 2017).

Özdemir et al. proposed an Analytical Hierarchy Process in first step, and used VIKOR method as second step in order to find the most suitable location for a Solar Energy Plant among the alternatives (Özdemir et al. 2017). Tayşı addressed the selection and sorting of the types of fuel used to produce electricity. In his study, he applied TOPSIS and AHP in order to determine the optimal energy policy. As the result, biomass energy has been found as the most preferred fuel type (Tayşı 2012). Çelikbilek et al. studied a grey based multi-criteria decision model to evaluate renewable energy sources. They integrated three MCDM methods which are Decision Making Trial and Evaluation Laboratory (DEMATEL), ANP, and VIKOR (Çelikbilek and Tüysüz 2016). At the end of the study, they presented the effectiveness of the developed approach with a case study.

Erkan et al. determined the best "zero energy house" building strategy by selecting the right components such as solar panels, wind turbine, hybrid systems by using Analytic Hierarchy Process method (Erkan et al. 2016). Sánchez-Lozano et al. proposed a method which is based on the combination of a Geographical Information System (GIS) and Multi-Criteria Decision-Making methods, and includes extensive cartographic and alphanumeric database in order to find an optimal placement for photo voltaic solar power plants in southeast Spain (Sánchez-Lozano et al. 2013). Haralambopoulos et al. propose a decision-making framework, using the PROMETHEE II outranking method in order to assist multi-criteria analysis in renewable energy projects. The developed methodology provides a user-friendly approach and enhances overall transparency (Haralambopoulos and Polatidis 2003).

Uludağ et al. concentrated on founding Turkey's most efficient city for sustainable energy using fuzzy grey relational calculus with analytical hierarchy method. At the end of the paper, solar energy found as most suitable sustainable energy for Turkey, and they determined Mardin as the most efficient city for solar energy (Uludağ and Dogan 2018). Ünlüsoy et al. determined investment priorities with sorting Turkey's sustainable energy resources by TOPSIS method, considering strategic plan of Ministry of Energy and Natural Resources (Ünlüsoy et al. 2017).

In the literature, there are studies exist which deal with the current situation of sustainable energy in earth or in particular countries, also evaluating the potential. In this context, Behçet, et al. searched for the potential and usability of wind energy in Malatya/Turkey and determined the locations which wind energy can be used most efficiently. At the end of the paper, they made recommendations to benefit wind energy widely in Malatya (Behçet et al. 2014). Altaş discussed the current usage situation of wind and solar energy in Turkey, projects and studies carried, Turkey's convenience of wind and photovoltaic solar energy, and usage level of sustainable energy resources in foreign countries (Altaş 1998). Küpeli and Alp (2018) presented sustainable energy performance of G20 countries by using Data Envelopment Analysis (DEA) and Balanced Performance Weight methods (Küpeli and Alp 2018). Ağaçbiçer reviewed conventional energy sources from prehistoric times to the present besides renewable energy resources. To this purpose, potential, cost and economic effects analysis of renewable energy sources are done (Ağaçbiçer 2010).

Özgür proposed Turkey's the most usable energy source as wind energy. In this study, he demonstrated wind energy potential, usage areas and projections in earth and Turkey (Özgür 2008). Şenel et al. examined current situation of wind energy in Turkey and world, share other renewable energy resources and developments in years. Also, they suggested increasing power output of the current wind energy plants (Şenel and Koç 2015). Güler analyzed distribution of current electric energy production of Turkey by resources and reviewed Turkey's situation relative with world's development of wind energy usage (Güler 2005).

Hayli, proposed the importance of wind energy for Turkey and world, referred countries studying in this area, advantages and disadvantages of wind energy and applications in Turkey (Hayli 2001). Gençoğlu analyzed Turkey's renewable energy sources individually, and the current situation and the possibilities to use the

potential were investigated. Also, the author presented some suggestions for the solution of the energy problem (Gençoğlu 2002). According to Şeker's study, Analytic Network Process (ANP) has chosen the selection of the energy source to be used in electricity production in Turkey. As a result of the study, small hydroelectric and geothermal power plants were prioritized (Şeker 2010).

Ervural et al. proposed an integrated multi-purpose decision model for renewable energy planning. Demand forecasting methods and decision-making approaches were used as methodologies. A multi-purpose model were established and the importance levels of the objectives were determined by using AHP—fuzzy TOPSIS methodology (Cayir Ervural et al. 2018a).

There are some studies in the literature which concentrate on technical details of solar and wind energy resources. When we look at the relevant studies in this area, Nurbay et al. examined the properties of wind turbines, and specified advantages and disadvantages of them (Nurbay and Çınar 2005). Taktak et al. analyzed land selection, legal processes, setup stages, and financing model of a solar energy plant which are planned to be established in Uşak-Turkey area (Taktak and Ilı 2018). Elibüyük et al. made comparisons according to wind energy, wind turbine classification, turning axis and place of installation of wind turbines. In addition, they gave information about storage of wind turbines (Elibüyük and Üçgül 2014).

Other area of our interest is financing and cost analysis. There are many studies which analyze financing processes and economic relation of sustainable energy resources. Ağpak et al. performed an analysis that covers 59 countries at the period of 1991–2014 in order to determine the employment effect of renewable energy usage. At the end of the study, a negative relationship with renewable energy usage and employment has found (Özçiçek and Ağpak 2018). Usupbeyli et al. proposed how the increase in the renewable energy share in the electricity production affects real growth. At the end of the study, he found an increase in electricity production from renewable energy sources, through which total electricity production rises in gross domestic product, accordingly contributing to a total growth in the country economy (Usupbeyli and Uçak 2018). Yıldırım presented an idea map about renewable energy investments and financing and analyzed developments of Turkey in renewable energy sector inside historical process. As a result, they stated Turkey's domestic and sustainable energy production has the strategic importance (Yıldırım 2016).

In the literature, studies also demonstrate environmental effects of sustainable energy resources. In this area, Uyanık reviewed the advantages and disadvantages of model of renewable energy development with public policies. As a result, they found that democratization and going away from decentralization are the side product of conversion of energy production toward sustainable energy (Uyanık 2018). Yılmaz et al. researched the effects of renewable energy resources in Southeastern Anatolia Project (Güneydoğu Anadolu Projesi—GAP) area (Yılmaz and Öztürkmen 2018). Bayraç discussed effective energy management policies, various incentives, and precautions in the framework of global collaboration in order to avoid global warming and its effect on earth (Bayraç 2014).

9.3 Wind Energy

Wind energy is one of the first energy sources used by humanity. Wind energy was used in sailboats, mills, and irrigation. It is a clean energy source compared to other energy sources. It does not harm the environment, does not cause atmospheric heating and thusly is an environmentally friendly energy (Koçaslan 2006). The complete history of wind energy goes back to 2800 BC. It is known that wind energy was first used in irrigation in Mesopotamia during the Babylonians period, then in vertical axis windmills to grind wheat during the Persians period. It was started to be used in Europe Netherlands at the end of the sixteenth century and in the production of electrical energy in the 1900s.

After the economic crises in the world, many countries wanted to reduce their foreign dependency by using renewable energy sources. From this point of view, wind energy has started to be preferred more due to its cost, availability, and inexhaustibility. When wind energy is compared with other energy types, it turns out that wind energy is a very advantageous energy type in terms of investment and unit energy cost (Özen et al. 2015). Today, countries are harming the environment to produce energy. To prevent this situation and prevent global warming and climate change, Kyoto Protocol has emerged between countries. This protocol includes legal regulations on the emission of gases that cause carbon dioxide and greenhouse effect into the atmosphere and studies to reduce these amounts as much as possible. The Kyoto Protocol as of 2020? covers 160 countries on the earth and more than 55% of greenhouse gas emissions. With such agreements, countries have been asked to move away from fossil fuels as an energy source and turn to renewable energy sources.

How is wind energy produced? The answer to this question is solar energy all over the world; wind energy occurs due to pressure and temperature differences caused by not heating the land, sea, and atmosphere equally (Köse and Özgören 2005). Wind energy is the conversion of kinetic energy of the air mass into mechanical energy.

Wind turbines are machines that convert the energy of moving air into mechanical energy. Elements in wind systems are; turbine, tower, cabling and balance systems, transducers, batteries, control equipment (Nurbay and Çınar 2005). General operating principles are the same for most turbines. The wind hits the blades of the turbine and the blades begin to rotate due to the special aerodynamic structure they possess. The speed of rotation of the wings depends on the wind force. This process results in kinetic energy. There is a gearbox, generator, and other parts in the machine place at the back of the propeller. The rotational movement of the propellers is transferred to the gearbox with a shaft (slow shaft). Since the shaft does not have the high speed required to generate electricity, the shaft is increased to high speeds with the gearbox. The high-speed shaft from the gearbox is connected to the generator. As a result, electricity is produced according to generator capacity and shaft rotation. There is no fuel cost for wind turbines. There are only operating and maintenance costs. In addition, wind turbines are installed in a short time and begin to produce

energy. In this respect, they provide significant time savings. Wind turbines have two types of rotation axes. These are horizontal and vertical axes. According to the general classification, there are four types of wind turbines: land-in, land-on-shore, sea-off, sea-shore (Koçaslan 2006).

Wind energy systems are large turbines, that is, turbines installed for investment purposes and small turbines are individually installed turbines for wind turbine site selection. The average wind speed in the area where the turbine will be installed must be at least 6 m/s and above by determining the dominant wind direction in the region. Within the wind power plant, the wind turbines must be placed so that they will not interrupt each other's wind, in the direction of the prevailing wind and at least seven blades (7D) apart (Şenel and Koç 2015). In this way, there is a space that can be used as agriculture land, animal husbandry, park, garden, and or to serve other purposes. There are some criteria to be considered before installing a wind turbine in an area. These criteria are expressed by two parameters such as wind direction and wind speed and the characteristics of the wind vary temporally and locally due to local geographical differences and inhomogeneous heating of the earth (Karık et al. 2015). Therefore, proper analysis should be made before installing wind turbines. The content of these analyses includes various criteria such as location, turbine type selection and maintenance cost. Detailed information about these criteria will be given in the continuation of the report.

9.3.1 Potential in the World

In the studies conducted by the international energy agency (IEA), the world technical wind potential has been calculated as 53,000 TWh/year based on the prediction that only 4% of the regions with a wind capacity of 5.1 m/s will be used due to practical constraints and social constraints. Continents and regions with high wind energy potential, respectively; North America (14,000 TWh/year), Eastern Europe and Russia (10,600 TWh/year), Africa (10,600 TWh/year), South America (5400 TWh/year), Western Europe (4800 TWh/year), Asia (4600 TWh/year) and Oceania (3000 TWh/year) (OECD/IEA 2019).

There are more than 100 countries producing electricity with wind energy in the world. According to Global Wind Energy Council Global Wind Energy Report 2018 data, as of the end of 2018, there is a total wind power generation potential of 591 GW in the world. This potential has increased from 362 GW to 591 in the last 5 years, an increase of approximately 63%. The highest new investment in the world has been in 2015 with 63.8 GW. With a share of 36% in 2018, the People's Republic of China ranks first in the world with its total installed power. This is followed by the USA with 17% and Germany with 9%. Likewise, 45% share of the total 46.8 GW wind power installed in 2018 belongs to the People's Republic of China. Then comes the USA with a share of 16%, and Germany with a share of 5%. 23.1 GW of the wind power installed in the world in 2018 is produced in offshore facilities (OECD/IEA 2019).

9.3.2 Potential in Turkey

The energy needs of our country, which entail a rapid growth, are gradually increasing. Turkey meets a large part of its energy needs with non-renewable energy sources. But this kind of energy supply is both consumable and environmentally harmful. All over the world as well as in Turkey electric power generation is engaged with wind energy. Grid-connected electricity generation by wind power in Turkey began in 1998. Especially after the renewable electricity law numbered 5346 since 2005, the installed power and energy production has increased by over 100% every year and reached 1329 MW at the end of 2010 with 39 wind power plants operating partially or completely. As of May 2011, it has reached 1405.95 MW with capacity increases in existing power plants and three new power plants added (EPDK 2018).

Turkey Wind Potential Atlas (REPA) is made by EIE in 2006 in order to determine the characteristics and distribution of wind sources of Turkey. When the average annual value considered, it is stated that Turkey's best wind source areas are located near the tops of mountains, or high ridges and open spaces (Onat 2018). The most severe annual average wind speed near open areas are situated along Western Coast, around the Sea of Marmara, in a small area near Antakya. The vast region with a moderate wind speed and wind power density is present throughout the central part of Turkey (Altuntaşoğlu 2011).

When the measurements above wind speed of 6.5 m/s which are made by TSMS (Turkish State Meteorological Service) are analyzed, Turkey's terrestrial wind power potential is estimated 131756.40 MW, when the areas that wind power potential at wind speed is 6.5–7.0 m/s ignored and only areas that have wind speed of above 7.0 m/s is considered, the terrestrial wind power potential is estimated 48,000 MW. Also, sea wind power potential is estimated as 17393.20 MW when only areas considered which have 6.5 m/s wind speed. The installed power of wind power plants (WPP) is increasing every year in our country, while our installed power was 8.7 MW in 1998 and our installed power was 3424.48 MW as of July 2014. Average wind speeds and wind power densities of all regions in our country, measured at a height of 10 m, are given in the Table 9.1 (TSMS 2018). The regions

Table 9.1 Wind energy potentials in Turkey

Region	Average wind speed	Average wind power density
Marmara Region	3.30	51.91
Southeastern Anatolian Region	2.70	29.33
Aegean Region	2.60	23.47
Mediterranean Region	2.50	21.36
Black Sea Region	2.40	21.31
Central Anatolia Region	2.50	20.14
Eastern Anatolia Region	2.10	13.19
Average	2.59	25.82

Source: TSMS (2018)

with high wind energy potential are as follows; the Marmara, Southeastern Anatolia, Aegean, Mediterranean, Black Sea, Central Anatolia and Eastern Anatolia Region.

9.4 Solar Energy

The sun, one of the billions of stars in the Milky Way galaxy, is our greatest source of energy. It is the radiant energy released because of the fusion process in the solar core. This energy is released by the conversion of hydrogen gas into helium gas. Outside the Earth's atmosphere, while the intensity of solar energy is about 1370 W/m^2, our Earth reaches 0–1100 W/m^2 due to the atmosphere. Even a small part of this energy coming to the earth is many times higher than the energy consumption of humanity. Solar energy plays a role in the formation of all kinds of energy other than nuclear energy. After the 1970s, the efforts to utilize solar energy have accelerated and studies are continuing to accelerate today (EIGM 2019).

Fossil fuels, which are widely used today, have transformed into the current form by being transformed centuries ago thanks to the energy they received from the sun. As a result of the research, scientists predict that fossil fuels will run out soon. Therefore, most of the energy need should be met from other energy sources as soon as possible. One of the most important alternative energy sources here is solar energy.

Solar radiation which covers a wide range from long red sub-wavelengths from the Sun to short ultraviolet wavelengths. Solar radiation is directly proportional to the efficiency from solar power plants. Therefore, the regions with high solar radiation should be selected during the installation of the solar power plant (Akçay and Atak 2018).

Solar energy is a clean source of energy. Solar energy will be a logical option in meeting the increasing energy needs. Environmental friendliness and low cost have made solar energy a demanded type of energy. Therefore, solar energy has become noticeable and widespread in the last decade. There are two main types of solar energy systems which are Thermodynamic Systems and Photovoltaic Systems.

9.4.1 Thermodynamic Systems

Thermodynamic systems are systems in which solar energy is collected and converted into heat. Solar energy is converted into heat (normally) in buildings without using any electromechanical equipment. Heat transfer and conversion of hot fluid naturally occur. Passive solar heat systems also include energy collector elements such as windows or storage elements like building walls. Persons designing passive solar systems need information such as global solar radiation, long-wave terrestrial and atmospheric radiation, sunbathing time, and moving data (polar data) to calculate the optimization and performance of the system. In addition,

temperature, wind direction and intensity, humidity and evaporation must be known (Enerji 2019).

9.4.2 Photovoltaic Systems

In the voltaic collectors in photovoltaic systems, solar cells are manufactured from Cd S or silicon materials to convert solar energy directly into electrical energy, and the sun rays coming on these materials are instantly converted into electrical energy. In these systems, the highest possible solar energy is utilized at any time with the solar tracking system. Since solar tracking is expensive, these types of collectors are also used without tracking. The electrical energy of artificial satellites is provided by photovoltaic collectors. It is not widely used due to its very efficient?? cost of only 10%, as well as the very high cost of photovoltaic collectors (Enerji 2019).

9.4.3 Potential in the World

It can be said that electricity is produced by solar energy in almost all countries in the world. But in official statistics, in other words of-grid power plants, which are not connected to the interconnected system of nations, are generally excluded from statistics. In other words, when looking at the distribution of on-grid systems across countries in the world, China is the leader with its installed power exceeding 131 GW. Turkey is in the 11th position with 5987 GW. In terms watt per capita, Germany is the world leader with 550w. Unfortunately, Turkey is in 28th position and 62w per capita (Atlası 2019).

9.4.4 Potential in Turkey

Our country is one of the richest countries in the world in terms of renewable energy sources. Turkey has the world on the position of 36°–42° north latitude and between 26°–45° east longitude. This position is the key for our country to become a self-sufficient country in terms of energy. As a matter of fact, our country has the potential to produce 380 billion kwh/year of electricity in Solar Energy.

Turkey's average annual solar radiation is 1303 kWh/m^2 and the average annual sunshine duration is 2623 h. This data corresponds to a daily power of 3.6 kWh/m^2, approximately 7.2 h in a day, and sunbathing time of 110 days in total. It has an energy potential of 26.2 million TEO (tons of equivalent oil) annually, including 9.8 million TEO thermal applications. During the 10 months of the year, it can be used technically and economically at 63% of the country's surface area and 17% throughout the year. If the solar radiation is perpendicular to the atmosphere of this

Table 9.2 Solar energy potentials in Turkey

Region	Total solar energy (kWh/m^2/year)	Sunbathing time (h/year)
Marmara Region	1168	2409
Southeastern Anatolian Region	1460	2993
Aegean Region	1304	2738
Mediterranean Region	1390	2956
Black Sea Region	1120	1971
Central Anatolia Region	1314	2628
Eastern Anatolia Region	1365	2664
Average	1303	2623

Source: Ekolojist (2018)

Table 9.3 Current status of solar power plants

Number of active plants	520
Number of licensed power plants	12
Number of unlicensed plants	508
Installed power	802 MWe
Installed power ratio	%0.99
Generated electric energy	≈1.184 GWh/year
The ratio of energy produced to consumption	%0.46
Installed power targeted until 2023	3.000 MWe
Realization rate	%26.7

Source: Kayışoğlu and Diken (2019)

world, a drop is 1.367 W/m^2 (if we accept the sun is constant, otherwise this angle will change because of the earth rotations). Here, 50 W/m^2 is absorbed in the atmosphere and 1100 W/m^2 is absorbed to the earth. (Kır 2019). In the Table 9.2 Turkey's Total Annual Regional Distribution of Solar Energy Potential is given.

9.4.5 Current Status of Solar Power Plants (SPP) in Turkey

Turkey has a great solar energy power potential. Technically, there is a 50,000 GWh/year electrical energy potential. However, there is a huge difference between technical and practical data. In year 2016, the status of the existing solar power plants in our country is given in Table 9.3 (Atlası 2019). In all over the country, 520 Solar Power Plants are actively working. Only 12 of them are licensed. The table below shows the current status of Solar Power Plants:

9.5 Methodology

AHP (Saaty 1980) is a structuring, measurement and synthesis method for multi-criteria decision-making problems that was come up with by Thomas L. Saaty in 1980s. To decide, we need to know the problem, the necessity and purpose of the decision (Thomas L. Saaty 2008). Saaty sought a simple way to deal with complexity and found a common theme for people to deal with complexity.

AHP is a method that extensively supports multi-criteria decision-making methodology, which is accepted as a prioritization and selection problem for the decision problem, which can provide various answers for the decision problem and offer various rankings of alternative solutions (Kazibudzki 2013). AHP method is widely used in all kinds of multi criteria decision making problems.

Unfortunately, in the application part, there are some limitations for AHP methodology. Decision maker's complex linguistic explanations are not easy to be explained by using crisp numbers. On the other hand, if there is more than one alternative, AHP methodology's inconsistency rates are dramatically increasing. For that reasons, in this paper, Fuzzy-AHP and ELECTRE methods were combined.

9.5.1 Fuzzy-AHP

The AHP method, which is effectively used to solve many decision-making problems in real life, has been criticized for using real numbers in the binary comparison process. Deciding to use real numbers is a big problem, especially when comparing qualitative factors. In different studies, it is recommended to use fuzzy numbers to overcome this problem. Factors and sub-factors affecting the decision-making process were compared with fuzzy numbers and priorities were calculated. The fuzzy priorities determined were clarified with different methods and factor numbers and exact numbers were determined.

Fuzzy AHP is an extended version of AHP methodology. Fuzzy sets theory is introduced by Zadeh in 1965 (Zadeh 1965). Pairwise comparisons have some linguistic complexities to express decision makers' itself. For that reason, applying fuzzy sets theory has good results for better decisions (van Laarhoven and Pedrycz 1983). In this study; Buckley's Fuzzy AHP approach was used (Buckley 1985). The Fuzzy-AHP approach is detailly explained in below.

Step 1: Creating the Hierarchical Structure. First, the problem is defined, and the desired goal is determined. A decision hierarchy is created starting from the top for the purpose of the decision. The following Fig. 9.1 is a hierarchical structure between purpose, criteria, and alternatives.

Decision makers linguistic expressions that are used in Fuzzy-AHP and related fuzzy numbers are given in Table 9.4. That comparison scale is referred to in pairwise comparisons for decision matrix.

Step 2: Create the pairwise fuzzy decision matrix (A) with decision makers.

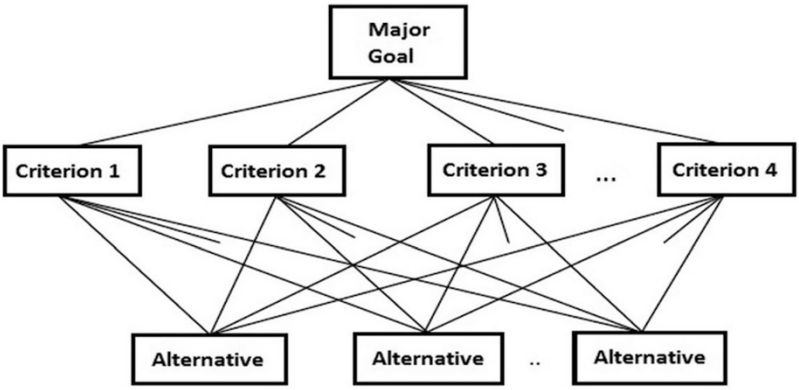

Fig. 9.1 AHP Hierarchical Structure. Source: Thomas L. Saaty (2008)

Table 9.4 Comparison scale between criteria

Fuzzy representation	Linguistic variable	Explanation	Triangular fuzzy numbers
$\tilde{1}$	Equal importance	Two activities contribute equally to the objective	(1, 1, 1)
$\tilde{3}$	Moderate importance	Experience and judgment slightly favor one activity over another	(2, 3, 4)
$\tilde{5}$	Strong importance	Experience and judgment strongly favor one activity over another	(4, 5, 6)
$\tilde{7}$	Very strong importance	An activity is favored very strongly over another; its dominance demonstrated in practice	(6, 7, 8)
$\tilde{9}$	Extreme Importance	The evidence favoring one activity over another is of the highest possible order of affirmation	(8, 9, 9)
$\tilde{2}, \tilde{4}, \tilde{6}, \tilde{8}$	Intermediate values	When compromise is needed	(1,2,3), (3,4,5), (5,6,7), (7,8,9)

Source: Chan and Kumar (2007)

$$\tilde{p}_{ij} = \left(a_{ij}, b_{ij}, c_{ij}\right)$$

Step 3: Fuzzy weights for criteria can be calculated as following equations,

$$\tilde{r}_i = \left[\prod_{j=1}^{n} \tilde{p}_{ij}\right]^{\frac{1}{n}}$$

$$\widetilde{w}_i = \widetilde{r}_i \times \left[\sum_{j=1}^{n} \widetilde{r}_j\right]^{-1} = \left(w_i^l, w_i^m, w_i^{u.}\right)$$

Step 4: Fuzzy numbers are converted crisp numbers by using following center of gravity defuzzification formula.

$$w_i = \frac{\widetilde{w}_i}{\sum_{j=1}^{n} \widetilde{w}_j} = \frac{w_i^l + w_i^m + w_i^u}{\sum_{j=1}^{n} \widetilde{w}_j}$$

At the end of the step 4, weights for each criterion were determined. These weights are going to be used in the second step of ELECTRE algorithm.

9.5.2 ELECTRE

ELECTRE is a multi-criteria decision-making method. The word ELECTRE consists of the initials of the words "Elimination Et Choix Traduisant La Reality" and it means the selection and selection reflecting the truth. The ELECTRE method was first developed by Benayoun and Sussman (Benayoun and Sussman 1966). With the ELECTRE method, which is one of the mathematical programming techniques for optimization purposes, the decision maker can include a large number of quantitative and qualitative criteria in the decision-making process, the criteria can be weighted in accordance with the purpose and can determine the most suitable alternative by collecting their weights (Govindan and Jepsen 2016). The method has two indices defined for each of the alternatives; the fit index and incompatibility index are based on its assessment (Wang and Triantaphyllou 2008). ELECTRE method; is based on the dominance measure of the options with respect to each other depending on the specific criteria and the weights of these criteria. The ELECTRE method consists of seven steps (Tunca et al. 2015) given in below:

Step 1: Establishing the Decision Matrix (A): The rows of the decision matrix include alternatives that are desired to be listed, and the columns include evaluation factors to be used in decision making.

$$\mathrm{A} = \begin{bmatrix} a_{11} & a_{12} & a_{13} & \dots & a_{1n} \\ a_{21} & a_{22} & a_{23} & \dots & a_{2n} \\ a_{31} & a_{32} & a_{33} & \dots & a_{3n} \\ \dots & \dots & \dots & \dots & \dots \\ a_{m1} & a_{m2} & a_{m3} & \dots & a_{mn} \end{bmatrix}_{m \times n}$$

Step 2: Creating the standard decision matrix: It is calculated by using the elements of the decision matrix and using the formula below.

$$x_{ij} = \frac{a_{ij}}{\sqrt{\sum_{k=1}^{m} a_{kj}{}^2}}$$

To calculate the element of the matrix X, the element of matrix A is obtained by dividing the square root of the sum of the squares of the column elements of the matrix. The aim is to weight one decision point in relation to other decision points while associating the relevant evaluation factor.

$$X_{ij} = \begin{bmatrix} x_{11} & x_{12} & x_{13} & \ldots & x_{1n} \\ x_{21} & x_{22} & x_{23} & \ldots & x_{2n} \\ x_{31} & x_{32} & x_{33} & \ldots & x_{3n} \\ \ldots & \ldots & \ldots & \ldots & \ldots \\ x_{m1} & x_{m2} & x_{m3} & \ldots & x_{mn} \end{bmatrix}_{m \times n}$$

Step 3: Creating the Weighted Decision Matrix (W): Weighted normalized matrix is obtained. The decision maker should first determine the weights (w_i) of the evaluation factors.

$$\sum_{j=1}^{n} w_j = 1$$

The normalized matrix is multiplied by the weights of the criteria and a weighted normalized matrix can be obtained.

$$Y_{ij} = w_i x_{ij}; j = 1, \ldots, n; i = 1, \ldots, m$$

$$Y_{ij} = \begin{bmatrix} w_1 x_{11} & w_2 x_{12} & \ldots & w_n x_n \\ w_1 x_{21} & w_2 x_{22} & \ldots & w_n x_{2n} \\ \ldots. & \ldots & \ldots & \ldots \\ \ldots & \ldots & \ldots & \ldots \\ w_1 x_{m1} & w_2 x_{m2} & \ldots & w_n x_{mn} \end{bmatrix}_{m \times n}$$

Step 4: Determination of Concordance (C_{kl}) and Discordance (D_{kl}) Sets: For each pairwise alternative comparison, the criteria are divided into two separate sets. In cases where the alternative or alternatives that are sought and the solution to the problem are not "the best" according to all criteria, they are asked to be "good"

according to the majority of these criteria and pairwise comparisons are made. For all Y_{kj}*and* Y_{lj} ($k \neq l$), the concordance set formula is given below.

$$C_{kl} = \left\{ j, Y_{kj} \geq Y_{lj} \right\}$$

If the Y_{kj} alternative is a worse than Y_{lj}, then it is a member of "Discordance" set.

$$D_{kl} = \left\{ j, V_{kj} < V_{lj} \right\}$$

In the ELECTRE method, each concordance set (C_{kl}) has an inverse which is called as a Discordance set (D_{kl}). In other words, there are as many Discordance sets as and concordance sets. Discordance set elements consist of j values that do not belong to the concordance set.

Step 5: Creation of the Concordance and Discordance Matrices: Concordance sets are used to create the Concordance matrix (C). The matrix C is m×m in size and does not take value where $k = l$. The elements of the matrix C are calculated as given in the formula below.

$$C_{kl} = \sum_{j \in C_{kl}} w_j$$

The elements of the Concordance matrix (C) are conducted as in the matrix given below.

$$C = \begin{bmatrix} - & C_{12} & C_{13} & \ldots & C_{1m} \\ C_{21} & - & C_{23} & \ldots & C_{2m} \\ . & . & . & . & . \\ . & . & . & . & . \\ . & . & . & . & . \\ C_{m1} & C_{m2} & C_{m3} & \ldots & - \end{bmatrix}$$

The elements of the Discordance matrix (D) are calculated by the following formula:

$$d_{kl} = \frac{max \left| Y_{kj} - Y_{lj} \right|}{max \left| Y_{kj} - Y_{lj} \right|}$$

Like the C matrix, the D matrix is m×m in size and does not take values for k = 1. Matrix D is shown below.

$$D = \begin{bmatrix} - & d_{12} & d_{13} & \dots & d_{1m} \\ d_{21} & - & d_{23} & \dots & d_{2m} \\ . & . & . & . & . \\ . & . & . & . & . \\ . & . & . & . & . \\ d_{m1} & d_{m2} & d_{m3} & \dots & - \end{bmatrix}$$

Step 6: Determination of Concordance ($\underline{c}$) and Discordance ($\underline{d}$) threshold Values: The fit threshold ($\underline{c}$) can be obtained by the following formula.

$$\underline{c} = \frac{1}{m(m-1)} \sum_{k=1}^{m} \sum_{l=1}^{m} C_{kl}$$

The elements of the F matrix (f_{kl}) take either the value 1 or 0, and there is no value, on the diagonal of the matrix.

$$\text{If} \quad c_{kl} \geq \underline{c} \Longrightarrow f_{kl} = 1 \; else \; 0$$

The Discordance threshold value ($\underline{d}$) can be calculated by the following formula:

$$\underline{d} = \frac{1}{m(m-1)} \sum_{k=1}^{m} \sum_{l=1}^{m} d_{kl}$$

The elements of the G matrix (g_{kl}) take either the value 1 or 0, and there is no value, on the diagonal of the matrix.

$$\text{If} \quad d \geq \underline{d} \Longrightarrow g_{kl} = 0 \; else \; 1$$

Step 7: Determine the Aggregate Dominance Matrix: Rows and columns of matrix E shown as decision points and calculated as given below.

$$e_{kl} = f_{kl} \times g_{kl}$$

9.6 Application and Results

In the application part, the approaches that have been explained in methodology part were used and a real location selection problem were solved by using proposed methodologies. First of all, selection criteria are determined for wind and solar energy investments. For that purpose, with a contribution of group of experts and

Table 9.5 Main criteria, sub-criteria and weights

Main criteria	Main criteria weight	Sub criteria	Sub criteria weight
Land criteria	0.25	Total land needed	0.06
		Distance from main road network	0.03
		Distance from city/urban area	0.03
		Distance from industrial facilities	0.05
		Distance from power lines	0.08
Social criteria	0.16	Effects on life quality of residents	0.06
		Effects on other living creatures	0.04
		Social acceptability	0.06
Financial criteria	0.59	Setup cost	0.09
		Operation and maintenance cost	0.04
		Return of investment	0.14
		Land cost	0.13
		Governmental support	0.19

Source: Table data by researcher

literature review were used for criteria selection and construction of hieratical structure of Fuzzy-AHP. According to the research in the literature, three main criteria were determined. These criteria are Land, Social and Financial. For each main criterion, sub-criteria were defined with experts.

In the second step, three experts were evaluated the criteria. These experts have both sectoral and academic experience. In this evaluation step, Fuzzy-AHP and group decision making approaches were used. For each pairwise comparison table, consistency checks were made. All pairwise comparisons are consistent ($CR <= 0.1$). As a result of first and second step, the criteria hierarchy and weights of criteria are given in Table 9.5.

In order to find out the best location for wind and solar energy investments separately, 5 locations were selected in Turkey's various regions that are Ankara, Bursa, Muğla, Van, Sinop. Here, two assumptions were made for this example problem. First assumption is for each power of plant investment, energy output is fixed for 1MWh. If needed, this assumption can be scaled for future investment plans. Second assumption is for each alternative location, %50 wind—%50 solar, hybrid power plant complex is going to be established. Like the first assumption, the ratios one can be changed in line with the requirements for future investment problems.

All locations were evaluated in terms of sub-criteria. The evaluation is given in Table 9.6. After that, ELECTRE methodology were applied so as to compare the alternatives and select the best one. As a result, five alternatives and thirteen criteria were used for ELECTRE methodology. The evaluation for all criteria were made between 1 and 10. Here, higher values are better for all.

After steps of ELECTRE algorithm were applied, calculated outcome matrix is given below.

Table 9.6 Initial table for ELECTRE

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
A1	7	7	8	7	9	8	7	9	9	9	9	8	8
A2	8	8	7	9	9	7	7	8	10	10	9	7	9
A3	9	6	6	8	8	7	7	9	9	9	9	9	9
A4	8	5	4	6	7	9	9	10	7	7	8	10	10
A5	8	6	5	6	7	8	7	9	8	8	8	10	9

Source: Table data by researcher

$$e_{kl} = \begin{matrix} - & 0 & 0 & 0 & 0 \\ 1 & - & 0 & 0 & 0 \\ 1 & 1 & - & 0 & 0 \\ 0 & 0 & 0 & - & 1 \\ 0 & 0 & 0 & 0 & - \end{matrix}$$

Rows represent positive superiority and columns represent negative superiority. According to results matrix, A3 is the best alternative. Respectively, A4, A2, A5 and A1 follow it. On the other hand, ELECTRE methodology allows pairwise comparison between alternatives. The intersection between fourth row and fifth column is one. This can be explained in the following way if we compare between A4 and A5, A4 is better alternative than A5.

9.7 Conclusion

The dramatic increase in energy consumption, especially because of increasing population, industrialization, and urbanization phenomena, continuously developing technology and increasing trade opportunities, has directed governments to sustainable policies. In this context, the only alternative is the one provides three basic elements of sustainable energy policies i.e. efficiency, economy, and environmental awareness. Also, we should state that, efficient use of renewable energy resources is important for strategic development of our country and to achieve that, more scientific studies should be done.

In our study, we have examined wind and solar energies from Turkey's and the World's perspective, and we have given examples for a better understanding of the explanations of the methods that applied. A fuzzy-AHP—ELECTRE methodology were used to compare the possible plant selection sites and find out the best one.

ELECTRE algorithm's output matrix allows pairwise comparisons between alternatives as mentioned before. If the results are analyzed more detail, A3 dominates A2 and A1. On the other hand, A2 is a better alternative than A1. This means, within these three regions, A3 is strictly the best alternative. But these regions are not

going to directly dominate the other regions. Independently, A4 is a better alternative than A5.

In the application part, only five cities were selected for the given problem. For future research, different locations can be added to the selection process. There is no limitation for locations. If needed, more than thousand locations can be compared efficiently with the proposed methodology. Also, solar-wind hybrid systems can be analyzed by using the suggested methodology. Hybrid systems have more than one energy resource and for that reason, they may be more efficient than single system ones. They also depend on location and this selection problem can be solved again with the proposed methodology. On the other hand, Fuzzy sets approach can be applied for ELECTRE methodology. This can increase computation complexity but results will be more accurate in terms of linguistic expression of decision makers.

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Part III
Digital Corporate Governance and Sustainability

Chapter 10
Digital Corporate Governance: Inevitable Transformation

Abdulkadir Varoglu, Soner Gokten, and Burak Ozdogan

Abstract The process of digitization, which represents one of the sharpest turns in the long-running transformation journey of enterprises throughout history, represents a transformation that affects not only internal operational environment of a business but also all stakeholders, including the shareholders, management and suppliers by utilizing communication technologies and other emerging technologies. During this transformation, the short-term focus for enterprises was replaced by the long-term, and the profit focus in its objectives was replaced by sustainable added value. Thanks to the impact on accounting function which is one of the most crucial supporting tools of corporate governance pillars, digitalization, provides a more developed responsibility and accountability framework by ensuring transparent, timely, and accurate information needed and requested by stakeholders. By courtesy of the developing technologies in this process, the amount of data included in the business decision processes has increased and therefore the possibility of richer content opportunity has emerged in terms of both financial and non-financial reporting. Big data analysis, artificial intelligence, and blockchain technologies enable the transformation of the accounting function and therefore of corporate governance practices, along with other business functions. In this chapter, the impact of digitalization on corporate governance practices is discussed from the perspective of developing technologies and institutionalization, revealing potential effects, transformations, and steps to take.

Keywords Digitalization of corporate governance · Artificial intelligence · Blockchain technologies · Big data analytics · Stakeholder expectations · Neo-institutional theory · IT governance

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10.1 Introduction

Institutions are made up of rules, procedures, and norms devised by humans to constrain the behavior of individuals in maximizing the wealth or utility of principles (North 1981, 1990). Emphasizing the importance of institutional quality, Douglas North has put the existence of institutions at the foundation of development. North and Thomas (1973) expressed that differences in institutions are the fundamental determinants of the differences in the development levels of countries. In other words, the differences in political and civil rights, degrees of democracy and the rule of law, political risk, and checks and balances play a key role in explaining the difference in the development level of countries (Baser and Gokten 2019). All these indicators and measurements, taken together, constitute institutional quality. On the other hand, these are classified as formal and informal institutions. If these are formally written down in a rule book, for instance, the legal texts are called formal institutions. The unwritten rules, such as morals, norms, and traditions, are called informal institutions (Dobler 2011).

There is a complex interaction between development at a country level, caused by institutions, and at the corporate level, caused by corporate governance institutions (Roe 2005). Achieving corporate status as an organization through sustainable development can be achieved through an institutionalization process based on the creation and development of institutional structures and procedures within the organization.

Effective corporate governance is built on four pillars: fairness, accountability, responsibility, and transparency. These principles directly reflect the kinds of institutions needed by corporations. It is fair to say that there are no distinct differences between political and corporate-level institutions. For instance, limitations on executive power are important in ensuring the pillars of corporate governance at both the national and the corporate level. The maintenance of an effective decision-making platform with a high-quality check-and-balance system imposes limitations on executive power. A pluralistic decision-making body based on a fair judicial system, individual freedom of expression, and the right to come together freely provides an efficient check-and-balance system while also protecting the rights of minorities. Fair and free elections (in other words, the right to choose and to be elected) are the basis for the existence of such a decision-making body. Just as a parliament or senate with all these criteria limits the executive power at the country level, the general assembly body limits the executive power at the corporate level. In short, the institutions developed for both corporations and countries share the same targets; both include light from the same candle.

Fairness refers to the quality of independent judicial actions. In other words, for a decision to be fair, it must be taken independently and duly. Clearly, making a fair decision also requires a robust rule of law. Fairness serves to ensure inclusive protection, which is centrally located in the relationship of corporate governance principles and maintains the existence of the other three principles since the need for fair decision-making processes is the result of transparency, responsibility, and

accountability. Transparency refers to the lack of hidden agendas or conditions. The main reason for ensuring and maximizing transparency is to limit the information asymmetry between the stakeholders of a corporation. In this way, no stakeholder will be able to identify a suitable environment in which to maximize their interests or wealth. To understanding the existence of a highly institutionalized environment in the framework of fairness and transparency, consider the following general assembly environment. A general assembly, attended by fully informed shareholders, is where decisions will be taken through voting based on information about the corporation. Clearly, decisions reached in such a general assembly will be fair because they will be made by the fully informed voting shareholders. However, it is not enough for the shareholders alone to be informed; stakeholders also need to be fully briefed. The only difference, especially today, in terms of institutionalization between stakeholders and shareholders is the right to vote and participate in the management process. This aside, stakeholders who interact directly or indirectly with the activities of the corporation have the right to access the information transparently because stakeholders can develop into shareholders in the future. Even if they do not, being affected by the activities of the corporation is a sufficient basis for their right to information.

If we accept the interaction of fairness and transparency with each other as a *sine qua non* for corporate governance, an effective information system should be established to allow this interaction to contain a high level of institutional quality. In other words, it is simply necessary to effectively convey all the information about the corporation to stakeholders. The information system used for this is known as accounting.

Accounting converts data on the activities of the organization into meaningful information and reports it. In this respect, reports are the outputs of accounting. Therefore, although it includes recording functions, accounting's main goal is to produce understandable and comprehensive reports. These reports are mainly the claims of the executives. The board of directors elected at the general assembly is authorized to manage the corporation for a limited period, during which it takes decisions within its jurisdiction and presents these to the stakeholders at the next general meeting. In addition, an audit committee is selected on behalf of stakeholders to ensure transparency and control the appropriateness of the board's activities during the execution period. This board also provides an independent audit report. The rationale for establishing these mechanisms is the realization of the principles of responsibility and accountability, which are other corporate governance principles. Accounting is, therefore, the most significant tool used in establishing each of these corporate governance principles.

In 'Summa de Arithmetica' (1494), Luca Pacioli outlined the basis of the accounting field, which, beginning with the development process for the double-entry system, became the standard method for reporting financial information. In other words, financial accounting, in which information that can be measured with money is reported, came to play a dominant role in corporate reporting. The financial accounting development process, which began as a means of inventory-based recording and then attached importance to financial status reporting and performance

reporting, is now concentrating on fair value-based value creation reporting. In addition, financial accounting has gained a common global reporting language that has become especially relevant following the globalization developments that occurred in the 2000s. The financial scandals experienced and their serious negative effects on economies increased the need for financial reports audited on behalf of stakeholders, and thus, the concept of auditing has become one of the important drivers of corporate governance. These developments were not sufficient to meet the information needs of stakeholders, however. In short, the development of financial accounting has failed to meet the requirements of corporate governance principles. The main reason for this is that stakeholders are beginning to need more non-financial information along with the financial information they receive.

The Exxon Valdez oil spill in 1989 can be regarded as the catalyst that led stakeholders to start requesting non-financial information relating to companies' operations. Eleven million gallons of crude oil leaked from the Exxon Valdez, an oil tanker owned by the Exxon Transport Company, off the coast of Alaska. This accident, which was recorded as the largest environmental disaster in US history, caused a 1300-mile stretch of coastline to be exposed to oil spillage, affecting hundreds of thousands of lives. Exxon was forced to pay around $2 billion in cleaning costs and compensation and around $1.8 billion for the restoration of the area. The Exxon Valdez accident made it clear that the environmental impact of business activities could have significant financial consequences, especially for investors.

In fact, Exxon Valdez is one of the key events that justified the 'Brundtland Report', published in 1987 by the 'World Commission on Environment and Development'. The report's primary argument was based on the definition of sustainable development: a development that meets the needs of the present without compromising the ability of future generations to meet their own needs. This kind of development undoubtedly serves to increase social value. For this reason, the need to communicate non-financial information related to the activities of the corporations to the stakeholders is inevitable for ensuring sustainable development. Sustainability reporting, which is based on reporting the environmental, social, and economic impact of business activities, is the main tool used to transmit non-financial information to stakeholders.

Reporting financial and non-financial information according to the two separate methodologies that make up the standardization process has caused another problem. It has become necessary to evaluate the financial information in financial reports and the non-financial information in sustainability reports simultaneously. Regarding this type of integration, the question that needs to be asked is 'what will the simultaneous evaluation of financial and non-financial information mean?' The answer is that the integration of financial and non-financial information will allow organizations to report how they create value. The critical point to be considered regarding this identified reporting aim is that the concept of value is not one-dimensional. Gokten and Gokten (2017) show that profit is the result of short-term value creation, which indicates the value-to-value chain stakeholders. The expected fair value of equity represents the value to investors, while the

longer-term value represents the value to society, in accordance with the International Integrated Reporting Framework. It can be stated that integrated reporting, whose conceptual framework was published in 2013, has not yet entered the standardization process. In addition, corporations with prestigious brands and international fields of activity have started to publish integrated reports.

When these revolutionary developments in accounting are taken into consideration, it is understood that the effective implementation of corporate governance requires an increasingly intense effort. However, it is not only these developments in accounting that complicate corporate governance today. The digitalization process that we have faced in recent years also makes inevitable the impact of digital technologies on corporate governance. With developments in communication technologies, the transformation of business processes and the integration of new business models have gained momentum via digitalization (Burns 2001; Cross 2004; Manita et al. 2020). Technologies such as Artificial Intelligence and Blockchain have facilitated concepts such as flexibility, efficiency, transparency, and accountability, in the development of new application areas (Magnier and Barban 2018; Möslein 2018; Van der Elst and Lafarre 2019).

In 2020, the Covid-19 epidemic, which has accelerated digitalization processes around the world, is generating a need to carry out the activities required by corporate governance principles in the future. The most important building block of digital corporate governance will be the integration of accounting and digital technologies and the effects of this integration.

In this chapter, the effects of communication technologies and emerging technologies on corporate governance are discussed primarily in terms of corporate governance pillars and corporations. This is followed by discussions concerning digital transformation in terms of corporate governance and the role of the accounting function from an institutional perspective. Bankewitz et al. (2016) define digitalization as "the availability of large amounts of data (big data), increased (algorithm-driven) analytical and processing capabilities, and crowd/sensor approaches through which information flows increase". In this chapter, digitalization will be used to refer to the use of emerging technologies in business processes and operations for the transformation of the physical into the digital.

10.2 Emerging Technologies and the Digitalization of Corporate Governance

Sir Adrian Cadbury, who served in the 1990s as chairman of a committee intended to develop corporate governance practices[1] following scandals in the UK, did not have access to today's technological facilities and tools. While the burdens of corporate governance on the post-SOX boards increased, the technological tools they could

[1]University of Cambridge, The Cadbury Report, http://cadbury.cjbs.archios.info/report.

benefit from were not comparable to those available today. We have to accept that technology plays an important role in the development of corporate governance practices as well as the roles of traditional parties, which are frequently discussed (Cross 2004).

Information Technology (IT) has managed to establish a paradigm by accelerating the emergence or transformation of new cultural influences, approaches, business patterns, and business models in several areas, along with corporate governance (Cross 2004). The incremental increase in data transfer speed and processes and the evolving ecosystem around this have eliminated the low-efficiency practices of the past, while the next generation of problems has left them at the desk of business administrations and regulatory authorities. This transformation demonstrates the requirements for further monitoring and reporting non-financial indicators for businesses, as well as harmonizing all business operations, including production, supply, and distribution channels, in line with the expectations of social stakeholders (Eng and Mak 2003; Perrini 2006; Sun et al. 2010).

Parallel with the advancements in IT, other emerging technologies such as artificial intelligence (AI) and blockchain have paved the way for new enterprises with new business models shaped by the technology. Taken a step further, technology-centric enterprises have transformed the needs and expectations of corporate governance, and a new governance era has emerged around technology to develop more sustainable relations with stakeholders (Fenwick et al. 2018).

To prevent fraudulent financial reporting, allow investors to access reliable business data, and ensure a healthy market environment, many institutions have been entrusted with corporate governance practices (Rezaee 2005). According to the ACFE report, there were more than $7 billion of losses in 2690 cases of corruption worldwide in 2018 (ACFE 2018). Weak corporate governance is a potent catalyst for corruption. However, if technologies are adopted that will strengthen accounting and auditing activities and make reporting processes more comprehensive, timely, and transparent, this situation may change (Francis et al. 2003).

IT and other emerging technologies have taken on a simple yet complex task in terms of enterprise processes in attempting to ensure that fewer intermediaries are needed for each process and operation. These intermediaries were sometimes incorporated into the job as other institutions, departments, or people, and sometimes as other processes, procedures, and bureaucracies. This process of simplification has also led to significant changes in the relations between management, shareholders, and other stakeholders, which have not, historically, been amalgamated.

Since digitalization offers us the most powerful toolset for preventing information asymmetry, the argument of Marcoux (2003) regarding the impossibility of simultaneously serving more than one stakeholder group seems refuted. When evaluated using this framework, it would not be wrong to consider emerging technologies as enablers in terms of corporate governance practices and stakeholder relations, as Elizabeth Abraham (2012) has argued. Technology, as an enabler, has allowed the design of a double-sided, open, and transparent communication process (Fenwick et al. 2018). While ensuring managers and shareholders pursue the same goals and objectives (Lin et al. 2020), it also takes measures to address risks that threaten the

sustainability of the business, including technology, and to use this transformation in favor of the business (Flyverbom et al. 2019). Through careful use of emerging technologies to achieve digitalization, it is now possible for corporations to create an unmediated governance environment (Fenwick et al. 2019).

10.2.1 Big Data Technologies

Though there are controversial aspects to it (Flyverbom et al. 2019; Zuboff 2015), considering the amount of data that people produce in their daily lives, from the number of steps they take to their heart rhythm and the time they spend on social media applications, it is seen that data, and the decisions made according to it, are a crucial part of lives. For corporations, this has reached an even more vital level. Even a small company with few branches produces a huge amount of data daily. Today, information technologies allow companies to process this data and convert it into meaningful information (Tihanyi et al. 2014). Technological tools such as cloud computing and big data technologies are contributing to the improvement of companies' decision-making capabilities, and previously weak reflexes in terms of technology-supported agility are being strengthened.

Gartner defines big data as "high-volume, high-velocity and/or high-variety information assets that demand cost-effective, innovative forms of information processing that enable enhanced insight, decision making, and process automation" (Gartner n.d.). The literature on big data analysis and related technologies in terms of corporate governance has been discussed from different perspectives (Lin et al. 2020; Withers and Fitza 2017). At the heart of the discussions lies an uncertainty regarding the steps taken by the board of directors toward big data and similar technologies. The use of high technology may lead to even more empowering effects on management (Lin et al. 2020). On the other hand, conducting big data analysis that allows data from different sources to be converted into meaningful information and sharing these processes simultaneously with stakeholders would prevent managers from working on their own accounts and create an impact that may prevent insider trading activities (Zhu 2019).

Big data as a digitalization tool allows users to obtain meaningful results in terms of all business operations, especially industrial activities, while also increasing the effectiveness of accounting and auditing operations. This increase makes reporting, the administration's most critical communication channel, more precise, timely, and inclusive through its analysis of significantly larger quantities of data. A broad literature review on digitalization and accounting studies can be found in the work of Knudsen (2020).

With the help of big data analysis, it is possible to include information and results from both financial and non-financial operations in decision-making processes and prepare integrated reports from a more holistic perspective. Along with big data applications, there has been a significant transformation in accounting processes and responsibility areas (Bhimani and Willcocks 2014). The integration of big data in

accounting and auditing processes will increase the transparency of operations and operating results, allowing internal control to develop, thereby reducing the possibility of fraud (Rezaee 2005). The development of the accounting and audit mechanism will mean superior reporting capabilities for management, which will allow stakeholders to access more timely and accurate reports while ensuring that the management fulfills its responsibilities of transparency and accountability (Al-Htaybat and von Alberti-Alhtaybat 2017). Increasing the trust of the company's shareholders and stakeholders on the audit and control mechanism of the business will also enable the enterprise to gain a holistic efficiency increase in terms of corporate governance (Halbouni et al. 2016).

Large audit companies, in particular, are actively taking advantage of big data analytics and other emerging technologies and are working in coordination with audit committees of businesses to generate more meaningful reports from a rich data pool. On the other hand, the compliance of audit committees and any technology committees working under the board of directors facilitates the use of emerging technologies in the development of the enterprise's corporate governance understanding.

In another aspect, the governance of this information, produced through technology, makes it the primary responsibility of the board of directors to use big data and related technologies in a way that can contribute to corporate governance and the sustainability of the business operations in the long term (Coyne et al. 2018; Information Governance Initiative 2018). Past practices show that companies that do not take precautions regarding data security and other information-based risks may face serious consequences such as penalties, data losses, and theft. Therefore, in order to ensure the use of big data for both ethical and business purposes, boards must pay attention to information governance (Flyverbom et al. 2019).

10.2.2 Artificial Intelligence and Blockchain Technologies

It is not yet known if there happened to be someone with an artificial intelligence (AI) background as a member on the boards of directors. This is among the predictions just 5 years before we realize how much of the predictions in the World Economic Forum's 2025 survey are realized. However, we know that close to 90% of people have established a digital presence on the internet, which was another prediction made by the survey. On the other hand, we also know that business operations, including the meetings of the boards of directors, are being entirely digitally implemented owing to the pandemic.

AI and blockchain technologies, whose effects are frequently discussed, also have an impact on corporate governance practices directly and/or indirectly since they are integrated into different business processes. In terms of accountability, the digitalization of corporations and the use of AI are topics on many agendas, with a range of questions being raised (Neyland 2016; Whittlestone et al. 2019). On one side, the increase in algorithmic decision-making creates enormous benefits by generating

solely data-based decisions and reducing the need for managers' personal judgment, but how will the accountability responsibilities be distributed on the other side (ICAEW 2019).

Computer-assisted decision processes can, as a result of AI applications and underlying machine learning, leave their role in the future to human-assisted decision-making processes. Even today, though, the complex operations of companies require their boards to consider and evaluate more data than previously in decision-making processes. Libert et al. (2017) describe the current shift as augmenting board intelligence with AI. In another study, it has been argued that board members may make better choices than company management representatives (Erel et al. 2018). The study used the acceptance level of directors from shareholders as a good dimension for the selection of directors. Using an appropriate algorithm, machine learning technology may also take into account the expectations of different stakeholder groups and create decision-making processes to improve overall corporate governance.

Another dimension of AI tech integration into governance relates directly to the board itself. Autonomous company systems, artificial intelligence, and constitutional and other legal system states are already being discussed (Bayern et al. 2016; Carpenter and Poon 2018; Fenwick and Vermeulen 2018; Möslein 2018). With AI and other digital technologies having a direct impact on the decision-making processes of corporations, regulatory authorities have also begun to strive to eliminate gray areas in the regulations. In this context, the report published by the EU commission in 2016 also evaluates the digital transformation of corporate law (Armour et al. 2016). Various corporations around the world have already begun to implement AI technologies into board decision-making processes and have also integrated it as a board member.[2] The companies developing AI technologies are also taking various principles into account to ensure the fair and ethical use of these technologies. Many technology companies have announced their AI principles and stated their commitments to those principles.[3]

To summarize, corporations' AI strategies cannot be devised by departments before they are added to the agenda of the boards of directors. AI technology-supported tools, which are expected to rapidly increase their share of the decision-making processes, will cause significant transformations both operationally and in terms of the way business is done, the organizational structure, and the organizational culture. The boards need to be prepared and well-informed concerning the level of the use of AI technologies in business and processes, along with its potential risks and benefits. The AI policy and implementation plans should be established, and a continuous environment for monitoring the current and potential risks should

[2]See: https://www.businessinsider.com/vital-named-to-board-2014-5, https://www.dailymail.co.uk/sciencetech/article-2632920/Would-orders-ROBOT-Artificial-intelligence-world-s-company-director-Japan.html.

[3]See: https://www.migarage.ai/ethics-framework/, https://ec.europa.eu/digital-single-market/en/news/ethics-guidelines-trustworthy-ai, https://www.microsoft.com/en-gb/ai/responsible-ai, https://ai.google/principles/.

be created. Also, it is important to inform stakeholders about the policies and implications transparently and regularly. According to McKinsey's research, corporations that successfully adopt AI technologies in their business processes employ top executives who are actively supportive of the process (Bughin et al. 2017).

Emerging technologies have an increasing effect on processes in different fields such as voting systems, supply chains, financial markets, accounting, and blockchain technologies, and are seen as a promising means of democratizing and transforming ineffective business models (Dai and Vasarhelyi 2017). Blockchain, a technological infrastructure defined as a distributed ledger that can work without the need for any intermediaries, enables monitoring of all processes by the related parties and, assuming previous records are unchanged, will be able to serve as an important tool for the development of good corporate governance practices.

Discussing blockchain technology's effects on accounting and auditing practices, along with its many business functions, will have a significant impact on corporate governance (Gökten and Özdoğan 2020). Audit committees, which are among the most important representatives of accountable corporate management, will be able to implement stronger control and monitoring mechanisms on the audit structure of the business through a blockchain-based accounting and audit process. The implementation of new models, such as blockchain-based continuous auditing and a triple accounting system, will enable enhanced accountability and potentially reduce the likelihood of fraud. Using blockchain technology as the main infrastructure in accounting, auditing, and other business functions emphasizes the role of technology as an enabler, as discussed above. The integration of data creation, monitoring, and reporting processes will open up new opportunities for the integrated reporting practices of corporations (Smith 2018). Enhanced integrated reporting, which provides accurate and timely information, satisfying the needs of stakeholders, along with the simultaneous presentation of financial and non-financial information, generates a wider perspective for decision-making and assessing the responsibilities of the management of the corporation (Son-Turan 2019; Stein Smith 2018).

On the other hand, moving the ownership structure of the company and voting processes to a blockchain infrastructure will lead to improved transparency (Heminway and Sulkowski 2019; Lafarre and Van der Elst 2018; Wright and De Filippi 2015; Yermack 2017). Corporate voting is one of the critical variables for corporate governance and is an important indicator of the ability of shareholders to represent themselves (Harris and Raviv 1988; Yermack 2010). As mentioned earlier, when a complex ownership structure is added to a lack of sufficient and timely information and other problems caused by corporate structures, there may arise situations where shareholders cannot fully exercise their voting rights effectively (Kahan and Rock 2008). While the benefits of emerging technologies used for corporate governance practices are discussed in the literature, Cheffi and Abdennadher (2019) have found that executives have concerns about losing the control they have following the implementation of digital voting processes, which demonstrates the importance of corporate governance theories in the literature.

Considering the increasingly complex ownership structures of modern corporations, the pillar of transparency, in particular, is among the most significant aspects

of using blockchain in the name of corporate governance (Malinova and Park 2016; Yermack 2017). Bringing blockchain-based processes into practice would increase the transparency of ownership records, enhance mobility for investors, and improve the monitoring of insider trading actions (Peterson 2018; Yermack 2017).

With the blockchain-based digitalization process, as the level of stakeholder participation in information and processes for business decisions increases, accountability will improve for executives, and a much fairer corporate governance process may emerge (Wright and De Filippi 2015). One of the tools associated with blockchain technology that can be used to create the interaction mentioned above is smart contracts. Smart contracts will enable the automation of transactions within the framework of predetermined rules, thus saving time and intermediary costs and thereby managing board and shareholder relations more effectively (Van der Elst and Lafarre 2019). In addition to the analysis and discussion of potential impacts, researchers have begun to develop model suggestions on how to achieve the governance of blockchain itself if the model is fully implemented (Ferreira et al. 2020).

10.3 An Institutional Approach to Digitalization of Corporate Governance

Corporate governance principles and practices have been on the table since the early foundation of modern corporations with multiple roles and responsibilities, including sustainability (Aras and Crowther 2008; Kolk 2008). With the dynamic shift in the ownership complexity of corporations, which runs parallel to the globalization of both market potential and competition, shareholders and boards started to seek new approaches to traditional relationships that would help to sustain transparency, accountability, responsibility, and fairness. The OECD's Principles of Corporate Governance have implemented a guiding qualification for regulatory authorities and professional organizations around the world. On the other hand, many institutions, NGOs, and other stakeholders have interpreted and tried to implement corporate governance principles from their own perspectives. Today, at the beginning of a new era, both the global society and its businesses are challenged by pandemic diseases and technological advances simultaneously. This new paradigm shift in business and corporations requires new approaches to the practice of corporate governance principles (Armour et al. 2018; Belloc and Pagano 2005), so much so that the development of technology and its mode of integration into business models will have an effect that can lead to the spontaneous disappearance of some of the matters we consider as fundamental to corporate governance.

Most of the theories concerning organizational survival have centered their arguments on a more technically defined business context. The actors' actions are based on self-interest and profit maximization in such a rationally defined environment. However, it was overlooked that the societal factors might be as influential as

the technical factors in terms of success in the contemporary business world (Selznick 1953; Watson 1954; Zald 1970). Societal factors such as history, culture, norms, attitudes, and beliefs may institutionally define the unwritten rules of business. Therefore, actors adopt new managerial practices, and business trends depend on their legitimacy in an institutionally designed business context. Neo-institutional theory claims that organizational forms will become more isomorphic with each other as a result of legitimacy concerns relating to firms (DiMaggio and Powell 1983; Meyer and Rowan 1977; Meyer and Scott 1983; Zucker 1983, 1987). In a business environment dominated by strong institutional forces, the viability of start-ups, innovative ideas, new managerial practices, and new concepts depends on the extent of their consistency with the institutional norms. Thus, the initial step for the diffusion and adoption of concepts such as "digital corporate governance" should be to seek possible tactics to legitimize it. It can be inferred from the debates between institutional theorists that there may be three types of tactics that can be used to overcome the problem of "institutional legitimacy".

DiMaggio and Powell (1983) highlight the impact of large and old organizations in terms of determining the standards for what is or is not legitimate. Mimetic isomorphism occurs when others imitate the business actions of large and old organizations. In this respect, these corporations may play a key role in terms of the diffusion and adoption processes of digital corporate governance in the field. For example, the diffusion of TQM practices was initially started by established corporations such as Toyota, GM, and GE. Public institutions may also enable the diffusion of new practices via their regulatory power. DiMaggio and Powell (1983) define this state-driven institutionalization process as coercive isomorphism. Finally, occupational norms may have a decisive influence in some sectors. All business processes, ethical standards, and even proper organizational design are determined by strong NGOs such as accountants' associations, pharmacists, and physicians' unions. Therefore, influential NGOs can act as brokers to legitimize—through rhetoric—the concept of digital corporate governance.

Along with digitalization, the three pillars defined by Judge et al. (2008) that affect corporate governance perception on a national basis (law and order, global competitiveness, and corruption) can, from a neo-institutional perspective, also be evaluated for businesses within the micro-framework. Institutional structures shape the use of technology and digital tools, as well as the expected benefits (Mignerat and Rivard 2009). Therefore, it is necessary to see digitalization as a means of institutionalization and consider these two dynamics as being parallel in order to establish an understanding of the shifting dynamics (Orlikowski and Barley 2001; Thorseng and Grisot 2017).

10.4 Conclusion and Discussion

The New Paradigm Report, prepared by the World Economic Forum in 2016, discusses the corporate governance framework and highlights the goal of creating long-term sustainable value (Lipton et al. 2016). In line with the New Paradigm Report, delivered in August 2019 with the signature of 181 CEOs, including Bank of America, Apple, Amazon, JPMorgan Chase, and General Motors, the Business Roundtable Association has redefined the purpose of the corporation and emphasized the responsibility of all social stakeholders, rather than shareholder value. Corporate scandals and fraudulent financial reporting cases in the early 2000s caused serious shocks not only to the public trust in corporations but also to institutions and regulatory bodies (Fich and Shivdasani 2007; Seal 2006). Business science has also focused on the disruption in the practice, entering a period where new questions are asked, and new theories are discussed (Dacin et al. 2002; Judge et al. 2008). While faced with rapid paradigm changes in every aspect of business, it is the time for corporations to consider more closely their stakeholders and their sustainability, rather than the financial results (Klettner et al. 2014; Levy et al. 2010; Michelon and Parbonetti 2012). Accounting mechanisms within a company, such as audit committees at the board level and accounting information systems at the functional level, are two important beneficiaries of digital tools. The accounting system plays a critical role in the transformation of businesses toward enhanced transparency and accountability intended to keep businesses and their stakeholders in line with long-term goals. Thus, it is crucial to share the information created in accounting information systems via financial and non-financial reporting in order to strengthen institutionalization (Seal 2006).

As discussed, the digitalization of business functions the use of emerging technology at the board level would increase the efficiency of businesses through more data-reliant decision-making, along with transparency and the other pillars of corporate governance. Thus, from the institutional perspective, digitalization may act as a catalyst for enhancing the three pillars of institutionalization, as argued in the work of Judge et al. (2008).

As Fenwick and Vermeulen (2018) state, “corporate governance is about people, transparency, and accountability”. As a contribution to this statement, the interaction between people and technology for better transparency and accountability can also be considered as a basis for the new corporate governance paradigm. One important aspect of this approach is understanding and monitoring risks. Risk analysis needs to be done meticulously in order for digitalization and emerging technology to improve corporate governance and manage businesses in line with long-term sustainable goals and stakeholder expectations. Unexpected effects may be encountered if the board of directors ignores the governance process required by this transformation by focusing on benefits alone (Mikalef et al. 2018; Morabito 2015). It is significant that companies, especially top management, do not adequately take ownership of the efforts to integrate technology into corporate governance practices (Nolan and McFarlan 2005).

In this context, it is recommended that IT governance committees be established at the board level. Premuroso and Bhattacharya (2007) argue that there is a meaningful and positive relationship within corporate governance, with businesses voluntarily creating technology committees. However, even 10 years after these studies, a small number of companies truly believed in the functioning of these committees and placed them within the organizational structure (Lankton 2016).

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Chapter 11
Strategic Digital Marketing and Sustainability

Alisan Baltaci

Abstract Nowadays, people spend their lives in two different worlds, namely the real world and the cyber world. This reality affects both commerce and consumption-related issues. In the cyber world, consumers are exposed to commercial messages more than in the real world and sometimes they are unable to avoid this. The main reason behind this reality is the introduction of Artificial Intelligence (AI). By applying AI technologies, businesses become able to customize their commercial messages for every Internet user. Digitalization also allows businesses to reduce their costs by reaching the target audience more effectively. Moreover, they can present their products in a far and wider geographical range even if they don't have a physical presence. These developments have helped businesses to widen their target audiences. Besides, these opportunities boost the total consumption level of the world. Since this affects the depletion of the world's resources, it also increases the amount of environmental waste produced. This situation causes serious concerns for consumers and they begin pushing businesses to produce more sustainable products. This study aims to explain the concepts, methods, and opportunities for using digital marketing for businesses.

Keywords Sustainability · Digital marketing · Digitalization · Artificial intelligence · Strategy

11.1 Introduction

The world has been facing rapid growth in commerce with the rising population, and technological developments since the second half of the twenty-first century. Dramatically, these issues brought environmental concerns because of the rapid natural resource depletion and environmental pollution. While environmental concerns were

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rising, the first definition of sustainability was made at the UN Conference on Human Environment in Stockholm (UN 1972). In 1987 the World Environment and Development Commission took sustainability as a common concern of the communities and governments and widened the concept. 1992 was the year for the United Nations to establish the Parties to the United Nations Framework Convention on Climate Change (UN 1992). The Kyoto Protocol in 1997 and the Paris Agreement in 2015 followed the United Nations. The pressure of economic development encounters sustainability concerns as an action-reaction dilemma.

The development of communication technologies has removed many physical barriers between people and organizations. Digital marketing is an output of this era as a new emerging marketing method for businesses, which transforms how they reach and communicate with their audiences (Chaffey and Ellis-Chadwick 2019). Digital marketing is defined as using communication technologies to improve the effectiveness of marketing activities by improving customer knowledge and the level of satisfying their needs (Chaffey and Smith 2013). As a new commercial method, digital marketing is surely affecting the consumption and production processes.

This research aims to explore the threats of unsustainability and opportunities of digital marketing for sustainable development from a strategic perspective. Towards achieving this, both sustainability and digital marketing literature has been reviewed widely.

11.2 Digital Marketing

The concept of conventional marketing refers to the pre-internet era when classical marketing methods such as newspaper, magazine, television & radio advertisements, brochures, and telephone were used (Todor 2016; Xu et al. 2016). From the perspective of consumers, the concept of digital marketing includes the marketing of products or services through electronic channels such as mobile phones, computers, and tablets (Montgomery et al. 2012). On the other hand, as viewed by businesses, digital marketing is presenting products and services in virtual media, which is efficient, easy to experience, inclusive, and useful in terms of making the right choice (Royle and Laing 2014). According to another definition from the businesses' point of view, digital marketing is the process used to increase brand awareness, understand consumer preferences, establish a good relationship with the customers and increase sales (Kannan 2017). Businesses have started to show more interest in digital marketing methods especially as the usage area of Internet technologies expands. The reason is that; it is now possible to bring customers together with the products or services of the business regardless of location by using digital marketing methods. Digital marketing methods also provide businesses with the opportunity to deliver marketing content designed in accordance with the characteristics of their target audience such as age, gender, education, the field of expertise, personality, values, tastes, fears, goals directly and in the most remarkable way (Malar 2016).

Oklander et al. (2018), suggest that digital marketing methods are more cost-effective when compared to conventional marketing methods. As the communication activities carried out in online channels can be delivered directly to the target audience and often comes cheaper than using a promotion agency. Additionally, processes carried out with digital marketing tools are much faster than the ones carried out with traditional marketing. As soon as the publication of a digital advertisement or the presentation of the product to consumers on an online sales site, the masses can be reached, and the number of people reached and their reactions (number of clicks, the number of orders, number of views, etc.) can be measured instantly. Whereas, in traditional marketing, the process can be quite prolonged depending on the broadcast flow, page layout, or publication policies of the mass media where the process is carried out; and often it remains a mystery how many people are reached (Rosario and Cruz 2019).

Digital marketing is one step ahead of the traditional marketing concept with the instant communication opportunities it offers. Businesses can maintain a more effective process with their customers by using online communication tools (such as e-mail, SMS, live support system). In addition, consumers can express their opinions online on the products and services they have purchased, and this can affect the decisions of other customers (Rosario and Cruz 2019).

Digital marketing practices are not only separated from conventional marketing methodically. The tools used differ from those of conventional marketing as well. According to the reviewed literature (Chaffey et al. 2009; Rosario and Cruz 2019; Saura et al. 2019a; Taiminen and Karjaluoto 2015), these tools are:

- Search Engine Optimization—SEO
- Search Engine Marketing—SEM
- Social Media Marketing—SMM
- Affiliate Marketing
- E-mail Marketing
- Online Public Relations Management
- Content Marketing
- Electronic Word of Mouth Marketing/E-WoM

Digital marketing is not only a trading tool, but also an element that can create changes at the commercial and microeconomic level, and brings some changes in marketing practices and theory (Chaffey and Patron 2012). To be defined in the shortest way, digital marketing can be articulated as "achieving marketing goals through digital technologies" (Chaffey et al. 2009).

Digital marketing is also defined as measurable communication methods applied for establishing a strong relationship with the existing customers and e-marketing practices applied for catching the attention of customers or increasing the number of customers (Mazzarol 2015; Royle and Laing 2014). The importance of digital marketing actually stems from the fact that the channels which today's customers used for searching and accessing information, making purchasing decisions, and applying for these causes have changed (Leeflang et al. 2014). Along with the transition to the technological age, businesses resort to digital marketing, which is

a very efficient tool to reach potential customers and compete in the market (Kannan 2017). On the other hand, although businesses have been in contact with their customers from their inception, it is a fact that customers also increase electronic communication pressure in order to react to these communication processes as the communication technologies develop (Mangold and Faulds 2009; Tiago and Verissimo 2014). The elevated customer pressure precludes businesses from resisting the transition to digital applications. Thus, the businesses need to complete their digital transformation in accordance with their conditions. Conceptually, digital transformation is the sharp and profound changes that businesses accomplish by redesigning technology, employees, and processes in the business model while presenting their value proposition to their customers (Boulton 2019). For digital marketing transformation, while taking the possible future changes and needs into account, the businesses need to;

- Describe and evaluate the current situation regarding digital marketing,
- Compare themselves with competitors by assessing the current situation,
- Designate the best practices and customize these practices in accordance with their needs,
- Determine the strategies that can increase their capacity by determining the targets, the resources, and the road maps needed to reach these targets (Chaffey and Bosomworth 2020).

E-commerce businesses, especially, can gain a competitive advantage in the market with their new digital strategies (Kotler et al. 2017). Although, it would be unfair to say that digital marketing practices are only beneficial for online shopping. Customers sometimes research the products they are curious about, through digital marketing channels. However, they make their purchases in physical stores in light of the information they obtain from virtual media (Verhoef et al. 2007). It should also be noted that, by means of digital marketing practices, the effectiveness of e-promotion proposals that can be tailored for each individual is higher than traditional practices (Zhang and Krishnamurthi 2004; Zhang and Wedel 2009). Thus, it would be appropriate to state that digital marketing applications are flexible and efficient strategic tools.

The "Technology Acceptance Model" can be a useful tool for consumers' intention, motivation, and acceptance levels for digital marketing practices (Rauniar et al. 2014). The perceived usefulness and ease of use in the use of digital technologies have a direct and positive effect on users' attitudes towards using these technologies (Scherer et al. 2019). However, due to the disappearance of the physical control mechanism, the risk level perceived by customers might increase, and accordingly, they may move away from digital trading channels (Rahman and Sloan 2017; Zainab et al. 2017). Consumer behavior models in online channels can be discussed under five titles:

- Information/experience seeking behavior models,
- Reaction shopping hierarchy models,
- Multi-channel shopping models,

– Trust-based models,
– Community involvement models (Chaffey et al. 2009)

In order for businesses to understand and interpret these five behavior models correctly, it is necessary for the businesses to take action by acquiring and classifying digital data, and transforming this data into information.

Digital marketing practices also become critical in times of natural disasters. For example; as a result of measures such as isolation and quarantine that emerged during the COVID-19 pandemic, while customers have to move away from physical shopping points, they can continue to meet their needs from virtual media with the opportunities offered by digital marketing. Thus, retailers, wholesalers, and manufacturers are protected commercially in terms of sustainable development goals.

11.3 Strategic Digital Marketing

Marketing strategy is the decisions that businesses take and implement in order to offer a more sustainable and differentiated value proposition for their stakeholders when compared to their competitors. On the other hand, strategic digital marketing is about businesses using their digital resources carefully in order to offer their customers a differentiated and sustainable value proposition (Sridhar and Fang 2019). In other words, strategic digital marketing is a corporate statement that defines marketing objectives, solutions, and methods through marketing components such as market segmentation, target internet market, and positioning in order to achieve a specific marketing goal (Meshko and Nikolaev 2017). In the literature, there are also studies on the sales increases obtained as a result of using digital marketing applications as a channel to reach consumers (Acker et al. 2011; Ryan 2016). Therefore, it can be said that digital marketing applications are strategic tools utilized to increase turnover.

Strategic digital marketing has not only enriched the tools that can be used by businesses but also changed the scope of marketing by making customers interact with businesses easily (Sridhar and Fang 2019). Digital marketing requires comprehending not only the technology but also the way people use this technology (Ryan 2016). Technological innovations provide the opportunity to obtain customer insights at lower costs and to observe real-time customer experience (Macdonald et al. 2012). The speed, flexibility, efficiency achieved with the dynamic nature of the digital environment, and the ease of access to data have enabled marketers to have more opportunities to acquire and retain customers or expand in the market (Varadarajan 2020; Wedel and Kannan 2016). The strategic importance of the large amount of data generated by customers in digital channels has been increasing exponentially and the correct use of these data sources in decision-making processes positively affects the competitive power of the business (Sridhar and Fang 2019; Varadarajan 2020).

Table 11.1 General frame of the SWOT analysis

	Helpful for achieving the goals	Harmful for achieving the goals
Internal environment	*Strengths* (E.g.: Employees, capital structure, corporate efficiency, etc.)	*Weaknesses* (E.g.: Not having sufficient resources, low qualified employees, not adopting a quality philosophy)
External environment	*Opportunities* (E.g.: The widespread use of the Internet, increasing population, developments in the logistics industry, etc.)	*Threats* (E.g.: New competitors who want to enter the market, fluctuations in global markets, pandemics, etc.)

Source: Baltacı (2020)

Developments in strategic digital marketing and emerging new business models are undeniably affiliated with developments in digital technology, and businesses should focus on digital strategies and include these developments in their strategic plans (Armitage 2015; Longo 2016; Sridhar and Fang 2019).

Digital strategies consist of four parts:

- Scope: Defining the boundaries where digital strategies are implemented,
- Scale: Determining the manufacturing and supply/demand framework of the strategy,
- Speed: The timing of strategic decisions framing the value creation process,
- Resource Allocation: The definition of the resources that can be used for the business value creation process and business model (Bharadwaj et al. 2013).

The first stage of developing a successful strategy is to establish the scope of the business environment and stakeholders. The most commonly used method to determine this is SWOT analysis (Chaffey 2009). SWOT analysis discusses the environment of the enterprise in two sections as an internal and external environment. Table 11.1 shows a sample SWOT chart that can be applied for strategic digital marketing studies.

The business can present a digital value proposition, which is to be put on the market after defining its external environment and the environment it is in with SWOT analysis (Baltacı 2020). Digital marketing managers are responsible for determining the goals, technological resources, methods and processes to be applied at this stage.

In the goal-setting phase, the goals to be reached within the scope of digital marketing are set forth by taking the situation of the business into account. Among the methods used in practice for goal setting processes, SMART is the leading method. SMART is the abbreviation for Specific, Measurable, Attainable, Relevant, and Time-Bound concepts (Doran 1981). The RACE method, on the other hand, refers to the steps to be applied when implementing the digital marketing strategy (Chaffey and Bosomworth 2020) (Table 11.2).

In order to implement the strategy smoothly and to obtain opportunities; goals and tactics should be cross-checked with the needs and resources of the business after the determination.

Table 11.2 SOSTAC model in digital marketing

Abbreviation	Stage	Checklist
S	Situation analysis	SWOT • Strengths • Weaknesses • Opportunities • Threats
O	Objectives	SMART • Specific • Measurable • Attainable • Relevant • Time-Bound goals are to be set.
S	Strategy	RACE • React • Act • Convert • Engage
T	Tactics	Tactics: • E-Mail Marketing • Online Advertisement • Affiliate Marketing • SEO • PPC • Social Media • Application development • ORM • WebPR
A	Actions	Actions: • Responsibilities and structures • Systems and processes • Control lists and guides • Internal marketing • Reaching perfection • Employees and other stakeholder organizations
C	Control	Control practices: • Controllers to be made and their frequency • Key performance indicators • Digital data analytics • Customer satisfaction surveys • Reporting at a specified frequency • Reporting processes and operations

Source: Baltacı (2020); Chaffey (2009); Chaffey and Bosomworth (2020); Doran (1981); Smith (2020)

While creating an efficient digital marketing strategy, the following should be considered:

Table 11.3 Five costs decreasing as a result of digital technology

Cost type	Example
Cost of searching for information	Customers' access to detailed information on many alternatives in the market quickly and almost free of charge
Cost of Manufacturing	Software manufacturers' delivering the software to a large number of people over the internet at no cost after manufacturing once
Cost of shipping	Transferring money through means of banking applications, sending designs in digital media
Cost of tracking	Tracking the location of the product transported by cargo companies in digital environment instantly
Cost of verification	Opportunities to query product evaluations in digital media with QR Code

Source: Goldfarb and Tucker (2019)

- It should specify a direction for marketing strategies to be carried out over the internet in the future and should be able to increase the functionality of the services to be provided on the Internet by providing a long-term road map.
- Analysis of the external environment of the business (especially the customer structure and competitors of the online market), internal resources, and competencies for implementing the strategy should be performed.
- The goals supporting the marketing objectives related to digital channels should be clearly stated.
- Strategic planning should be designed to include important marketing strategies in order to achieve goals such as target market, positioning, and characteristics of marketing mix elements.
- In order to achieve the goals for digital channels, the options to be applied while achieving a differentiated sustainable competitive advantage should be determined.
- It is necessary to define the strategies that are not suitable and will not be applied for the implementation.
- For the strategy to be successful, the way resources are allocated must be determined (Chaffey 2010).

Undoubtedly, costs also take an important place in determining the corporate strategies of businesses. When compared to traditional marketing methods, digital marketing channels are cost-effective platforms and can convey the messages of the business to a very large audience (Shirisha 2018). It is possible to state that the decrease in marketing communication costs by means of digital marketing opportunities changes the communication competition between large enterprises and small enterprises in favor of small enterprises. The increase in digital opportunities has led to a decrease in the weight of five cost types in the market. These costs are given in the Table 11.3:

With the advent of digital marketing applications, businesses have the opportunity to transfer many of their operations directly to third-party businesses. This also provides an important advantage in terms of costs. For example, in digital media, a

Table 11.4 Return of investment and click through rate

ROI (Return of investment)	CTR (Click through rate)
It is a measurement method used to determine the efficiency of one or more investments. It can be calculated by comparing the amount spent on digital marketing efforts with the increase in sales.	It is a method that measures the number of clicks advertisers receive per page view. It can also be discussed under cost per click or pay per click.
Formula: (Amount earned from investment – Cost of investment) Cost of investment	Formula: Number of clicks Number of views

Source: Saura et al. (2017)

flow from the seller to the buyer can be mentioned with third-party distribution service providers rather than intermediaries such as wholesalers or retailers. Since these service providers are focused and specialized in the distribution field, they can provide services at affordable costs together with the effect of the economy of scale (Bakos 2001).

In order to understand the effectiveness and efficiency of digital marketing strategies, it is necessary to have the ability to measure them first (Pauwels et al. 2016). Interactive media has brought along different measurement tools that can be used at both strategic and tactical levels for online marketing campaigns. For this reason, appropriate, accurate, and timely digital marketing data is a critical guide to determine issues such as whether the business has chosen the right strategy or applied the chosen strategy correctly. Measurement tools are used for expressing which value changes are meaningful for the business. Digital marketing activities should be done taking the return on investment (ROI) into account. Measuring tools to be used in the early stages of the strategy should be determined and the variables to be taken into account in the evaluation of success in the later stages should be revealed (Table 11.4).

By combining search engine marketing data, SEO, and WA data, it may be possible to calculate parameters such as return on investment, profitability, and efficiency for digital marketing studies (Mathews et al. 2016; Saura et al. 2017).

11.4 Digital Marketing Mix Strategies

11.4.1 Promotion Strategies for Digital Marketing

Businesses can use several operational level promotion tactics in order to be successful in their activities in strategic digital marketing. For example, even the selection of the banner is an action performed at the operational level, and its timing and implementation are carried out with strategic-level planning (Amiri and Menon 2003). Promotion tactics that can be used by businesses are as below:

- ***E-mail Marketing***: It can be defined as sending electronic messages for commercial purposes to the e-mail addresses of individuals or institutions within a target audience determined by the business (Hudák et al. 2017). The content of the e-mails sent by the business can be informative, reminding, announcing a specific campaign, creating an instant purchase impulse or communication (Chaffey 2009). Although e-mail marketing is an affordable digital marketing tool (Chaffey 2009; Samantaray and Pradhan 2020), today, many countries make this kind of submissions subject to permission by enacting laws on the protection of personal data, and financial penalties can be imposed for violations in this regard. Therefore, the laws need to be regarded while implementing this promotion tactic.
- ***Online Advertisement***: The probability of unplanned purchasing behavior is higher than the physical shopping environment due to various stimuli (discount, buy now campaign, etc.) faced by consumers who encounter product promotion in online channels or browse sales sites to spend time (Hanson and Yuan 2018; Hildebrand and Schlager 2019; Mills and Zamudio 2018; Sciandra et al. 2019). For these reasons, online advertising is an important digital marketing tool. According to Goldfarb (2014), there are three types of online advertising models. These are:

  Search engine advertisements: It is the display of the advertisement published by the advertiser to the appropriate user with various algorithms according to the search criteria of the user in search engines.

  Classified advertisement: Fixed advertisements that are posted by advertisers on a specific website and do not have a specific search/keyword algorithm.

  Display advertising: It is the general name of structures like Google AdSense that can be found in many different ways such as images, text, and videos on websites. The application and payment methods are flexible, and it is an efficient online advertising route used by many businesses.

- ***Affiliate Marketing***: It is a method for selling someone else's products or services by advertising them online and earning money from this action (Hoffman and Novak 2000). In this method, the sales partner makes a contract with the company that owns the product, based on the commission from the purchases to be made by the customers, and carries out promotional activities in digital media to mediate the sales of the products subject to the contract (Gregori et al. 2014). It is possible to say that it is a performance-based method.
- ***SEO***: Internet search engines have become one of the main channels that consumers refer to access information and act as a channel between the website of the company and the customer (Nabout and Skiera 2012). SEO (Search Engine Optimization) is a method that is used for ranking a website at the top in a search engine index (Saura et al. 2017). At the most basic level, SEO is the activity of associating the content of a web page, including its codes, with certain keywords and ensuring that it is indexed correctly in search engines (Liu and Nain 2006; Saura et al. 2017).

- ***Web Analytics***: Web analytics (WA) are the data referred for understanding how the user group utilizes the website and for optimizing the website (Bourne et al. 2002). In other words, it can also be referred to as digital resources to understand and make sense of the behavior of customers browsing the website of the company.
- ***Pay per Click (PPC)***: Although there are many different pricing models in digital media, the most frequently used is the cost per click method. In this method, the payment is made per click on guiding stimuli on the page. Apart from that, there are mixed price models that use more than one method together, and their purpose is to minimize the cost of the advertiser and maximize the profit of the web portal in general terms (Hengbo and Yanfeng 2012).
- ***Social Media***: Social media is the most popular online communication tool today. Social media networks have become platforms or ecosystems where users share their thoughts and opinions on different topics (Boyd and Ellison 2008; Stieglitz et al. 2018). Due to its low cost and high power of influence, communicating with customers on social media is an accessible and usable tool not only for large businesses but also for small businesses (Leonardi et al. 2013). Social media management should be seen as an integral part of businesses' marketing strategy and should not be underestimated (Mangold and Faulds 2009). Social media changes the way businesses work in the following ways:

  From sales to interaction with the consumers,
  From large marketing campaigns to small but swift actions,
  From controlling the messages to transparency,
  From being unapproachable to being accessible from everywhere (von Scheel et al. 2015: 379).

  As a consequence, businesses use social media sites as strategic tools, even establish departments, and employ personnel to manage their platforms (Sinclaire and Vogus 2011).
- ***Application Development***: E-commerce applications provide customers with the opportunity to have products or services through digital media, regardless of time and place (Daniel 2005). This is why global players such as Alibaba, eBay, and Amazon develop user-friendly mobile phone and computer applications for their customers.
- ***Online Reputation Management (ORM)***: Online Customer Relations Management: The customer relations management system creates synergy when integrated into strategic plans by creating a link between customers and the business (Rust and Chung 2006). In digital marketing activities, companies' referring to E-CRM applications is used as an effective tool to gain new customers, retain existing customers, and increase the number of customers (Reinartz and Venkatesan 2008). For the E-CRM strategy to be implemented smoothly, it is necessary for all structures within a business to be in relation and cooperation with each other, and if necessary the stakeholders need to be supported with in-service training in a customer-oriented manner to establish this structure (Brito 2011; Mendoza et al. 2007).

Table 11.5 Tactics in digital marketing

Tactics	Output
E-mail marketing	Customer retention
Online advertisement	Branding and gaining new customers
Affiliate marketing	Sales and branding
SEO	Customer retention and gaining new customers
Web analytics	Customer retention, customer engagement
PPC	Customer retention and gaining new customers
Social media	Branding and customer engagement
Application development	Customer retention, customer engagement, sales
Online reputation management	Customer retention, branding and customer engagement
Online customer relations management	Customer retention, branding
WebPR	Branding and gaining new customers

Source: Saura et al. (2017); Wątróbski et al. (2016)

– ***WebPR***: "Public Relations" is the structure responsible for corporate communication and reputation in a business and is responsible for the management of processes such as corporate communication, stakeholder relations, risk communication, corporate social responsibility, and public relations (L'Etang 2009). WebPR refers to the method by which these processes are managed through digital channels. The importance of online public relations is also increasing, as digital channels provide a space-independent and rapid interaction by their nature. Businesses have to ensure that the digital marketing components they offer are consistent and reliable to keep customer satisfaction high. Online trust refers to the level of trust that its stakeholders have in the commercial activities of a business in an electronic environment and is one of the key components of the business strategy to gain a competitive advantage (Shankar et al. 2002). Online trust refers to the level of trust that its stakeholders have in the commercial activities of a business in an electronic environment and is one of the key components of the business strategy to gain a competitive advantage (Shankar et al. 2002). Therefore, it is possible to state that applying online public relations applications in an integrated and consistent manner with other tactics creates a synergy.

The concept of digital marketing is an umbrella term that covers all digital techniques applied to promote the brand, develop relations and gain new customers, retain existing customers and increase sales (Sundaram and Sharma 2020). Accordingly, when determining their digital marketing strategies, businesses want to acquire these results as a final output. The outputs of tactics that can be used within the framework of business strategies are given below (Table 11.5):

Clearly, new opportunities such as product reviews, blog pages, and instant messaging made by customers published on websites have replaced traditional word of mouth marketing (Vrana and Zafiropoulos 2010). This could be the reason behind businesses today preferring to work with social media influencers instead of

cooperating with famous people. Likewise, considering that users expressing their opinions on similar issues by using hashtags also advertise and involve in the subject, it would be beneficial to analyze them as well (Reyes-Menendez et al. 2019).

By analyzing these digital contents, businesses can create an accurate and sustainable digital marketing strategy, design their corporate image positively, and attract customers' attention, thus they can gain a competitive advantage in the market with sustainable product and/or service offerings (Li et al. 2019).

In digital marketing applications, a more efficient marketing process is constructed by using more than one digital or traditional channel tool together in cross-channel harmonization applications. For instance; while a website has some information about the product, an online customer representative can be found on the same page; a customer who has registered their e-mail information in the system can open the way for reaching them through e-mail marketing at certain periods; a customer who shares his mobile phone number in the system can be reached directly through the traditional method or SMS marketing methods can also be used (Chaffey 2010). Additionally, in cross-channel applications, different marketing departments such as brand management, direct sales unit, product promotion unit can work together to increase the efficiency of the system.

11.4.2 Price Strategies for Digital Marketing

Digital marketing applications are distinguished from traditional marketing methods with their low cost, easy access to large masses, speed, and high interaction with customers from many different channels. Therefore, in such a dynamic structure, pricing decisions and methods also differ from the traditional method. The reasons are as below:

- Cost of customers' searching for information and product is low,
- Cost of businesses' online price update is low,
- Changes in shopping environments are swift and instant,
- Retailers can react to customers' demands faster,
- Price is more flexible in online channels,
- Businesses in online trade can quickly be informed and react to the prices and campaigns of their competitors,
- Customers make faster and more price comparisons compared to the physical shopping environment; for this reason, online customers are more sensitive to price,
- Opportunities for shopping by auction are richer in online media (Degeratu et al. 2000; Granados et al. 2012; Kannan 2017).

Additionally, increase in price sensitivity as consumers' ability to access information and make comparisons between products increase, and similarly, competitors' being instantly aware of each other's prices turn into an element of pressure on

price in online channels (Degeratu et al. 2000; Granados et al. 2012; Kannan and Kopalle 2001).

For all these reasons, while pricing in digital marketing activities, customer data should be analyzed correctly, prices of competitors should be kept under control, the cost advantages offered by the digital marketing system should be reflected in the price (Pistol and Bucea-Manea 2017). The superior aspects of the business in digital marketing should be accurately conveyed to customers, customer requests should be responded quickly and smoothly. In addition, it is not possible for customers to make transactions with real money in the digital environment, except for the cash on delivery method. For this reason, an intermediary that can transfer money between the parties is also required at the payment stage. Businesses should choose the intermediary that will cause the least problems with their digital marketing tools like the payment system.

11.4.3 Product Strategies for Digital Marketing

A product is defined as a *"bundle of attributes (features, functions, benefits, and uses) capable of exchange or use, usually a mix of tangible and intangible forms"* (American Marketing Association 2020). According to another definition, a product is anything that is presented to the market to satisfy a need or desire (Kotler and Keller 2006). In traditional marketing, products are tangible objects that emerge as a result of a number of physical and chemical processes to satisfy customer wants and needs. However, digital products (software, banking services, etc.) are designed to respond to consumers' wants and needs without going through any physical or chemical processes (Baltes 2016).

Digital marketing strategy for physical products is handled in a slightly different way. Customers only pay for the features they need in products (Kleindle and Burrow 2005). Considering that the wants, needs, and expectations of each customer are different, it is very difficult to manufacture a product that can satisfy every customer with traditional methods. However, digital marketing opportunities offer mass customization opportunities to businesses. Customers can create their own final products and place orders by visiting the websites and choosing the desired components from several presented (especially the clothing industry tries to provide these opportunities to its customers with many options such as color, size, and pattern).

11.4.4 Place Strategies for Digital Marketing

The distribution channel structure in digital marketing is different from traditional marketing. In traditional marketing, the customer usually buys the product by coming to the place where the product is sold or orders a product he is familiar with from a company he is familiar with, and the product is delivered by the

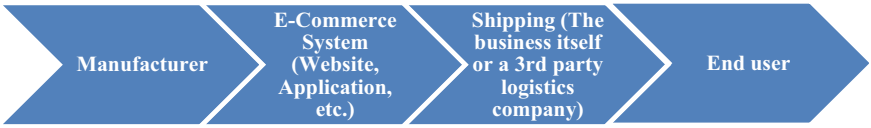

Fig. 11.1 Place strategy for digital marketing

company. However, there is no physical selling area in digital marketing, and many businesses deliver the product to the end consumer by receiving distribution support from specialized third party logistics companies, instead of establishing a logistics system (Goldfarb and Tucker 2019). Distribution costs have a significant impact on the final product cost, and businesses' use of digital marketing methods does not eliminate this fact (Kleindle and Burrow 2005). However, with the effect of economies of scale, specialized logistics companies can reduce these costs to some extent. At this point, the issues that businesses should consider strategically are as follows:

- Whether they will work with their own distribution channels or with specialized distribution companies,
- Whether they will introduce the product to the market directly or via mediators,
- How they will turn the cost advantage and speed resulting from digital marketing into competitive advantage.

The Place strategy for digital marketing can be defined as the flow-chart below (Fig. 11.1).

11.5 Sustainability

Sustainability has been a prominent issue for businesses since the beginning of the twenty-first century (Jones et al. 2008). The concept of sustainability has been on the agenda of researchers since the 1960s with the emergence of global risks such as the breakdown of the ozone layer, climate change, decrease in biodiversity, and change in the nitrogen cycle (Geissdoerfer et al. 2017). The World Environment and Development Commission defined the concept of sustainability in 1987 as *"meeting the needs of the present without compromising the ability of future generations to meet theirs"* (World Commission on Environment and Development 1987). This definition has been generally accepted in the literature. The Commission has defined three pillars on sustainability: environmental protection, economic development, and social justice. In addition to these, culture is also mentioned as the fourth pillar today (Weaver 2016). Within the scope of this definition, corporate sustainability, on the other hand, can be defined as the policies and actions used for the development of the natural environment, society, economy, and culture.

There are seven approaches in the literature regarding sustainability. These are:

- Understanding the perspectives of customers and other stakeholders on social and environmental issues,
- To provide customers with quality, affordable, and high-performance products while doing the lowest level of harm to the environment.
- Raising the awareness that these products will affect future generations while offering products to customers,
- Emphasizing the legal compliance of business practices,
- Exploring the impact of new product development skills on competitive advantage,
- Showing an approach to addressing environmental issues,
- Influencing environmentally friendly purchasing patterns with sustainable activities in a persistent manner (Ottman 2011).

Sustainability is a current topical issue that is captivating companies, communities, and supply chains. Since it is a common concern, all stakeholders of the economic system are trying to establish innovative ways for being more sustainable (Silvestre 2015). Sustainable business development has three guiding principles: Environmental Integrity, Social Equity, and Economic Prosperity (Withisupakorn et al. 2019). Good strategic planning is a must for proper resource allocation and applying the practices for achieving these principles successfully. Digital marketing is one of the most suitable and innovative ways of achieving sustainable development and environment.

11.6 Strategic Digital Marketing and Sustainability

In recent years, the issue of sustainability has occupied an important place in many areas of business management. With the emergence of new electronic business models in parallel with the development of internet technologies, the issue of sustainability has started to have a significant impact on the positioning strategies and digital reputation of businesses (Bennett et al. 2000; Saura et al. 2019c). As the financial wealth of the consumers increased, their natural and environmental opportunities started to decrease and this situation caused sensitivity in them (Zhu and Sarkis 2016). The fact that customers have started to question issues related to sustainability and corporate social responsibility more, creates pressure on businesses at this point. Each day, more and more consumers prefer to consume non-polluting goods and services (Chen et al. 2015; Zahid et al. 2017). For this reason, businesses try to convey their actions to their target audience by using digital marketing methods and try to create a positive impression of themselves in the minds of their customers. Sustainable marketing is the process of producing, communicating, and providing value for customers by preserving or increasing natural resources and human capital (Martin and Schouten 2012).

Although marketing is considered as a process of creating value for customers, nowadays it has to undertake a mission to create social value in a larger scope. Kotler

(2011) states that customers now choose brands not only for functional and emotional reasons, but also according to the level of fulfillment of their social responsibilities, and this creates pressure on businesses to operate within the frame of sustainable marketing principles (Feng et al. 2016; Geng et al. 2013; Kotler 2011). In this case, it is clear that the issue of sustainability for businesses is not only a concern for the marketing function but also should be addressed with a corporate approach by stipulating it in the macro-level strategies of the enterprise, including corporate mission and vision.

Sustainable marketing can be stated as planning, implementation, control, and development of marketing mix components according to three criteria. These three criteria are:

- Meeting the customer needs,
- Achieving organizational goals, and
- The compliance of the processes to the ecosystem (Fuller 1999).

A sustainable marketing strategy refers to the business's integration of sustainability strategy into marketing decision processes (Baker and Sinkula 2005; Banerjee et al. 2003). With the development of the Internet and communication technologies, new business models have started to focus on sustainability strategies in line with corporate social identity and marketing strategies (Minton et al. 2012). Nonetheless, the issue of sustainability has begun to be addressed not only in terms of the environment but also in the axis of sustainable development within the framework of technological tools and resources used (Li et al. 2019; Saura et al. 2019b).

There are studies on the concept of sustainability within the framework of marketing in the literature (Leonidou and Leonidou 2011; McDonagh and Prothero 2014). Sustainability helps improvements in the supply chain, product differentiation efforts, raising awareness among investors, or improving employee loyalty (McDonagh and Prothero 2014). Marketing activities are used to announce these benefits emerging from sustainability practices to customers and to raise awareness about these benefits in customers (McDonagh and Prothero 2014). Businesses started to see digital marketing as a key competence and began to strive for developing innovative electronic business models (Linton et al. 2007). Within the scope of sustainable marketing strategy, businesses can increase their financial gains with the contribution of environmentally friendly customers by offering environmentally friendly products to these customers (Banerjee et al. 2003). However, customers may not always be able to distinguish the environmentally friendly nature of the products offered to them or the manufacturing processes of these products (McDonald and Oates 2006). For this reason, it is beneficial for businesses to inform their customers about the environmentally friendly features of their products.

Considering that the number of customers who are sensitive to environmental issues is increasing rapidly, businesses that introduce environmentally friendly products to the market will be preferred more, and thus these businesses can gain a competitive advantage over their competitors (Chen et al. 2015; Garay and Font 2012). According to a study performed by Harvard Business Review, approximately 16.5% of the participants declared their interest in sustainable brands (White et al.

Table 11.6 Global customer principles and values regarding sustainability

Take care of yourself	Take care of the community	Take care of the environment
• Consuming local foods • Plant-based nutrition • Work-life balance • Effectiveness and cost efficiency • Health and safety	• Transparency, openness, and trust • Localization • Empathy for family, friends, and community • High expectation from businesses • Values shared with the community	• Recycling • Products with long life • Climate changing • The world behind the product (who produces the product, the raw materials used, etc.)

Source: Bernyte (2018): 30

2019). It can be said that the brand perception and corporate reputation of companies that incline to the marketing of environmentally friendly products will increase over time (Fraj-Andrés et al. 2009).

Digital marketing practices are used together with sustainable marketing strategies in many industries such as retail, manufacturing, and wholesale (Chaffey and Ellis-Chadwick 2019). Internet technologies and increasing logistics opportunities offer businesses an important opportunity for sustainable commercial growth by providing the opportunity to deliver their products at any time to their customers globally (Dumitriu et al. 2019) (Table 11.6).

It is said that businesses see the digital ecosystem not only as their present but also as their future as they explore the sustainability aspects of digital marketing, (Saura et al. 2020).

As consumers' concerns about sustainability increase, businesses try to develop business models that can create positive perceptions by interacting with consumers in virtual media using digital marketing components.

Five critical elements are mentioned to ensure sustainable digital marketing transformation. These elements are:

– Understanding consumer behavior,
– Contents created by social media and users,
– Platforms and bidirectional markets,
– Search engines, and
– Content interactions (Kannan 2017).

Businesses' use of digital marketing applications allows for more efficient allocation of resources together with increased productivity and benefits the economy and society (Mehmood et al. 2019; Razali et al. 2014; Shirowzhan et al. 2019).

Five important components are mentioned for success and sustainability in digital marketing:

– User interest,
– User participation,

- User retention,
- Understanding the preferences of the users,
- Encourage users to engage in tailored interactions (Kierzkowski et al. 1996; Parsons et al. 1998).

Ecological innovation is a matter of focusing on each step of the production processes, taking the necessary measures related to environmental sustainability, thus reducing the consumption of natural resources, increasing efficiency, and gaining competitive advantage (Khanh 2020).

Since adding the corporate sustainability framework to the management model of the enterprise is an element that increases stakeholder satisfaction, it should also be taken into account in the strategic management model of the enterprise (Engert et al. 2016; Silvius and Schipper 2015).

Considering that the number of customers who are sensitive to environmental issues is increasing day by day, it can be said that the preferability of businesses that introduce environmentally friendly products to the market will increase, and thus these businesses can gain a competitive advantage over their competitors (Chen et al. 2015; Garay and Font 2012). According to a study performed by Harvard Business Review, approximately 16.5% of the participants declared their interest in sustainable brands (White et al. 2019). It can be said that the brand perception and corporate reputation of companies that incline to the marketing of environmentally friendly products will increase over time (Fraj-Andrés et al. 2009).

11.7 Conclusion

Marketing activities are generally considered as a concept in contradiction of sustainability (Lim 2016; Pereira Heath and Chatzidakis 2012). However, increasing the level of awareness regarding sustainability and introducing sustainable products to the market can be achieved through marketing methods (Charter et al. 2002; Peattie 2001; Peattie and Peattie 2009). In parallel with this, it may be effective for marketing professionals to do planning to continue their activities without increasing unnecessary consumption (Varey 2010).

There are also academic studies that have been conducted to define a new understanding of sustainable marketing by considering relational, ethical, social and, green marketing approaches together with a broad social perspective (Belz and Peattie 2010; Gordon et al. 2011). According to this approach, socio-ecological problems should be addressed with a broader and macro approach rather than an external perspective, and it is necessary to redesign the marketing mix elements for sustainable production and consumption (Belz and Peattie 2010).

Digital marketing practices will allow less consumption of institutional scarce resources such as paper, motor vehicle, and manpower used for promotional activities, thus protecting forests, not increasing carbon emissions, and using manpower

in areas where it can be more efficient, as well as contribute to corporate sustainability by increasing efficiency.

When it is accepted that the product is the value produced by an enterprise (Porter 1985), the damage caused to the environment after its use should be considered as the damage caused by the enterprise to the environment (Polonsky et al. 2003). There are many different production methods and these have different effects on nature. For this reason, it will be appropriate for businesses to plan their sustainability strategy by taking into account the production and consumption processes of their products.

Today, the physical distribution of some products (e.g., software, music, money, etc.) has ceased or decreased, and instead, distribution systems have been established in digital media. Although this is not applied to all products, the natural resources consumed for the mentioned products and the materials harmful to nature as a result of their consumption have decreased. Besides, products offered digitally to the consumer via online channels have provided an important benefit for customers during the COVID-19 pandemic process and eliminated a potential risk of contamination during shopping.

Businesses should convey their solutions and discourses on sustainability to their customers and other stakeholders in their promotional activities (Belz and Peattie 2009). It is thought that it would be appropriate to apply digital opportunities and especially to use social media actively in carrying out these activities. Thus, stakeholders and customers will be able to communicate interactively about the sustainability commitment of the businesses.

In strategic decisions to be taken regarding distribution, businesses should be sure whether their product has to be physically distributed. Today, a consultancy company can provide its services online, and designers can transfer their designs intercontinentally with cloud technology. Additionally, in some cases, instead of distributing the product, it may be more appropriate to offer the product to the consumer with the benefit of space in digital media and to transfer the logistics issue to third party businesses.

Although cost-based pricing is a practical method in pricing decisions (Kotler et al. 2012), the consumer's perception of the product should also be taken into account (Booms and Bitner 1980). Since, in some cases, the value of the product can be much higher than its cost (e.g., health-related goods and services). At this point, it is important to be able to offer customers the highest value proposition in the digital medium at optimum costs to maximize business profits. The presence of sustainable production and consumption opportunities among the value proposition components that the business offers may be a reason for customers to prefer the product.

Another important issue is that individuals can market their products in digital media. With the widespread use of internet facilities, people can sell their belongings that they do not use, no longer need, and are in good shape as second-hand products on the Internet. Thus, the products that are not needed but are in good condition are not unutilized any more, and people who can use them at affordable prices can reach them. Another point is that with these markets, some unusable products can be repaired or used as spare parts and delivered to those in need (Hansen and Le Zotte

2019). That is they can be brought into the economy instead of being left to nature as waste. This situation, as the amount of alternative purchasable products in the market increases, limits both the amount of production and prices to a certain extent. There are many advertisements in digital media about products such as used cars, whiteware, clothes, and books. Additionally, the high demand for second-hand products for a brand is an important indicator of the customer quality and reputation perception for that brand.

Customers can be skeptical about the sustainability statements of businesses (Banerjee et al. 2003). For this reason, the marketing strategy, sustainability discourses, and actions of the business should be seamless (Connelly et al. 2011) strategically. Thus, they will be able to create loyal customers (Fraj-Andrés et al. 2009).

Sustainability and digital transformation should primarily be made a part of organizational culture. In this way, they will be able to find more places in strategic plans and be adopted more by business stakeholders. Subsequently, the marketing unit, like all the elements of the business, will start to think with sustainability in mind and will reflect this philosophy in its digital actions. To the extent that this reflection coincides with the expectations of the customers from the business, it is expected that the business will gain a competitive advantage over its competitors. In fact, this situation will contribute not only to the benefit of the business and the customer, but also to the formation of a sustainable production and consumption balance that will have positive results for protecting nature, preventing the rapid consumption of resources, and reducing the environmental pollution.

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Chapter 12
Corporate Social Responsibility Disclosure (CSRD)

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Abstract Modern environmental issues, such as the effects of global warming like ozone depletion and climate change, made companies realize the negative indirect environmental effect of their daily business activities. Not only do the environmental themes are important, but also the present financial crises have contributed to global concerns. At present, businesses are not always concerned with profit. The existence of a business cannot unattached with social and ethical responsibility issues. Corporate Social Responsibility (CSR), appears to be everywhere and is known to be relevant to firms all over the world. Companies are not only responsible to shareholders alone but also, they have to be responsible for their social, environmental and financial sides. They have expended money on social projects, such as education, art, sport and investment in environmental facilities. They have considered the interests of employees and some other actions that service not only the company but also society as a whole. The companies are facing increasing pressure due to grow the customers' consciousness of CSR-related issues. This pressure to deliver their CSR activities during compulsory and voluntary disclosure to assurance that shareholders are recognizing the suitability of their procedures undertaken about environmental and social issues. The desires of society to obtain the largest possible amount of social and environmental information have urge companies to disclose their environmental and social information in several ways to meet these demands. Through this chapter, an adequate picture of corporate social responsibility will be presented, its most important historical stages, and the challenges facing its disclosure.

Keywords Corporate social responsibility disclosure · Sustainability · Accountability · Social audit · Rating of ethics · Eco-management and audit scheme · Agency/legitimacy/signaling theory · The global reporting ınitiative GRI

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12.1 Introduction

Corporate influence on the environment and society is facing global attention. Consumers, employees, investors, business partners, and local communities are increasingly looking for the role of business in community. Public, private and human rights organizations demand greater transparency and accountability, not only in the day-to-day operations of companies but their impact on society and the environment, especially after recent financial and accounting scandals and their impact on capital markets as well as the big banks and firms.

These issues have become more imperative than before. Despite this increasing interest, it remains difficult to assess and measure the influence of a firm on society against setting norms. Stakeholder groups try to design valuation tools according to standards professional organizations attempt to implement social audits. Governments on the other hand are working on developing legislation that requires the preparation of social reports, rating agencies, classifying and ranking the companies. The companies themselves are constantly displaying growing numbers of reports regarding their social performance and behavior. Despite these many efforts, stakeholders are dissatisfied with the reports and demand to make a greater effort to minimize the negative effects of institutions on society. They also work on how to harmonize this impact with the needs of society.

The main purpose of this chapter is to try to give a complete and clear image of corporate social responsibility disclosure by defining CSR, explain its principles, its important dimensions, the key theories that support it, and the methods of measurement used to evaluate it.

12.2 Definition and History of CSR

The following passage will try recounting a brief history of social responsibility and the most common and acceptable definitions for it. Throughout the 1960s until the early 1970s, groups of social activists and others were calling for a general idea of corporate responsibility. These messages became very clear and new governmental entities (the Equal Employment Opportunity Commission (EEOC), the Environmental Protection Agency (EPA), the Consumer Product Safety Commission (CPSC) and the Occupational Safety and Health Administration (OSHA)) assured that national public policy formally has acknowledged the environment, consumers, and employees, to be considerable and rightful stakeholders of business. In that period, companies' administrators had to confront how they could make equilibrium between obligations to the owners of the firm with their liabilities to an ever-widening group of stakeholders who request both ethical and legal rights (Carroll 1991).

In the 1980s, the concentration had increased on improving and developing new definitions of CSR and research on it and a divided of writings into various concepts

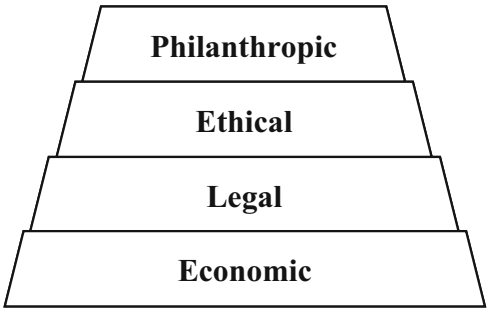

Fig. 12.1 The pyramid of corporate social responsibility (Carroll 1991: 228)

and subjects such as corporate social responsiveness, social performance, public politics, ethics of business, and stakeholder theory/management, etc. It was defined at that time as the idea that companies had to commit to constituent groups in society, not just its shareholders. The commitment must be applied voluntarily and to be widespread, to extend beyond the classical duty to shareholders into other social groups such as customers, employees, suppliers, and neighboring societies (Jones 1980).

In the early 1990s, quite a few contributions to the definition of CSR occurred. Its concept became a base for other related concepts and themes; many of them adopted CSR thinking and were very compatible with it. The corporate social responsibility pyramid below defined the four forms of CSR (Carroll 1999).

Besides, Brummer (1991) have tried to provide obvious definitions of responsibility and searching at the different philosophical methods. Through an accurate review of the content of responsibility, Brummer suggested that the meaning of responsibility is to hold directors accountable for their activities. He totalized three kinds of corporate behavior demanding are introduced from director: (1) when the procedures that are being carried out exceed the scope of the company in terms of permissibility or authority. (2) If the company's activity is not within the limits of its responsibility. (3) The performance of acts was inferior (Fig. 12.1).

Carroll and Shabana have stated the definition of CSR as the social responsibility of companies include the philanthropic, ethical, legal, and economic predictions that the community has of companies at a specific time. Also, they opined that this definition could be a positive and sufficient definition to use as it is consistently applied in corporate social responsibility research at the time (Carroll and Shabana 2010).

In the early 2000s, to CSR, continued, the search to find business legitimacy has increased and the concern and up growth with business ethics hid the persistent increase and expansion of the topic of responsibility of society, although important advances were achieved, particularly in Europe and the UK. The pursuit of the case for CSR surely became a prevailing subject through this time, particularly the society of business were willing to legalizing and rationale on actions and activities that have started and are still ongoing (Carroll and Shabana 2010).

Some scholars consider CSR is a matter of public relations. Frankental (2001) submit that CSR is an innovation of public relations and it may only have a real

presence if it takes into account all interest groups and is enhanced by changes in firm law or rewarded in financial markets.

CSR was defined by the World Business Council for Sustainable Development as the moral behavior of a firm towards the community. The management has acted responsibly with other interest groups who have a legal interest in the business, and CSR is the persisting obligation by working to manage, participate and ethically to economic growth while optimizing the life quality of the laborers and their families, further of the domestic society and society at all (Moir 2001).

Hancock (2005) identified a set of core CSR drivers, such as the main impact of the integration of social responsibility elements within the activities of the company. Reduce investment risk premium in stocks, the direct link between financial and reputation result assess, and credit rating and stock price. The effects of scandals of companies as Enron, WorldCom, and others have grown the realizing greed among the top business executives in the firms' world. Finally, the CSR programs could build loyalty with customers, which presentation a competitive feature in diverse markets where consumers desire goods and services that are delivered or produced ethically.

Based on all, it could be said that CSR is a moral and national sense of social contribution toward the environment and society represented by people who worked in the organization or those living in society and the surrounding environment. Besides, the firms want to take a comprehensive and integrated program to structure a CSR system that permits them to instinctively manage in a socially responsible way. In exchange for exploiting the material and human resources of society and making profits.

12.2.1 Principles of CSR

Although the definition of CSR has not been stabled yet, it has been known as long-term work planning. By its various methods, it tries to strike a balance between the economic rights of businesses and their social and environmental obligations. CSR linked these methods with the companies' strategies recognizing four basic principles (Mermod and Idowu 2014).

1. The societal approach: this principle is supposed that business companies have to participate in construction preferable communities, therefore, they have to combine the social interests into their essential strategies to take into account the full extent of their influence on societies. Additionally, these principally require business firms to support human rights as well as labor rights, and to deal with any other related moral issues.
2. The economic principle: this principle emphasized the effectiveness of business companies in providing or producing goods and services without causing harm to social or environmental values.

3. The environmental principle: this principle states that the companies must not damage the environment to aggrandizement their profits, also they ought to play the main role in fixing any environmental harm caused by their unaccountable use of natural resources.
4. The stakeholder approach: this principle holds the business firms responsible to consider the legal interests of their stakeholders. Because of the lack of clarity on the nature of CSR practices, it is hard to define it and to be sure of any activity. Therefore, it is necessary to determine these activities (Crowther and Aras 2008). Crowther and Aras (2008) believe that three basic principles include all activity of CSR:

   (a) Sustainability: It is concerned with the influence of actions taken now on the choices available for the future. The resources that are utilized now maybe will not be available for use in the future, and this is of special worry if the resources are limited in quantity. Thus, sustainability means that society must use no more of a resource that can be renewed.
   (b) Accountability: It is concerned with an enterprise admitting that its activities impact the surrounding environment, and therefore supposing responsibility for the influences of its behaviors. It is also a mean measurement of the effects of actions taken, whether internal to the organization and externally.
   (c) Transparency: it is meant that the influence of the firm's activities and behaviors is clear and explicit through the company's reports, as well as the relevant facts visible in those reports. Also, it can be considered that the concept follows the other two principles and is part of the procedure of accepting responsibility on the part of the company for the outward impact s of its operations and an equal part of the procedure of transfer control and control to external stakeholders.

12.2.2 Motivation for CSR

For many centuries, the motive and requirement that the business firm has some a sense of responsibility and concern for the sake of society have existed with interest generating revenues. CSR existence broadly accepted by several sectors through the years has been over and over studied under various names that include company citizenship, social accountability, and strategic charity among many others. The idea of corporate social responsibility depends on the core idea of creating "shared value". CSR aims to generate value for the company, its consumers, and society as a whole, besides generating higher revenues. There are many reasons beyond the motivations of organizations for engaging in efforts of social responsibility (Sprinkle and Maines 2010).

- Companies have altruistic intentions; they merely think their CSR efforts are an integral part of being a good habitat. Recognized, it is hard to separate these intentions from profit-seeking ambitions.

- CSR can be a further cost for business: it is anything companies feel they should do to avoid negative advocacy and other reactions from various stakeholder groups, such as Nongovernmental Organizations (NGOs).
- Possible contracting benefits: companies suppose that CSR assists motivate, recruit, and holdover employees. Many sources listed these reasons as one of the most important benefits of practicing CSR programs.
- Motivations of customers: CSR may attract consumers to buy a firm's products or services. Such as, earn price premiums or set apart increases in market share.
- Firms' focus on concerns of the environment can lead to reduced production costs.
- CSR could be perceived as a part of a firm's risk management efforts. To achieve this end, CSR can be an efficient instrument for reducing legal or regulatory limitations.

12.2.3 Dimensions of CSR

While companies are trying to reach ethical standards that can be applied globally, the focus is on the decision-maker and his commitment to taking into account the CSR dimensions when decision-making. Carroll (1991) identified four dimensions of corporate responsibility through what is known as the corporate social responsibility pyramid:

1. The real economic commitment of companies in the implementation of their duties in the production of goods and services needed by society, and effectiveness and efficiency are the basis and precondition for other responsibilities towards society and the surrounding environment.
2. The legal responsibilities of companies are their obligations to implement laws, whether they are local, international, regional, or even transnational.
3. The company's ethical commitments are its obligations to follow and respect social customs, even those not enveloped by the law.
4. Charitable responsibilities in the first degree. They are not specific activities or commitments, but they are just expectations or indicators of what the community expects to satisfy its desires, such as charitable donations, funding schools, health care, and development programs in the community.

Through analyzing the definitions of CSR (Dahlsrud 2008), it became obvious that they were pointing to several of the same aspects of CSR. Therefore, the clauses, which indicated the same dimension, were collected together. This process determined five dimensions that were named to express the content of the phrases.

– The environmental dimension: means the natural environment, for instance, environmental oversight, environmental cleanliness, and environmental worries in firms' actions.

- The social dimension: refers to the relationship between society and business, for example, merge social concerns in their business operations, contribute to the best society, consider the full extent of their influence on societies, and contribute to economic development.
- The economic dimension: refers to financial aspects or socio-economic, involving describing CSR in the terminology of business operation, for example, keeping the profitability, engage in economic evolution and business operations.
- The stakeholder dimension: refers to stakeholder or stakeholder groups for example how companies interact with their workers, customers, suppliers, societies, and interaction with their stakeholders, and addressing the stakeholders of the company.
- The voluntariness dimension: means the procedures not expressly provided for by law, including, for example, that are based on moral values, without exceeding legal and voluntary obligations.

The European Commission Green Paper 2001 determines two dimensions of CSR. These are external and internal. The external dimension comprises business partners, local communities, consumers, suppliers, human rights, and the global environment. The internal dimension involves health and safety at work, human resources, environmental influences, and natural resources. The internal issues are supposed to be those dealing with firms' internal management. Similarly, external issues concern external management (Nasrullah and Rahim 2014).

12.3 Disclosure of CSR

CSR Disclosure has known as the delivery transaction of the social and environmental influences of companies' economical actions to certain categories of interest inside the society and its effects on community as whole (Gray et al. 1996). Furthermore, Heemskerk et al. (2002) referred to CSRD may be realized as an informed operation of environmental and social effects caused by a company's economic business to certain concerned and the firm as all.

CSRD is the thematic depiction of environmental and social practices so that stakeholder groups could use it reliably to assess the execution of the company's liability for society. Governmental and international bodies as Development and the International Labor Organization, the Organization for Economic Cooperation, and the United Nations, have advanced guidelines, principles, statements, and other tools, that provide schema the public criteria for agreeable behavior of firms. During the last 10 years, sundry national governments in Europe and the USA series of regulations have passed on environmental and social investments. Several regulations and laws call firms in sharing their CSR actions and practices with the audience via the reveal of non-fiscal information (Najah and Jarboui 2013).

Reports of CSR have to include four parts (Moravcikova et al. 2015):

1. Credibility: The reliability of the reporting may be binding on senior management. Also describe the introduction of personal responsibilities, company policy, data collection methods, and goals. Besides, credibility is affected by the level of participation of key stakeholders and has been grown through independent third-party confirmation.
2. Completeness: The CSR report involves all action and office operations in the region. They have to report on the major areas that the company impacts on the environment and society.
3. Significance: The company should improve the use of quantitative and qualitative indexes to assess its social and environmental liability.
4. Appropriate format: The format of the reporting has an important effect and helps to identify if the disclose is long and fairly clear.

With great acceleration, there are rising demands that corporates take responsibility for their societal and environmental effectiveness. As a consequence, many firms provide optional reports on the impacts of their commercial or industrial activities on the environment and society, and how they manage these businesses, which has led to great interest among academics and professionals. Therefore, organizations spend money and time for optional disclosure of CSR, so the follower expects that companies will benefit from the decision to provide such disclosures, otherwise they will be required to do so. How companies benefited from the voluntary disclosure of CSR that was investigated by researchers in a deferent of methods, with much focus on the worth of information related to investors and investments (Bowerman and Sharma 2016).

The main issue facing researchers is that the literature lacks a predominantly accepted theoretical perspective on the main reason organizations participate in social and environmental disclosure, and what are the effects of this on the different stakeholder groups and beneficiaries of that disclosure. Hence, a lot of the academic discourses in this field has been and persist to be, philosophical in its nature, focusing on the role of social accountability in institutions and society, and dealing with problems related to sustainability in the new company environment. These researches have raised normative inquiries about the scope to be taken by academics. The area of accounting involved in it and more controversy about environmental and societal problems caused by companies. Some researchers believe that the primary objective of an organization's disclosure is to influence impressions about the company's future financial prospects in the brains of external stakeholders, primarily financials, rather than trying to minimize social or environmental damage. Additionally, there is evidence that when disclosures are voluntary, companies will only present a judiciously selected portion of the information that presents the firm in a positive light, that increase questions about the integrity of disclosures of corporate social and demands for supporting these reports (Brooks and Oikonomou 2017).

12.3.1 Theories of CSRD

CSRD has been proven through a multiplicity of theories that include many solutions and alternatives. Included in the list and the most acceptable are agency theory, stakeholder theory, legality theory, and signal theory.

12.3.1.1 The Agency Theory

Also known as positive accounting theory relates to the view that a company is a contract among different economic agents that compete within efficient competitive markets. Here it can be said that the social and environmental reporting will be a useful guide in defining the contractual commitments of the debt, the implicit political costs, or the administrative compensation contracts. Nevertheless, the focus of agency theory on fiscal or wealth and value considerations among competitors in highly-efficient markets and informatics availability limit related environmental and social disclosure, also its intentional objective (Reverte 2016).

In the CSR respect, public interest attentions and image building can restrain the managers' decision to expand on social performance and to disclose social information. Nevertheless, net income is decreased by social performance costs. Consequently, the companies that favor conducting social performance and uncover it are more probably have lower monitoring and contracting costs, and to have high political costs but the decision to uncover social performance is positively associated with social performance, political visibility, and economic performance, and is negatively associated with monitoring and contracting costs (Wuttichindanon 2017).

In the view of agency theory, disclosure works as a control mechanism for manager performance. According to political cost theory, politically sensitive firms will be affected by high political costs (depending on the size of the firm), therefore will tend to disclose more information (Karim et al. 2013).

12.3.1.2 The Stakeholder Theory

Wuttichindanon (2017) found that, a stakeholder is any individual or group who affects or is affected by the accomplishment of the company's objectives.

The stakeholder theory assumes that a firm report is a tool, to manage the informational needs of several strong stakeholders (investors, shareholders, consumers, employees, public authorities and NGOs, etc.). Directors use the information to treat or address the strongest stakeholders with a view to earn their support that is needed for existence and continuity (Reverte 2016).

The anticipations may be diverse for every stakeholder, so company management has to match firm policies and resources with the stakeholders' concerns. The CSR model is formulated to comprise the external effects that suppose adversarial attitudes to the firms, for instance, special concern groups, such as NGOs and

regulatory. The principle of CSR then originally included obligations to society (Pintea 2015).

Like the firm, the stakeholders have a negative or positive effect on the persistence of business. Stakeholders are individuals and groups that influence or be impacted by the policies, decisions, and operations of the Organization. Business persists to become more complex, the correlation between firms and stakeholders are now not limited to investors, employees, and customers. Stakeholder theory states that firms must disclose to be one of social responsibility to their stakeholders (Tjia and Setiawati 2012).

In sum, a company's financial success depends on the capability to formulate and implement a CSR strategy that runs effectively its relations with stakeholders as the stakeholders have their rights to seek information about how the company is affecting them (Tanggamani et al. 2017).

12.3.1.3 The Legitimacy Theory

Roots of this theory is in the idea of a social contract between the corporation and society. A firm's growth and survival depend on its ability to reach the desired results from the groups from which it derives its power (Duff 2017).

The legitimacy theory considers that organizations will strive to convince that their activities are conducted within the acceptable scope and norm set by the society where they work. This theory is instituted on the assumption that there is a social contract between the enterprise and its social environment that demands that the organization report their activities voluntarily provide that the management views that it is expected by the community. Information disclosure is used as a means for an organization to create a respectable image and to justify that it operates in accordance with social values held by the society in order to maintain or gain social legitimacy. Legitimacy theory is used to analyze the social and environmental accounting of the firm. It is closely tied to intellectual capital reporting. Firms tend to report intangibles if they need to do so for certain purposes. In other words, firms cannot legitimate their status only by revealing tangible asset that is considered to be a traditional symbol of the firm's success (Karim et al. 2013).

12.3.1.4 The Signaling Theory

Signaling theory is one of the theories that underlie the voluntary disclosure of where the firms were driven to offer information to external parties. The push was because of the asymmetry of information between outside parties and management. The existence of information asymmetry happens due to one party knows additional information than others. The manager of the organization has full information about the activities of the firm while stakeholders and shareholders lack the completeness of the information. The signaling theory declares that the companies give signals to the external firms with the goal to enhance shareholder value. In this case, the

information will be meaningful if used by investors in considering the decision to invest in the stock market. Accordingly, to minimize the asymmetry of information, disclosure has to be carried out by the firm (Tjia and Setiawati 2012).

Signaling theory demonstrates why companies have a motivation to disclose information optionally to the financial market: voluntary disclosure is substantial for companies to rival successfully in the market of capital (Omran and Ramdhony 2015).

12.3.2 Models for CSRD

Environmental and social responsibility methods have evolved considerably to cover different demands and purposes. They are all classified under the term CSRD, below some of the models used will be introduced and discussed, which may provide more benefit (Reynolds and Yuthas 2008):

12.3.2.1 Eco-Management and Audit Scheme (EMAS 1995, 2001)

The European Commission identified the basic principles, which they have established, the EMAS design in Council Regulation 1836/93—EMAS of the European Commission. The main points were the growth and improvement of ecological and social execution, which also was at first aimed at industrialization organizations. That has been reached out to permit wide investment by any private or public company craving to take part. The guideline is requiring environmental reporting from the firm and requiring reviewing. Moreover, there is a request to documenting persistent improvement through following the policies, programs, and the board frameworks by a deliberate, objective, and patrol assessment of execution. There is likewise a commitment to educating the general population of the consequence of the assessment. The section on engagement mentioned that the system is released to general or personal companies working in the EU or the European Economic Area (EEA). The site may be recorded if it has a policy, environmental check, the goals of continuous improvement reports, and an assurance that includes the policy, management system, programs, inspection and audit procedures, and reports submitted. And after the responsible body in the member state certifies the environmental report, it is sent. This report is also published to the public but only after the completion of the site registration. The report shall contain a brief and clear characterization of all actions at the site; Also, assess the relevant important environmental issues. Including disposal of waste, toxic and harmful emissions, consumption of raw materials, natural resources, water, energy, noise, and other important aspects; The report offers the firm's environmental policy, program, on-site management system, deadlines for the following reports, and the name of the Certified Environmental Auditor. Requiring ISO 14001 as the environmental management system strengthened the EMAS 2001.

12.3.2.2 International Organization for Standardization (ISO 14000 Series, 1997, 2002)

The International Organization for Standardization (ISO) released the 14,000 series (1997, modified 2002) as an environmental management system (EMS) norm comparable to the issuance of the ISO 9000 quality control standard. The aim is to present some consistency that enables outside gatherings to make decisions and survey patterns. This EMS show incorporates prerequisites for the executives' promise to the ecological and social approach. These policies should be defined with supporting documents related to organizational responsibility towards workers, implementation of the planned program, control measures, preparations for emergency conditions, verification and auditing, documentation, and communication. It can be said that the last three features produced EMS forms under the specialty of accounting and professional auditing (Mathews and Reynolds 2000). Beyond this standard, there is a significant shift from control and command to the protection and continuous improvement with a concentrate on the ISO firm or organization. Therefore, the organization must provide documents and make them available to the public upon request. Thus, though this is an optional standard, the moment that it is approved by the organization all social stakeholders' groups have the right to check the information.

12.3.2.3 Council on Economic Priorities Accreditation Agency Social Accountability Standard (SA 8000, 1998). Renamed Social Accountability International (SAI)

The criterion contains an alteration of concentrate and is interested in fair business practices around the world. It is split into objective and range, important standard elements and their explanation, concepts, conditions of responsibility, and social accounting. Social security requirements involve the work of minors, forced to work, safety and safety, association licensing and the right to social negotiation, discrimination, discipline, compensation, daily working hours, management systems and methods, internal control corrective, external communications, access to investigations and records. Entities that choose this norm are supported to demand their suppliers to be interrogated with their demands as well. This helps to apply them to the global community. Firms may apply these norms voluntarily and might report adaptation to the provisions of the rule as an integral part of other issued statements.

12.3.2.4 Institute of Social and Ethical Accountability Standard AA1000 (1999)

In November 1999, the date of issuance of the first standard for building company responsibility and confidence was by the Institute for Social and Ethical

Accountability (ISEA). ISEA stated that the AA1000 standard outfits a clear frame that companies can apply to identify and optimize their moral performance and is considered a tool to sentence on the truth of moral desires. The AA1000 norm is qualified as a responsibility standard, concentrated on guaranteeing the quality of ethical and social accounting, auditing, and reporting. AA1000 (2008) includes principles as features for a quality operation, also a collection of practicability norms. The practicability criteria are covering the planning, auditing, and reporting, accounting, stakeholder engagement, and merging. The concentrate is on optimizing total performance out of quality management, measurement, retention and recruitment of workers, outward stakeholder engagement, co-partnership, investors, risk management, governance, and regulatory relations and practice. As a part of the system, Auditing and quality confirmation are required. The users of AA1000 are anticipated to comprise adopting Entities, stakeholders, service suppliers, and standards providers. Consequently, the implying that the social stakeholders from constituents.

12.3.2.5 The Copenhagen Charter (1999)

The instructor was released at the third global seminar on Ethical and Social Accounting, Auditing, and Reporting, this convention was an introduction in the Danish offices of Ernst and Young, KPMG, Price Waterhouse Coopers, and the House of Mandag Morgan. The requisite attention of the convention is upgrading the sensibility to the worth of stakeholders. It goals to develop, briefly and accurately, the most important motivations and principals engaged. The scripts of the convention display the concentrate on stakeholders as an integrated side of the decisions and values of the firm. Dealing with reporting and its ingredients are directly and the principles are developed. The principles were listed in three groups: lay essentially, embedding, and communication. Lay essentially comprises the participation of top management that has to show commitment, select purposes and resource devote, create task groups, and get ready employees and management. The embedding process comprises reviewing values and vision strategies, determining key stakeholders and concentrate regions, determining worth and elements critical superiority, discussing with stakeholders, identifying the main performance indexes, an adaptation of administration information systems, and following efficiency for persistent enhancement. Communication is divided into having goals; presenting reports, conduct plans for improvements and budgets, checking reports, publication reports, and consulting shareholders about values and performance. Next part, Truthfulness in Stakeholder Reporting and includes principles of accounting (not necessarily GAAP), appropriate information (involving even the negative information if needed), and investigation. The perfect framework immediately dealings with stakeholder communication. The announced goal is frequent react and communication that depends on stakeholder esteems as expressed. Was launched as an administration guide to stakeholder connections.

12.3.2.6 Global Reporting Initiative Sustainability Reporting Guidelines (2000, 2002)

It was established in 1997 as a section of the Coalition for Environmentally Responsible Economies (CERES). The purpose is to give internationally viable directions for setting up sustainability reports, as opposed to environmental reports, sustainability is held to comprise ethical environmental and social sides. One aim is the offering of uniform disclosures about the economic, social, and environmental information in annual reports and media. The international guidelines committee, that supervises the activities of the GRI, involves NGOs, professional accounting bodies, corporations, and the United Nations. This process is suitable for ISO 14000 and the World Business Council for Sustainable Development (WBCSD).

12.3.3 Measures of CSRD

Based on previous studies the CSR is measured by diverse ways including the analysis of CSR information in company reports, questionnaires, ethical rating, expense measurement, reputational measures, and unidimensional and multidimensional assessments depend on some observable social accountability indexes (Soana 2011):

12.3.3.1 Content Analysis

Includes the assessment of the part related to social responsibility in reports released about a firm. Maybe progressed with just a few words, sentences, or lines, to the computation of the quantity of social information or a test of their goodness. Acceptance of this method assumes a social disclosure is a better representative of the company's social performance.

12.3.3.2 Surveys by Using Questionnaires

His questionnaire is sent to the officials in the higher management of the company, and then the researchers analyze it, then the answers received are detailed and accordingly it gives an evaluation of the level of social performance achieved by the companies. The main point is that the ruling here is internal and mostly reflects the perception and orientation of the higher management on the issue of social responsibility.

12.3.3.3 Measures of Reputational

Professional journals or researchers establish a set of ratios that are based on an individual description of social performance, and a mark is calculated for the reputation associated with the company's reputation. Connecting CSRD to reputation indicators means accepting two assumptions: the first is that the reputation perceived by external parties is the best picture of responsible behavior that companies actually practice, and the second is that reputation measures are not affected by the good financial and economic performance of firms.

12.3.3.4 Unidimensional Indicators

Concerns indexes that express an evaluation from one side of diverse socially responsible activates that firms may conduct. The CSRD proxies most used in the literature are; orientation towards the customer, interlocutor with domestic society and charity, the degree of engagement in illegal practices, and respect for the environment.

12.3.3.5 Measures of Spending

The CSR could measure through the level of expenditures and costs consumed such as voluntary donations and charitable contributions made by the company in order to improve and protect the environmental and social well-being of its stakeholders.

12.3.4 Rating of Ethics

A multi-dimensional indicator designed by specialized entities. Each one of these has inventive its quantitative model on the social outcome of firms for the identification of some indexes (The major part relates to the types of stakeholders that are relevant to firms) an individual score is attributed to it, which is then grouped into a synthetic result (moral assessment) according to a weighted or arithmetic average.

Many tools of rating CSRD also are considered ways of measurement and guidelines for CSRD. For example, KPMG that used in (De Klerk et al. 2015), MSCI (The KLD) has been used in studies (Birkee et al. 2016), (Ding et al. 2016) and (Wuttichindanon 2017), as well the GRI in studies like (Mukhtaruddin et al. 2014; Nekhili et al. 2017; Plumlee et al. 2015; Reverte 2016).

Evaluations are prepared for several purposes, including, for example, providing important and accurate information to assist investors in assessing the financial, social, and environmental commercial risks that result from companies' activities. Rating agencies provide important information about a company's sustainability

activities, mainly to investors and ethical managers who notice weaknesses in their organizations that are vulnerable to their mistakes or a target for their competitors. The evaluations take place in a practical form and the evaluation result is based on the standard. Through this operation, the required information is alternated between the rating agencies and the corporate is rated. Ratings can be classified as required or not required. Meaning that the required ratings are the evaluations requested by the company that seeks and requests the evaluation, and there is, broadly, clear and explicit contractual relationship between the requesting firm and the rating agency. Conversely, unsolicited assessments are not based on an explicit contractual relationship, and the rating agency performs the rating at its own risk. The evaluations are treated as a form of disclosure as the company that was evaluated publishes data that the stakeholders will not be able to know or see in another way, and in this way, the rating agencies certify and document the validity and merit of the evaluations they have provided (Schafer et al. 2006). The following is a definition of these tools:

12.3.4.1 KPMG

The KPMG "Klynveld, Peat, Marwick, Goerdeler" survey of corporate responsibility reporting, its surveys depends on a long time of research by specialists at KPMG member companies across the world, who analyzed thousands of corporate responsibility (CR) reports, firm annual financial reports, and websites (KPMG 2015).

The study is afforded in three parts:

Part 1: Accounting for carbon
Part 2: Quality of CSR disclosing
Part 3: Global directions in CSR disclosing

In Parts 1 and 2, KPMG valued the goodness of CSR disclosing from the world's 250 largest firms by revenue (G250) with a specific concentrate on the carbon information these firms present in their annual reports. The quality was valued by using valuing methodologies depend on KPMG professionals' judgment of leading reporting practices.

In Part 3, the study offers international CSR disclosing directions-based reports released by the top 100 firms in the 45 countries.

The report searches how the world's biggest 250 firms report on carbon in their annual reports. Further, it covers quantitative data on CSR reporting trends, involving 4500 firms from 45 countries. KPMG has published this survey at orderly periods since 1993. The increase in the number of countries and firms involved is just one reference for how CSR reporting has progressed into Business practice prevalent over the past two decades.

12.3.4.2 MSCI (The KLD)

Morgan Stanley Capital International (MSCI) is supporting a pioneering investment decision. MSCI ESG STATS (known as KLD Research & Analytics Inc. "the Kinder, Lydenberg, and Domini, Inc.") It is a statistical analysis of the US MSCI ESG Research's Environment, Society and Governance database. KLD offers an overall CSR rating of more than 3000 U.S. companies. To meet the needs of investors in society and the environment, KLD provides research services, standards, compliance, and related advice similar to those offered by companies specializing in financial research. KLD has consistently provided support for research products and services to the financial services market since 1988. Made up of the largest corporate social research teams in the world, KLD produces consistent, high-quality, integrated research that is a pillar for organizations to rely on. This classification is based on 8 social and environmental dimensions, which are adapted to more than 60 criteria. Nonetheless, because of their heterogeneity, SER investors are motivated by various values and will seek firms respecting specific dimensions of Corporate Social Responsibility (CSR) (Cabello et al. 2014).

The KLD measures, ratings, and analysis both the strengths and concerns of the CSR program in each dimension of CSR (community relations, diversity issues, employee relations, environmental issues, product issues, governance, and human rights) through a binary system. If the company implements the criteria, it scores a (1). Otherwise, it scores a (0). It uses the company's internal sources of annual reports and external sources (articles in the business press) to conduct annual assessments of the social and environmental performance of 650 companies, including companies involved in the S&P 500 composite index and those included in the Domini 400 Social Index. Since 2001, KLD has developed its business to include the 1000 largest American companies by market value, and this expansion increased in 2003 with the listing of the 3000 largest American companies. Independent researchers also consistently apply the above criteria and debate ambiguous judgments to reduce the subjectivity of the entire process (Waddock 2003).

12.3.4.3 The GRI

The Global Reporting Initiative (GRI) The Sustainability Reporting Guidelines provide, Standard Disclosure Principles and Implementation Guides for developing sustainability reports by companies, whether it is their size, sector type, or geographic position. These principles also represent a global reference for all concerned in disclosing the system of government, performance, and the influence of organizations. The guidelines are helpful in preparing any type of documentation and reports that require such disclosure. These principles have been progressed through an international approach involving multiple stakeholders including representatives from different businesses, financial markets, and civil society, as well as experts and auditors in diverse scopes; And through close discussions with governmental

organizations and agencies in many countries. The guidelines have been sophisticated in line with internationally known reporting documentation, which is referenced throughout the guidelines (GRI 2013).

The principles are presented in two parts:

- Standard Disclosure Principles
- Implementation guide

Part One—Standard Disclosure Principles: It contains the standard disclosure principles and standards that the company should apply to prepare its sustainability reports. Introduction of the main terms is also involved. The most important categories are:

(a) Economic: It covers economic performance, position in the market, indirect economic influences, and purchasing practices.
(b) Environmental: Includes raw materials, water, energy, biodiversity, liquid and toxic wastes, products and services, emissions, compliance, supplier environmental assessment, transportation, and environmental grievance mechanisms.
(c) Social: Includes Sub-Categories (Labor Practices and Decent Work, Human Rights, Society, and Product Responsibility).

The second part—contains the implementation guide: It includes explanations of how to apply the principles of the disclosure, how to prepare and classify information, and how to interpret the different concepts in the instructions and directives. And notes on reports in general.

Bowerman and Sharma (2016) were discovered that CSRD, which followed GRI guidelines, was more helpful to investors and helped them conduct a more accurate market assessment of the company. He further noted that the information received on CSRD reduces information asymmetry, makes it comparable, and has added value for investors. Depending on KPMG (2008), the GRI framework is the most widely used global framework for corporate social responsibility reporting (De Klerk et al. 2015).

12.3.5 Challenges of CSR Disclosure

The requirement to get benefits related to CSR is the consciousness of CSR activities. Companies are meeting rising pressure from stakeholders' groups to engage in social responsibility activities and are predictable for reporting their CSR efforts (Grougiou et al. 2016). Corporations communicate CSR information to their stakeholders through a variety of channels. These reports cover environmental and social disclosure, sustainability information, media, corporate websites and advertising releases, and corporate social responsibility presentation. Among these channels, reporting of CSR has become an essential means used to deal with stakeholders' informational needs concerning firms' social and environmental performance. CSR reporting is knowing as the practice of communicating the

environmental and social influences of firms' economic actions to certain interest categories inside society and the community as a whole (Gray et al. 1996). The organization can enhance the community's perceptions of the organization's interest in some issue of corporate social responsibility by using annual reports that contain non-financial information, as well as for keeping them away from observing negative attitudes of the company. Disclosures are optional, and therefore the company must disclose some information that is expected to contribute to shaping the way stakeholders perceive the company (Neu et al. 1998).

Several studies have shown that there is uncertainty about the level of reliability in the corporate social responsibility information disclosed by companies in their annual reports. The absence of acceptable standards for the disclosure of corporate social responsibility, especially with regard to the type and quantity of information disclosed in the annual reports of corporates that reach the stakeholders, has made disclosure practices of corporate social responsibility many, very diverse, unequal, and incapable of making comparisons (Nekhili et al. 2017). Lack of consensus on what should be included (or should be excluded) in corporate social responsibility activities confuses the interpretation and understanding of the contents of the reports, as well as the information related to corporate social responsibility that has been disclosed that shows companies in a generally positive image "self-praising". Consequently, CSRD tends to avoid negative or possibly harmful information, and little motivations exist to report in areas where the firm has a worse track record (Aerts et al. 2008). Several companies that participate in CSR disclosure increase the size of information and over-report CSR investments for impression management. Corporate social responsibility disclosure is a powerful strategy for influencing public perceptions and expectations about the company and charting the way stakeholders perceive the company (Perks et al. 2013). Many companies consider corporate social responsibility disclosure as a system for building general bonds to create a good image and achieve a strong reputation in the market and among customers. Companies may try to use CSR reports to enhance the confidence and perceptions of stakeholders regarding the appropriateness and credibility of the social and environmental actions and activities of their companies, and voluntarily positively disclosing corporate social responsibility practices may lead to misleading and biased reports (Mahoney et al. 2013).

Previous studies confirm that the tremendous diversity and difference in the methods of disclosure of voluntary corporate social responsibility causes uncertainty about the validity of the declared corporate social responsibility activities. Some corporate social responsibility scandals have negatively affected the opinion and perceptions of the public about companies and corporate social responsibility reports, adding to the question marks and ambiguity about the validity and reliability of these disclosures (Du et al. 2010). Stakeholder beliefs are strong self-evident that companies spend more money and time implementing demands for accountability than they are concerned with implementing and practicing social responsibility that will reduce the negative environmental and social effect of their processes. The voluntary nature of social responsibility disclosure provides flexibility to management to selectively disclose information with a positive impact (Panwar et al. 2014).

12.4 Definition and Components of CSR Strategy

CSR strategy is defined as activities that aim to improve relationships with stakeholders, and at the same time, improve community well-being. Thus, the correct corporate social responsibility strategy is one that follows issues that show convergence between economic and social objectives (Carroll and Shabana 2010).

The designing of the basic elements of the social strategy is a necessary component to describe and explain such strategies. In 1987 the four elements of strategy and decision formulation were: (1) market chances; (2) firm resources and proficiency; (3) values and ambitions; and (4) knowledge of commitments to shareholders and society. Thus, the author has added a variable that is consistent with the interests of society among the basic components of social strategies (Filho et al. 2010).

Husted and Allen's (2001) Business strategy tools and concepts are being used to model new CSR strategies. Therefore, CSR strategies must be linked to the following four components: (a) Industry structure (b) The internal resources of the company (c) Company ideologies and worth and (d) the relationship with stakeholders.

CSR is an integral part of the company's strategies, as it is a tool that helps the corporate's management in finding new innovative solutions depend on the anticipations and desires of the stakeholders. The researcher proposes a model of innovation based on social responsibility, asserting that this may be a creative and driving factor in developing competition. The many ways or levels in which competition occurs, such as innovation, resilience, and corporate responsibility groups as well as direct and specific business benefits (Filho et al. 2010).

A firm can use its social responsibility activities and initiatives to improve its competitive position and improve the quality of the surrounding business environment. Focusing on this context by increasing its capabilities in supporting social responsibility activities and contributing in an organized and explicit manner to society. Thus, to maximize the potential of these actions, social responsibility activities must be directly related to their core business (Zadek 2006).

In the foreground, there are businesses strategy per se, the extent to which your company's business strategy takes corporate responsibility at its core. In the middle, we learn engaged learning, community engagement. Society is meant by many different potential actors: civil activists and analysts, labor forces, government and its institutions, and other local and international companies—regardless of who is involved in your work. At the bottom left, we have a lead. What we mean by that is that companies can operate in an unstable region, and drive innovation along with the core corporate strategy and responsibility axis. On the right is the capacity for operational excellence. The distinction is another kind of wise leadership, but not unstable. Excellence is when you know what to do and when to do and do it impressively well—if you like, operational excellence (Filho et al. 2010).

The reality is that CSR and company strategies have been taken into account separately, where social responsibility is engaging to social goals and companies' strategy is engaging in economic aims. However, they have been seen together

concerning maximizing both social and economic outcomes (Husted and Allen 2001).

12.5 CSR Audit

The phrase "social auditing/audit" was used for the first time in the 1950s. In earlier periods, many company owners adopted an external survey system to assess and measure the impact of their companies on workers, customers, and society. In the 1990s, other wide growths of social auditing surfaced, motivated by grew pressure on the firm to illustrate ethical performance, environmental, social, and responsibility. The concentration has been transformed apart from being compared to involving stakeholders to evaluate and consider its broader environmental and social performance. Scholars and practitioners of social auditing have offered numerous definitions of social audit. The first specialized conference on the social auditing systematized by the NEF (New Economics Foundation) in Edinburgh on 30th March 1995, social auditing was defined as the procedure on which it is based organization measures and reports on its performance in achieving its announced community, social or environmental targets. At a wider level, social auditing can be declared as an exercise that allows an enterprise to evaluate its performance in a relationship with society's expectations and requirements (Gao and Zhang 2006).

Generally, the auditing of social is considered a critical operation that a company goes ahead to compute for and optimize its performance, comprised of accounting, auditing, and reporting, planning, and stakeholder participation. It offers machinery for decision-makers to assess the ethical, social, environmental, and planning and simplify stakeholder participation in the ethical, environmental, and social decision-making process of a company. It is seen as a method of managing "rivaling interests and pressures from stakeholders". Depending on the NEF (1996), the report on ethical and social issues will enable firms to enhance relations with stakeholders and build organizational worth, where the general public is becoming increasingly worried about organization influence, objective, behavior, and trust. Nevertheless, it will be wrong to consider social auditing as the only disclosure of a company's social and environmental performance. Gao and Zhang (2006) take the view that the report on social and environmental performance is not just an important disclosure but as well as a process of contact between main stakeholders and the organization. The reporting is a method that stakeholders can discover if the organization takes into account their interests, and over time, whether it has a response in functional expressions. Therefore, the reporting is a piece of the consolidated connection, discussion, education, and decision-making procedure, and not the endpoint in an aftereffect process (Zhang et al. 2003).

Despite the identified role of auditing of social, which has to be discussed in the work context and enterprise kind, the final goal of social auditing is to make a company more transparently and accountable (Hill et al. 1998). The auditing of social is growing conduct and agreeable as a method in which companies are

transferring to become more explicit and outward to stakeholders and the discussion is fully advanced (Rotheroe et al. 2003).

By dealing with a company Traidcraft, the first social auditing model in 1993 was the NEF developed its first social auditing model in 1993. The model was used by diverse organizations containing business companies such as the Body Shop International (UK), BT (UK), Ben & Jerry's (US), Sbn Bank (Denmark). The other models of social auditing have been developed in South Africa, Italy, Scandinavia (called the ethical accounting statement), Mexico, Belgium, and the Philippines. The Traidcraft social audit process includes three main phases. The first phase is to determine the main stakeholders. The second phase is to start a process of consultation with every stakeholder group that permits them in the beginning to putting norms versus which they feel Traidcraft's social effect and moral attitude should be judged, and then to evaluate the company's actions on this basis. This phase demands advisory approaches designed to the characteristics of every stakeholder group, covering concentrate group face-to-face debate, postage questionnaire survey, and group workshops. The third phase is the output of draft social accounts (Gao and Zhang 2006).

Despite decades of development, the current environmental and social auditing practices are still in their infancy, and doubts remain regarding the ability of the accounting profession to deal with these situations, especially when companies' work styles and approaches to social auditing differ greatly among them. Nevertheless, concrete attempts are being made to implement social accountability measures among an increasing number of international companies, and thus the absence of guidance and follow-up in this area has led to the failure of many of these attempts. The lack of a reliable monitoring and auditing system may threaten the benefits and potential gains from the current increase in adopting disclosure practices for corporate social responsibility activities, due to the inability to ensure a high-quality level of corporate social responsibility reports. The most effective method for building a social audit system that can be trusted and relied upon, and to build sound decisions by stakeholders, is to implement specific laws, regulations, and directives, which thus help to ensure adequate data collection as well as a high level of impartiality by the auditor. In addition, it is equally important to ensure that the system will ensure that the information is fully accessible to the stakeholders. Without this guarantee, the benefits of implementing a social audit system would likely not be realized. For social audits and monitoring to be effective and reliable, they must not be concealed and withheld, but rather disclosed and reported appropriately and clearly. Currently, there is a global trend and an increasing awareness of implementing corporate social responsibility legislation, and it seems that now would be the best time to seriously consider implementing social audit legislation with the required impact to ensure a significant development in corporate social responsibility practices worldwide (Rahim and Idowu 2015).

One of the areas of research that focus on the reliability of corporate social responsibility disclosures focuses on the relationship between corporate social responsibility disclosures and the actual performance of corporate social responsibility. By taking advantage of the discretionary nature of the information in the CSR

reports, those with poor performance in CSR who are subject to more exposure to public and regulatory review are likely to disclose CSR information with a selective bias to give an image that they are performing at the best performance in corporate social responsibility. The method of self-polishing is used in the disclosure of corporate social responsibility in an attempt to change perceptions or divert public attention from environmental issues or environmental misconduct of the company to obtain some form of reputational insurance. There is also evidence showing the opportunistic use of corporate social responsibility disclosure by managers to enhance their careers or for another personal gain, rather than promoting the interest of stakeholders (Carey et al. 2017).

12.6 CSR in Turkey

Organizational behavior depends on the decisions taken by the top administration (leadership) that decisions are affected by the values and norms motivated by the societal and organizational education. Through international studies applied by the Environics International (www.environics.com) in 2001, it was discovered that the Turkish consumer appreciates and respects work ethics, business practices and activities, and environmental impacts and the concern for social responsibility appears slightly more than the quality of the brand itself when it is an impression of the firm. Furthermore, the study showed that in middle or low-income countries, corporations' social responsibility depends on data and factors not related to social responsibility. The survey indicates that the standard of education influences the public's expectations about corporate behavior; Society predominantly expects the development of economic performance (job creation) in those countries, and this is harmonious with the results, in Turkey (Habisch et al. 2005).

By reviewing the limited number of research and polls on the principles, moral values and corruption in Turkey and examining the research related to the characteristics of the traditions and culture of Turkey, Habisch et al. (2005) concluded that the observed weakness in social responsibility practices in Turkey probably partly attributable to cultural characteristics and dimensions. By also looking at the weaknesses in the institutional structure, the cultural characteristics of business organizations, and leadership behavior in Turkey, we can acknowledge that the motives and reasons for practicing corporate social responsibility may be for external reasons (multinational corporate social responsibility practices, laws, and regulations imposed on Turkey under International Agreements, INGOs (activism, rational choices driven by the desire to join the European Union, academic research, management education, etc.) It can also be said that the quality culture in Turkish companies is being used as a driver and a driver for corporate social responsibility. They consider corporate governance and corporate social responsibility concepts linked to each other, and as such, it can be noted that the expected impact of change in investor attitudes towards corporate social responsibility is due to the need for

innovation in the field of financial modeling in order to integrate corporate social responsibility.

Through research and personal interviews was applied with firms and stakeholder groups, the Turkish national team reached the following main findings regarding the status and level of corporate social responsibility in Turkey: In the business environment in Turkey, there is insufficient understanding and confusion about the definition of corporate social responsibility and this confusion reflects on actual corporate social responsibility practices. However, the business community side is trying to provide robust efforts to develop business and society. Among these efforts are sponsorship activities, as well as social projects that are organized with NGOs (Gocenoglu and Onan 2008).

Many empirical studies tried to examine whether CSR activities or disclosure benefit the firm or not. Yilmaz (2011) sought to verify whether there is any impact on corporate social performance (CSP) from financial performance and vice versa. The data source for CSP is the annual reports. In the absence of CSP ratings in Turkey, despite the claims of the European Union and the United States of America. His findings were, disclosure of corporate social responsibility activities is still at very low levels. Work must be done to enhance awareness of corporate social responsibility and sustainability, and firms of all types and sizes must pay attention and play more active and effective roles. Likewise, disclosure of those activities is very respectful of them. In the same goal, Feneir (2019) aimed to explore the nature and extent of CSRD practices in banks listed in Borsa Istanbul, and examine the effect of categories of CSRD (Environmental, Labor Practices, Human Rights, Society and Product Responsibility) on the firm value. The research found evidence of CSR engagement among listed banks, where the most disclosed categories were Society and Labor Practices while Product Responsibility was the lowest disclosed. The trend analysis findings suggested that CSRD practices as a whole or as categories unstable over the 5 years of this research. With regard to testing the impact of categories of CSR disclosure on the value of the firm, findings suggest that there is no significant relationship, in other words, banks listed in Borsa Istanbul do not experience benefits from participation and disclosure of social responsibility information in all categories.

Concerning consumers, the consumers' positive perceptions of corporate social responsibility activities influence their purchasing behavior towards the company's products and services related to these activities. For this, it can be suggested that producers and firms in Turkey should try to discover social, environmental, and educational issues that require actions and concerns from companies and develop corporate social responsibility activities around these issues. In addition, firms should look to corporate social responsibility issues as part of their overall strategies (in the short term and the long term) (Mermod and Idowu 2014).

European Union in its report "Turkey Sustainability Reporting National Review Report" (2016) identified that in the past 2 years, significant and positive changes have been achieved in the level of awareness of corporate social responsibility in Turkey. Within the project, the survey was examined from 2013, and it can be said that the rate of 52.9% of the level of awareness rose to 95.5% in the activities for the

year 2015. It is assumed that the works carried out within the scope of the last semester project, the media service of CSR experts in trade unions and companies, and the honoring and networking parties were effective in achieving this positive achievement. It can be seen that this positive development of awareness—as we will see in the future analysis—that was observed in the overview is reflected independently of the company's ownership structure, origin, and size, and the information has a nature that affects everyone (EU 2016).

12.7 Conclusion

In this chapter, we have identified a set of definitions and a brief description of the history of social responsibility practices and their disclosure, as well as explanations of the most basic principles agreed upon. We found out that CSR is a moral and national sense of social contribution toward the environment and society that is represented by people who worked in the organization or those living in society and the surrounding environment. Besides, firms need to take a comprehensive and integrated approach to build a CSR system that allows them to instinctively behave in a socially responsible way, in exchange for exploiting the material and human resources of society and making profits.

The chapter explains several theories that call for disclosure of social responsibility information. It also showed some models and techniques used to evaluation the disclosure of CSR and its most important dimensions according to the literature, as well as giving a general overview of the challenges of CSR practices and its disclosure and the definition of corporate social responsibility strategies and the most important components. The chapter discussed, the audit of Corporate Social Responsibility, together with an overview of the reality of CSR practices in Turkey as an example.

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Chapter 13
Sustainability in Full Service Carriers Versus Low Cost Carriers: A Comparison of Turkish Airlines and Pegasus Airlines

Mustafa Kemal Yilmaz and Aslihan Kose

Abstract Continuous growth and use of natural resources bring sustainability into question in the aviation industry. Airlines are expected to implement sustainable business strategies to reduce detrimental environmental and social effects in their operations. Strategies in technological improvements may be strong solutions to enhance sustainability. These include environmental-friendly aircraft design, use of alternative fuels, low emission engine design, advanced air traffic management procedures. This study explores how two airlines, Turkish Airlines, as a Full Service Carrier (FSC), and Pegasus Airlines, as a Low Cost Carrier, have addressed sustainability in their business models over the period of 4 years (between 2014–2018). The results reveal that both companies have performed well in the strategic integration of sustainability by substantially investmenting in new fleet and technological advancements, that aimed at reducing emissions and fuel consumption. While Turkish Airlines has publicly available policies and regularly publishes sustainability reports transparently disclosing its progresses, Pegasus Airlines does not follow similar approach in addressing and communicating its sustainability activities to the shareholders and stakeholders. Thus, Turkish Airlines' strategies leans more strongly towards sustainability than Pegasus Airlines.

Keywords Sustainability performance · Environmental performance · Governance performance · Air transportation · Sustainability reporting · Full service/low cost carriers · Turkish Airlines

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13.1 Introduction

Air transportation is an integral component of the global economy, and fosters economic growth with its dynamic nature. The industry has grown rapidly in the last couple of decades with the enhancements in technology. It provides 10.2 million jobs worldwide. Airlines carried 4 billion passengers in 2018 compared to 2.97 billion passengers in 2013. They also carried almost 62 million tons of freight, adding USD 704 billion to global gross domestic product (GDP). The industry created 11 million indirect jobs through the purchase of services and goods in the airline business (Air Transport Action Group (ATAG), 2018).

Aviation industry in Turkey has also shown a rapid growth over the last decade. In 2017, the industry generated one million jobs, carried 82.8 million passengers and contributed 44.7 billion to GDP. Over the last decade, the flight traffic, including overflight, has increased by 1.89 times, the number of passengers carried has increased by 2.45 times and the cargo carried by 3.27 times. The number of domestic and international passengers (including direct transit) increased from 181,437,004 in 2015 to 210,947,639 in 2018. Turkey is ranked as the tenth in terms of total services of revenue tonne-kilometers and eighth with regard to international services of revenue tonne-kilometers (International Civil Aviation Organization (ICAO) 2018).

This growth pattern in global and local basis has pushed aviation industry to take more environmental-friendly measures to protect natural environment, to meet expectations of stakeholders, and to improve welfare of society. Sustainability in aviation is quite important since greenhouse gas emissions and carbon dioxide are the main causes of global climate change. In fact, global connectivity by air transportation creates an environmental challenge. Around 859 million tons of CO_2 were emitted in 2017 by civil aviation which is roughly 2% of manmade carbon emissions. While airlines fulfil their business responsibilities by capitalizing on growth opportunities, they have also to be sustainable. This is not an easy task. Limiting air traffic is not a solution because governments do not want to reduce air traffic (Upham et al. 2012).

Thus, aviation industry should keep a balance between the dimensions of sustainability (environmental, social, and economic) and its missions (accessibility, safety and enhanced mobility) by providing services in line with sustainability principles. They have to implement four pillars strategy; new technology developments (including sustainable aviation fuel), more efficient operations, better infrastructure utilization, and a global market-based measure (International Air Transport Association (IATA), 2019). They should adapt technological enhancements to promote sustainability such as environmental-friendly aircraft designs, low emission engine design, advanced air traffic management procedures, alternative energy resources, reducing greenhouse emissions, efficient process management, CO_2 emissions reduction, and fuel savings.

However, there are several categories in the aviation industry and the sustainability policies changes from one airline to another depending on which category it operates. This study mainly focuses on two categories; Full Service Carriers (FSC)

and Low Cost Carriers (LCC). FSC are known as national flagship airlines and their main business is to carry passengers, cargo and do the maintenance. LCC are designed to have a competitive cost advantage over FSC and are known as low fare airlines. This study examines and compares sustainability performance of two airline companies operating in Turkey, Turkish Airlines as a FSC and Pegasus Airlines as a LCC by employing a case study approach. Available data from sustainability annual reports, sustainability performance indicators and publicly available information of companies would be utilized. We choose these two airlines because they are pioneering in both local and global market, and they are also traded in Borsa Istanbul.

The rest of the study is structured as follows. Section 13.2 provides a background for sustainability in aviation industry and business models. Section 13.3 presents data, and methodology. Section 13.4 discusses empirical findings, and the last section concludes.

13.2 Sustainability in Transportation and Airlines Business Models

13.2.1 Sustainability in Transportation

Current global challenges such as climate change, degradation of land structure and biodiversity lead to emissions and waste of resources. In this frame, sustainability issues have as much impact on biosphere and biodiversity as they have on people (Tukker et al. 2008).

Sustainability has mainly three components: economic, social, and environmental. It is an economic process that reduces negative social and environmental impacts. Companies should incorporate social and environmental values into their business and to their interactions with stakeholders to keep energy, material and pollution density of the operations within the sustainability boundries to contribute to natural ecosystem.

Green economy plays an important role in implementing sustainability policies. The United Nations Environment Program (UNEP) defines green economy as the economy that enables the development of human life and social equality, while reducing environmental risks and ecological famines (UNEP 2011). If the systems that add value to the ecosystem are widely used by the industries, resources will be used more efficiently and will be less harmful to the environment (Chang et al. 2017).

The relationship between sustainability and transportation is important to avoid potential environmental damages. Thus, the principles for sustainability in transportation have to be set up by a transparent policy (Sahan 2017). Experts treat standardization in reduction of emissions, integration of technologies and ensuring proper connection as basic strategies for sustainability in transportation (Aransson

Table 13.1 Dimensions of sustainability in transportation

Factor	Definition
Environmental	Integration of environmental concerns to transportation
Social	Improving quality of life, standard of living, and reducing poverty
Economic	Cost-effective transportation that achieves the highest social return on natural and physical capital
Financial	Creation of sufficient funds to cover operating and capital costs in long run

Source: Litmann (2009)

and Brodin 2006). As Table 13.1 below shows, sustainability in transportation is defined in four dimensions (Bartle 2006). The aim is to reduce environmental deficiencies, while executing transportation activities (Martins et al. 2019).

Studies that have investigated the relationship between transportation and sustainability usually refer to the effects of highway, maritime and air transportation on the atmosphere and human health. Yang and He (2016) examined the impact of various modes of transport on air pollution and human health in China and found that the health losses of residents in areas where air pollution was intense was high. Camlıca and Akar (2014) examined sustainability efforts of 29 firms operating in the logistics industry on sustainable transport and identified that companies demonstrate sensitivity to environment by employing various energy policies such as biodiesel use, solar power generation, training for driving techniques to reduce fuel consumption. Routing efforts towards minimizing distances and vehicle traffic contribute to sustainability as it creates an environmental benefit and a cost advantage by reducing fuel consumption and CO_2 emissions.

Kilkis (2016) examined major airports for sustainability and developed airports sustainability index. Similarly, he defined a sustainable aviation index by combining the indices obtained for airlines. The study contains important contributions not only in terms of enlightening social indicators, but also in terms of unified index guiding relevant institutions. Aydın et al. (2015) made exergy analysis on the parts of a turbofan engine and identified losses in the various parts of the engine. Since the exhaust gases of the engines are thrown directly into the atmosphere, it is not possible to recover the exhaust they contain. Therefore, they identified that the recoverable exergy rate is not so important in the exergic sustainability analysis of aircraft engines. Romero and Linares (2014) argued that increasing exergy efficiency is a good process, but it may not always help achieving sustainability. Moreover, accurate determination of the reference environment is of great importance, especially if the analysis involves chemical exergy in order for the analysis to give reliable results.

Tona et al. (2010) indicated that different environmental conditions used during exergy and thermoeconomic analyses made for a turbofan engine did not affect engine efficiency calculations much, but changed the distribution of irreversibilities between parts of the engine. This may affect component-based improvement efforts. Also, since aircraft engine operates in different environmental conditions during

flight, performing the analyses in changing conditions may make the results more reliable (Gogus et al. 2002).

13.2.2 Sustainability in Aviation Industry

Aviation industry provides various services and integrity for other transportation systems. The main fields are aerospace industry, airline operators, airports and suppliers. The social, economic and environmental dimensions created by airports directly affect urban, regional and national sustainable growth. Changes in business models in air transportation cause an increase in traffic density. This physically challenges airports to meet the demand in air traffic. They have to develop their physical capacity and this may lead to certain problems in terms of sustainability.

The market players in aviation industry have to keep a balance between the targets of transportation (accessibility, safety, and enhanced mobility) and the dimensions of sustainability (environmental, economic, and social). These dimensions may sometimes be in conflict. Thus, airline and airport companies should implement appropriate policies in developing new technologies, and improving their operations to increase sustainability (Lutte and Bartle 2016). Table 13.2 shows potential adverse effects of air transportation system on sustainability (Janic 2016).

Over the last decade, increasing demand in air transportation has also significantly affected airports and has lead to a capacity increase to meet the demand. Although the expansion of airports matter it is important to decide where to build them for sustainability. The nature of the hub and spoke system adds pressure for expansion at key airports and raise some environmental concerns such as increased noise, land contamination, impact on surface traffic, ecological effects and disruption of habitats. To avoid these problems, airport companies should take precautions such as using more efficient lighting, heating and cooling tools, i.e. solar panels, electrically powered vehicles and wind turbines (Budd et al. 2013). In this respect, the main sub-sectors that should be analyzed, in the aviation industry are; airframe and flight, aircraft propulsion systems, aircraft auxiliary energy systems, airports, air traffic

Table 13.2 Possible adverse effects of air transportation on sustainability

Economic effects	Environmental effects	Social effects
Facility costs	Climate change	Community liability
Barriers to mobility	Noise	Mobility disadvantage
Users' costs	Air pollution	Esthetic
Congestion	Water pollution	Inequity of impacts
Non-renewable resources depletion	Non-renewable resources depletion	Effects to human health
Accident damages	Damage to habitat and loss	Community cohesion

Source: Table data by authors

control and aircraft ground services, air vehicles except aircrafts, military aviation, recycling in aviation (Alpman and Gogus 2017).

The aviation industry and air transport business have international characteristics. Therefore, the problems in sustainability can not be solved by only local solutions. Technological improvements may be an important step. This may include environmental-friendly aircraft design, use of alternative fuels, low emission engine design, and advanced air traffic management procedures by modern navigational aids. For example, IATA emphasizes on the importance of reducing greenhouse emissions (IATA 2013). Also, more flexible and efficient flight paths that have performance-based navigation, less fuel consumption and operating costs, less emissions, little or no delays can be created. ICAO also sets policies and standards to fulfill this vision, *"to achieve the sustainable growth of the global aviation system"* (ICAO 2016).

On the other hand, aviation industry is trying to decrease the level of aircraft noise exposure. Aircrafts have become quieter, thanks to innovative aircraft technologies, optimized takeoff and approach procedures, and quieter engines. Active noise abatement by reducing noise caused by aircraft and passive noise abatement by relieving local residents are main focus points. For example, the noise produced by an aircraft has been reduced by 30 dB or 88% over the past six decades (Bld 2019).

The aviation industry shows very fast technological and structural changes. On the one hand, large-capacity, fuel-saving, low-noise and emission-level aircraft are developed, on the other hand, the production of small-capacity aircraft that are more suitable for regional transportation continues to grow rapidly. There have also been good progresses in the aviation industry for sustainability. Over the last 40 years, fuel use has been reduced by 70%. According to IATA, fuel burn per passenger kilometer has declined by half since 1990 (McKinsey and Company 2020). The aviation industry is the pioneer of e-transformation. Not only the tickets, but also the waste of paper in records keeping is minimized. However, the routes of aircraft, waiting times, lost time at airports, insufficient traffic controls are still problems to be solved. Despite all efforts, fossil fuel use continues to increase and CO_2 emissions can not be reduced very easily to the optimal level.

CO_2 mitigation efforts focus on four elements; technological improvements in aircraft, development of aviation infrastructure, engines and systems, optimisation of operating procedures and, market based measures (including charges, taxes, emissions trading and agreements). Domestic flights greenhouse gas emissions like CO_2 are covered in national regulations, while international flights are subject to the ICAO authority. ICAO Assembly established a target of achieving Carbon Neutral Growth after 2020,and an additional reduction of CO_2 emissions by 50% in 2050 (ICAO 2013) (Fig. 13.1). The key factor in this mitigation plan is the availability of biokerosene at great amount, to be initiated from the next decade. In spite of in-depth research in liquid hydrogen, fuel cells or electric power, the use of an alternative energy source for commercial use seems improbable at least during the next decades and viable applications are now centred in drop-in fuels. Biofuels and technological innovations also aim to foster the reduction of CO_2 use (Benito and Alonso 2016).

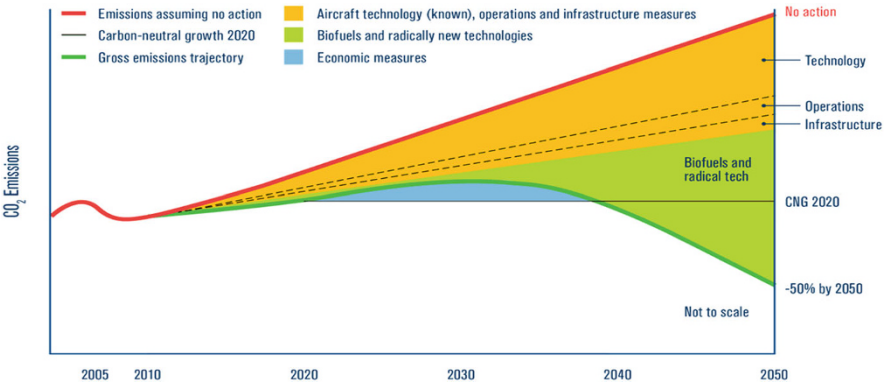


Fig. 13.1 ICAO plans to mitigate aviation climate change contribution (IATA 2013)

Table 13.3 Statistics of the aviation industry (2014–2017)

	2014	2015	2016	2017
Jet fuel used by operators (Liters)	273 Bn L	294 Bn L	278 Bn L	341 Bn L
Airlines paid for fuel (USD)	210 Bn	181 Bn	226 Bn	149 Bn
Average aircraft occupacy	79%	80%	80%	81%
Tons of carbon dioxide (CO_2)	688 Mn	781 Mn	738 Mn	859 Mn

Source: ATAG (2014, 2016, 2018)

Modern aircrafts are 75% quiter than the first ones and advanced new models maintain this declining trend. Each new generation decreases its noise footprints. This is important because increasing air traffic and number of aircrafts affect people who live under flight paths. Nearly 2.5 million people were exposed to noise in 2014 in European major airports, and this number is forecasted to increase by 15% from 2014 to 2035 (European Union Aviation Safety Agency 2016) (Table 13.3 and Fig. 13.2).

There are few studies on sustainability in airlines companies. Kotze (2017) investigated Ryanair as a LCC, and Scandinavian Airlines (SAS) as a FSC. He found that Scandinavian Airlines could learn from Ryanair in many ways of its low-cost strategies and this potentially gives benefit to SAS, such as minimization of services, increased focus on digital services, and less waste generation due to maximizing profit. However, Ryanair's low-cost strategy leads to minimizing attempts to address sustainability in its business models. Ryanair could also learn from SAS that conscious efforts towards sustainability need to be made to improve its environmental management and sustainability locations. Another study investigated the Global Reporting Initiative (GRI)-based sustainability reporting and its effect on firm performance in the aviation industry and showed that leverage and firm size are positively associated with sustainability reporting, while growth, profitability and free cash flow per share do not have significant impacts on sustainability reporting (Karaman et al. 2018).

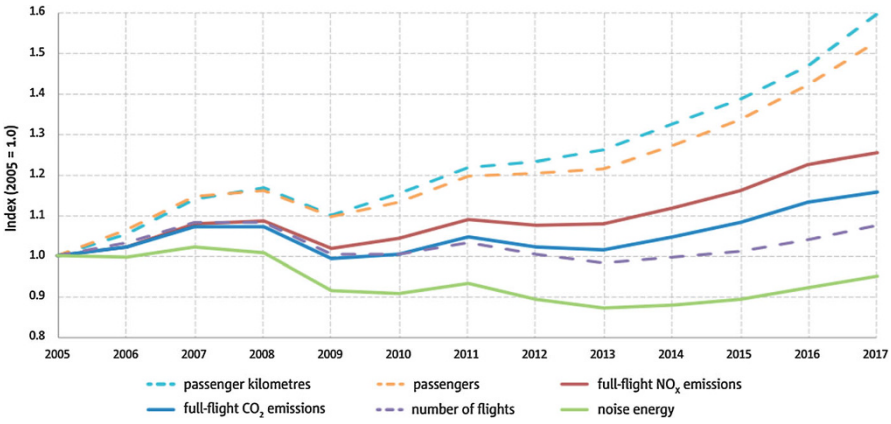


Fig. 13.2 Noise and Emission from 2005 to 2017 (European Union Aviation Safety Agency 2019)

Fleet age also affects environmental emissions and airline companies concentrate on reducing the average fleet age to be more sustainable. For example, Delta Airlines is renewing its fleet with approximately 25% more fuel efficient aircrafts. The average fleet age of Delta is 15.2 years that is between those of its competitors, American Airlines (11.6 years) and United Airlines (16.1 years). Thanks to the use of advanced aircrafts, LCCs like Europe's Wizzair highlights that its unit emissions are half compred to that of their competitors. With the orders for 269 more aircrafts, average fleet age of Wizzair is 5.7 years.

Climate change is a fundamental issue for the aviation industry. Not only does aviation affect climate change, but also the impact of climate change on the aviation industry is important. Greenhouse gas emission is one of the causes of climate change. The aviation industry needs to control the environmental effects on its operations. Shifting wind patterns, stronger jet stream wind, more extreme weather, warmer air and its results on take-off weigh restrictions and rising sea levels for costal airports may harm the industry. Besides these environmental impacts, social awareness for climate change has also increased over the last decades. Consumers have become more sensitive to climate change and its environmental impacts. Governments and multinational organizations are publishing new policies on CO_2 and sustainable aviation fuels. Customers unease are forcing them to make changes. The survey conducted by McKinsey and Company (2020) on flying and climate change shows that half of the partipants are really worried about climate change and young generation is more concerned (Fig. 13.3).

13.2.3 Business Models in Air Transportation

Airline companies are classified into different categories by ICAO such as local versus regional, public versus private, passengers versus cargo, full service carrier

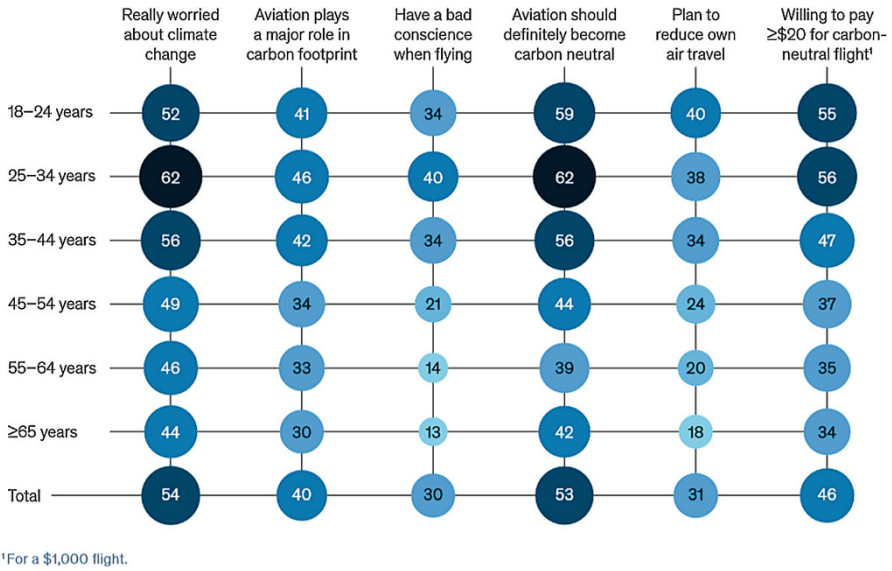


Fig. 13.3 Attitudes toward carbon-neutral flying, by age group, % of respondents (McKinsey and Company 2020)

versus low cost carrier airlines according to the type of operation, type of traffic they carry, their role in national or international markets or the scale of their operations, marketing and economic issues, and ownership structure (ICAO 2004). In this study, we will examine two prevalent business models; Full Service Carriers (FSC) and Low-Cost Carriers (LCC) in terms of sustainability performance.

13.2.3.1 Full Service Carriers (FSC)

FSC operate without compromising a particular service quality. They compete with other airlines in all passenger market segments and on all routes. They usually reach customers through global distribution systems and have complex price and service structures. One of their most prominent features is the use of revenue management to balance the fixed capacities of airline businesses and to maximize revenue against changing demand. FSC strive to achieve a global flight network by using hub and spoke network structures. Their fleet structures have a wide range from regional aircrafts to large-bodied, over-passenger and long-range planes according to their network structures and the lines they serve.

The products of FSC have high standards such as on board free catering and refreshment, comfortable seating, free newspapers or magazines and entertainment in flight. They usually use travel agencies to sell tickets. FSCs offer mainly continental and intercontinental flights and many of them are national flag carriers such as Turkish Airlines, Lufthansa, British Airways (Rozenberg et al. 2015).

13.2.3.2 Low-Cost Carriers (LCC)

Low-Cost Carriers (LCC) provide low-priced service to customers as their key marketing strategies. The concept of LCC refers to give up some of the services provided by traditional carriers, reduce the costs and offer cheaper prices to their customers. Although there is no specific definition for LCC, these are some common features (Koch 2010):

- Frequent use of aircraft,
- Standardized fleet configuration,
- Low ticket fares,
- Reduced costs by the abolition of services that generates no revenue,
- Direct flights from point to point at short distance,
- Reduced labor per aircraft.

In 2018, global aviation network carried 4.3 billion passengers on 37.8 million scheduled departures. It is estimated that this figure would nearly double by 2030. Over the past 25 years, LCCs have had a significant role in this enlargement, and are expected to continue doing so. In 2018, 1.3 billion passengers were carried by LCCs, this figure was equal to 31% of the world total figure (ICAO 2019a, 2019b). LCCs are now becoming a phenomenon. They can fundamentally change the competitiveness and market structure of airline industry, extending the effects beyond a core market segment limited to recreational passengers or a particular region. As LCCs grow, more competition is expected, especially in markets with high traffic density. There have been 242 LCCs since 1960s, but only 109 of them are active today. According to Center for Aviation (CAPA), LCCs had a share of 29% of all seats worldwide in 2018. This figure was 18.4% in 2008. Short/medium haul routes take higher part from this share.

There are also other differences between FSC and LCC. One of these is the flight refund or rebooking methods. It is easy to make cancellation or changes for FSC tickets, while changes are very limited for LCC. Refund policy is comprehensive for FSC tickets, but very hard to have refund for LCC tickets. Also, LCC have generally high seat denseness but, no free catering service. Generally, they do not have any possibilities to use connecting flights from carrier's network or another airlines' network. FSC typically have higher unit revenues than LCC. However, it is not clear whether they achieve higher margins. Table 13.4 shows characteristics of FSC and LCC (Rozenberg et al. 2015).

When regional airlines, FSC and LCC are compared according to unit cost for an average trip length, regional carriers have the highest unit cost, followed in decreasing order by FSC and LCC. Figures 13.4 and 13.5 shows the CASK versus average trip lenght and pitch lines for regional, FSC and LCC business models.

When the global growth of the models within regions are compared, one may see that LCC are broadening much more rapidly than FSC. LCC had 25% of intra-regional seat capacity, equaling to a gain of 8 percentage points (ppts) in 2009. Annual intra-regional seat capacity of LCC has doubled over the last 9 years and

Table 13.4 Operational characteristics of FSC and LCC

Characteristic	FSC	LCC
Generic strategy	Differentiation	Cost minimization
Scale	Large	Small
Market	In competition with FSCs Differentiation with class Flight flexibility High service image Using main airports Comprehensive in-flight service	Cheap sector in the market Segmentation by booking time Little flexibility Basic service quality Outsourced ground services and no catering
Operational and network model	Hub and spoke network Multiple hub and spoke linking with feeder routes Capacity utilization (around 60%) Different aircraft type & engines	Point to point Mainly short haul High capacity utilization (about 70–80%) Uniform aircraft type
Inventory management	Complex reservation system Using travel agents	Simple reservation No travel agents

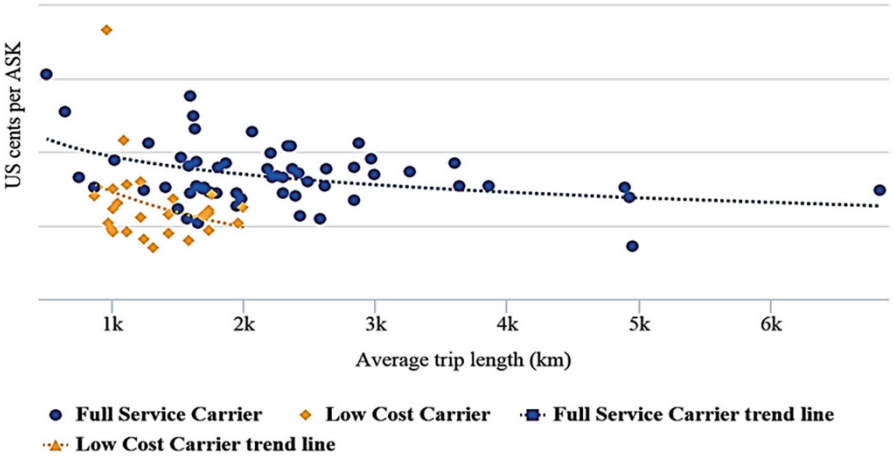


Fig. 13.4 Cost per available seat kilometer (CASK, USc) versus average trip length, 2016 (CAPA 2018)

increased from 753 to 1564 million, whereas capacity of FSC has increased by 41% (Fig. 13.6).

When the global growth of the models to/from regions are compared, LCC capacity across regions has nearly quadrupled over the last decade from 26 million to 101 million on a low base, while FSC capacity increased by 61%. LCC had just 6% of seat capacity that were equating to a gain of 7 ppts between regions in 2009 (Fig. 13.7).

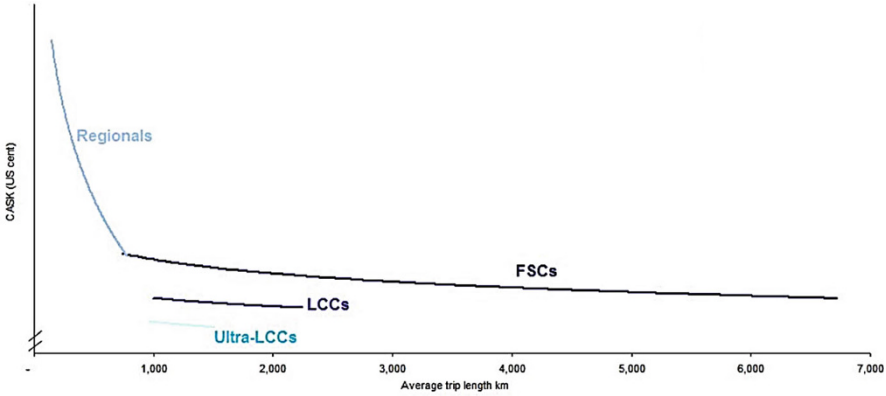
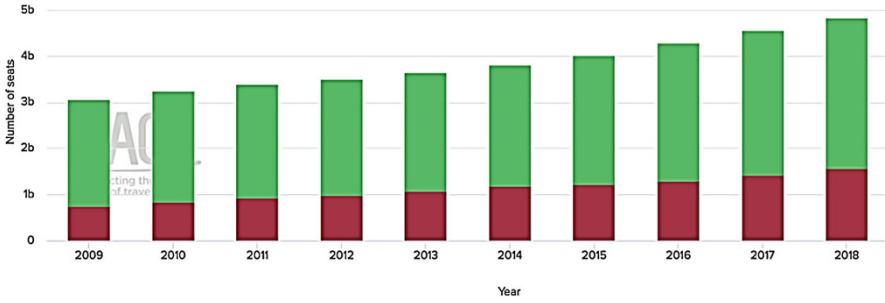
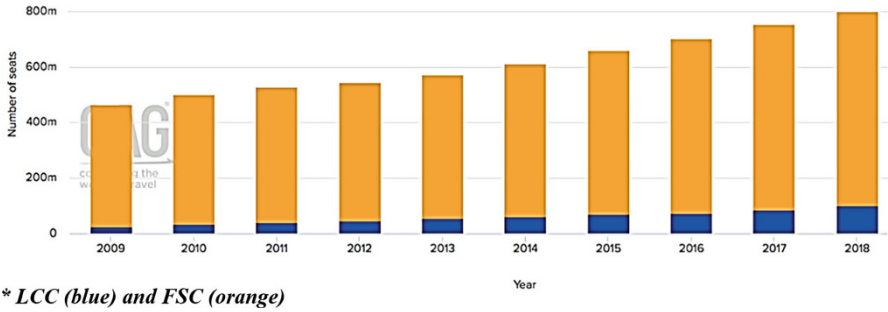


Fig. 13.5 CASK (USc) versus average trip lenght and pitch lines for Regional, FSC and LCC business models (CAPA 2018)



** LCC (red) and FSC (green)*

Fig. 13.6 Global LCC and FSC seats within regions from 2009 to 2018 (CAPA 2019). * LCC (red) and FSC (green)



** LCC (blue) and FSC (orange)*

Fig. 13.7 Global LCC and FSC seats to/from regions from 2009 to 2018 (CAPA 2019). * LCC (blue) and FSC (orange)

13.3 Data and Methodology

13.3.1 Data

There are very few studies on comparing sustainability of FSC and LCC airline business models. We aim to bridge this gap by studying sustainability performance of one FSC and one LCC operating in Turkey, namely Turkish Airlines and Pegasus Airlines. We chose these airlines because both companies are pioneering in local and global markets, and they are traded in the stock exchange (Borsa Istanbul). Their financial and non-financial information are publicly available both on their websites and Public Disclosure Platform (PDP).

We used secondary data to conduct the analysis. We collected the data and qualitative information from the websites and official reports of the companies, Thomson Reuters Eikon database, and other relevant databases. However, for Pegasus Airlines, due to the lack of sustainability reports, we examined Pegasus investor relations' webpage to find out information on sustainability attributes, and Carbon Disclosure Project (CDP) reports and certificates on environmental matters. We also refer to the health and safety, quality, and environmental policies of Pegasus Airlines to get information.

13.3.2 Methodology

We utilized case study approach in our analyses. Basically, we try to answer two questions. The first is *"How can we define the environmental performance and key performance indicators of Turkish Airlines and Pegasus Airlines as a FSC and LCC?"*. In this regard, we reviewed the profiles and reports of both companies for their environmental and sustainability performance; and we refer to a number of key environmental indicators. Although the data for these indicators are available for Turkish Airlines, those of Pegasus Airlines were incomplete. The second question is *"How does Turkish Airlines as a FSC and Pegasus Airlines as a LCC execute sustainability in their strategies and business models?"*. We used various sources ranging from research papers, journal articles, company websites to financial, sustainability and annual reports to answer this question.

13.4 Empirical Findings

13.4.1 Turkish Airlines

13.4.1.1 A General Outlook

Turkish Airlines is the national flag airline of Turkey and has flights to 126 countries with a fleet consisting of 350 aircrafts. It has an average fleet age of 8.3 years. According to BrandFinance Top 50 Airlines Report, the brand value reached USD 1.74 billion in 2019, while it was USD 1.6 billion in 2012 (Turkish Airlines 2019). Total passengers carried have increased from 61.2 million in 2015 to 75.2 million in 2018.

Turkish Airlines has 26,739 employees, with 46% of them females. In 2018, it had USD 12,855 million sales volume, generating USD 753 million net profit. It carried 1,412,423 tons of cargo. The company prevented 93,267 tons of carbon dioxide emissions and achieved 0.2% fuel efficiency (Turkish Airlines Sustainability Report 2018).

13.4.1.2 Business Model of Turkish Airlines

Turkish Airlines adopts Full Service Carrier as a business model. The company offers free catering and refreshment on board. It offers services for Business Class and Economy Class passengers. Applications allow passengers without baggage to download their boarding pass from the internet and buy tickets in call centers and on mobile applications. The company aims to maintain the growth above industry averages, minimize accidents, provide the best service, have unit costs equivalent to LCC, decrease sales and distribution disbursement below the industry averages. The company also aims to have loyal customers who are able to make their own flight reservation, ticketing and boarding. Another aim is to become an airline that embraces the principles of commercial entrepreneurship that establishes business for Star Alliance partners and principles of modern governance that favor the interests of its stakeholders and shareholders.

The mission of Turkish Airlines is to be a leading European air carrier and a globally active airline, preferably with its variety of products, service quality, flight safety, reliableness and competitiveness (Turkish Airlines 2019). The company is committed to implement sustainability acitivities as a natural part of its business and operations. The company conducts performance reviews every year and determines action plans for the future. The sustainability program of Turkish Airlines is based on four pillars; management, economy, environment and social factors:

- Management pillar covers corporate governance, business ethics and behavior and risk management.
- Economy includes contribution to GDP, job creation, public economy, export, trade, tourism, connectivity and local development in flight destinations.

- Environment consists of climate change, fuel efficiency, greenhouse gas emissions, sustainable biofuels, fleet modernization, waste, noise and water.
- Social pillar has corporate safety, flight safety, customer expectations, and value creation for employees.

13.4.1.3 Key Environmental Indicators

As key environmental indicators, we examine carbon emissions, fuel saving, noise emissions and Environment Pillar Score of Turkish Airlines (Table 13.5).

13.4.1.3.1 Carbon Emissions and Fuel Savings

Turkish Airlines has released carbon emissions figures in sustainability reports since 2014. Table 13.6 gives the tons of CO_2 prevented and fuel saved from 2014 to 2018. The company has managed to reduce its carbon emissions over the years and has made progress in reducing fuel consumption. From 2014 to 2018, 551,327 tons of CO_2 were prevented and 175,119 tons of fuel saved. This is due to enhancements in aircraft fleet and strategic decisions on fuel efficiency. The company aims to decrease fuel amount consumed per ton-km by 5% until 2025 by normalization of the Available ton-km (ATK) weight and range. The company also plans to reduce 130,000 tons of CO_2 emissions.

Turkish Airlines has also started collaborating with IATA Green Team. The company monitors and measures fuel efficiency. Besides, Turkish Airlines signed a non-binding letter of intent with the Solena Fuel Corporation in 2013. In 2018, it became a partner of the Renewable Jet Fuel project prepared by Bosphorus University in line with the target of reducing the carbon emission (Turkish Airlines Environmental Performance Report 2018). In 2016, the company saved 43,975 tons fuel and prevented 138,522 tons carbon. With this performance it was ranked

Table 13.5 Tons of CO_2 prevented and tons of fuel saved from 2014 to 2018

Year	Tons of CO_2 prevented	Tons of fuel saved
2014	86,916	27,592
2015	85,639	27,187
2016	138,522	43,975
2017	147,283	46,757
2018	93,267	29,608

Source: Turkish Airlines Sustainability Report 2014–2018

Table 13.6 Fuel consumption and greenhouse gas emission

	2015	2016	2017	2018
Fuel consumption (million tons)	4.3	4.6	4.9	5.3
Greenhouse gas emissions (million tons of CO_2 e)	13	15	15	16.7

Source: Turkish Airlines Sustainability Report (2018)

at the fourth place among 20 international airline companies that have flights to Amarica/Canada and Europe by The International Council on Clean Transportation (ICCT).

Turkish Airlines performed 20% more efficient flights compared to 2008 figures with its attempts to enhance fuel efficiency and diminish carbon footprint to preserve the environment and combat climate change (Turkish Airlines Sustainability Report 2018). The company's fuel policy is based on three pillars: improvement of the infrastructure, optimization of the operations and invesments in new technologies. Decrease in aircraft weight lessens fuel consumption and carbon emission. In this respect, 3000 light nets and 2000 light pallets were used. SKYLIFE magazine resorted with releasing lesser paper issues, tablet usage in cabins were provided, steel brakes were changed with carbon brakes and 2614 baggage containers were substituted for composite containers. Despite these efforts, prevented CO_2 and saved fuel was less than previous years in 2018 due to increasing aircraft number, cargo weight and flights. Table 13.6 shows the fuel consumptions and greenhouse gas emissions.

Turkish Airlines ordered 92 Airbus (A321 NEO) new generation aircrafts and 75 Boeing (B737-9 MAX and B737-8 MAX) which are equipped with 15% higher fuel efficiency rate (Turkish Airlines Sustainability Report 2018). A321 neo type has 15% less consumption than A321 type. Furthermore, Nitrogen oxide (NOx) emissions of these new generation environmental-friendly aircrafts are approximately 50% below the ICAO Aviation Environmental Protection Committee (CAEP) limits (Turkish Airlines Environmental Performance Report 2018). With the global warming issue becoming more important, ICAO has set three targets to reduce emissions in aviation industry: Achieving an annual average fuel efficiency enhancement of 1.5% from 2009 to 2020, to keep net CO_2 emissions constant in 2020 and, cutting emissions to 50% below 2005 levels by 2050. Turkish Airlines is engaged with these targets by its project management process and employs "Block off-Block on" method (Turkish Airlines Environmental Performance Report 2018).

13.4.1.3.2 Noise Emissions

There is no statistical data for Turkish Airlines on noise emissions emitted at various airports or at the home base airport in Istanbul. The company is committed to minimizing noise emissions according to its environmental policy. It has stepped up its goal towards noise reduction with an average fleet age of 8.2. Further, new-generation aircrafts are ordered and they will be delivered by 2023. The procedures are met in pursuant with international and national aviation requirements on noise reduction. The company uses Noise Certificate which enables it to check the noise level limits in the course of take-off and landing at the airports it operates (Table 13.7).

Table 13.7 Turkish Airlines' fuel saving practices

APU policy (Fuel)
APU policy (Maintenance)
Engine out taxi-in
NADP2 (Noise abadement departure procedure)
Reduced flap takeoff
Reduced flap landing
Idle reverse on landing
Engine out taxi-out
Commander/fueller extra fuel
CDA (Continuous descent approach)
Alternate selection
Dispatcher/ops extra
Route optimization
ZFW (Zero fuel weight plan vs. actual)
Statistical taxi fuel planning
Reclear dispatch
Aframe/engine drag/aerodynamics/wash/paint
Aircraft operational flight documents (EFB)
Potable water optimization
CG optimization

Source: Turkish Airlines Environmental Performance Report (2018)

Table 13.8 Turkish Airlines' environment pillar score

Environment pillar score				
2014	2015	2016	2017	2018
58.61	49.54	49.53	57.84	45.40

Source: Thomson Reuters Database

13.4.1.3.3 Environment Pillar Score

Sustainability has three dimensions: social, environmental and economic. The environmental dimension means that the company protects natural resources and minimizes damage to the environment or operates without harming the environment (Seker 2020). Environmental Pillar Score is a weighted average score of emissions, environmental innovation and resource use category scores (Nikolova 2019). The environment pillar score of Turkish Airlines has diminished from 58.61 in 2014 to 45.40 in 2018 (Table 13.8). The reason for the decrease may depend on many variables since Environmental, Social Governance (ESG) scores have dynamic nature and the sub-categories are unknown. The scores are based on public data which may not provide enough information for all indicators.

13.4.1.4 ESG Combined Score and CSR Strategy Score

As we stated before, sustainability has three dimensions. The economic dimension is realized by the firm's robust financial structure and profitability. Social dimension consists of improving working conditions of employees such as health, safety, salary, working time and taking into account the quality of life of society, future generations and the customers. The environmental dimension means that the company protects natural resources and minimize the damage to environment (Seker 2020).

ESG performances of companies positively affect the decisions of investors. Among them Environmental Pillar Score is a weighted average score of Emissions, Environmental Innovation and Resource Use category scores. Social Pillar Score is the weighted average of the Product Responsibility and Community, Human Rights and Workforce category scores. Corporate Governance Score is the weighted average of the CSR Strategy, Shareholders and Management category scores (Nikolova 2019).

ESG reports on performances increase transparency, reduce information asymmetry, ensure accessibility to management decisions, enforce corporate governance principles, enable long-term investor trust, facilitate access to capital, contribute to profitability, growth and risk management, increase corporate reputation, and brand value, provide opportunities, require protecting health, safety, social rights and working conditions of employees, encourage the development of innovative products and services, and contribute sustainable development and national economy (Seker 2020). Table 13.9 presents ESG scores of Turkish Airlines, including the social, environmental and governance pillar scores for the years 2014–2018.

When the CSR/ESG ranking of Turkish Airlines is compared with 19,184 companies, it is above the average with a score of 55% in 2018 and 2019. The data covers 19,184 businesses from 143 countries, driven by 662 industry-leading ESG/CSR data sources (Fig. 13.8).

Table 13.9 Turkish Airline's ESG scores, social pillar scores, environment pillar scores and governance pillar scores (2014–2018)

ESG score				
2014	2015	2016	2017	2018
62.45	55.75	55.04	50.70	48.47
Social pillar score				
2014	2015	2016	2017	2018
74.81	67.30	67.38	54.78	50.96
Environment pillar score				
2014	2015	2016	2017	2018
58.61	49.54	49.53	57.84	45.40
Governance pillar score				
2014	2015	2016	2017	2018
52.33	49.21	46.81	37.98	48.99

Source: Thomson Reuters

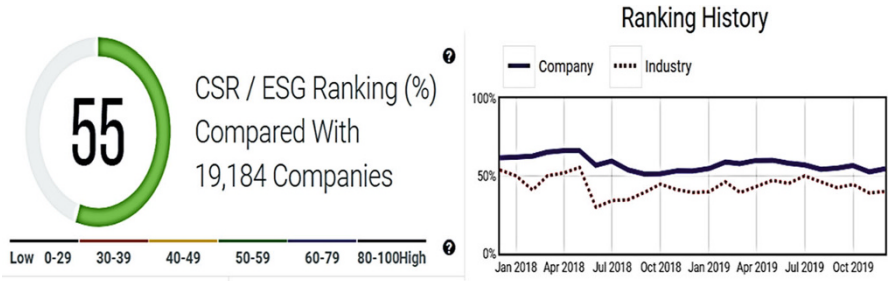


Fig. 13.8 CSR/ESG Ranking of Turkish Airlines (CSRHUB 2020a, 2020b)

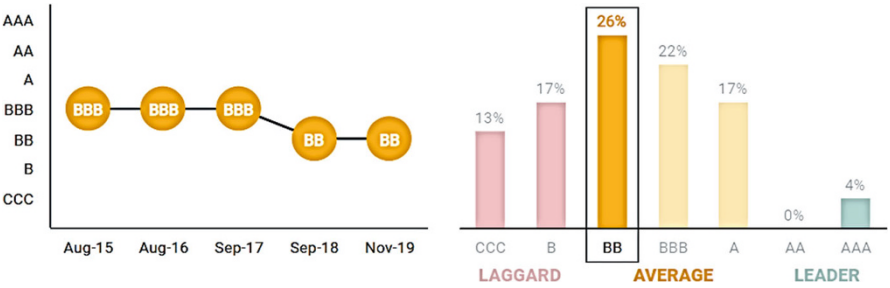


Fig. 13.9 ESG ranking history and ranking distribution (MSCI 2020)

Table 13.10 CSR strategy scores of Turkish Airlines

2014	2015	2016	2017	2018
26.56	38.89	40.74	57.41	26.92

Source: Thomson Reuters Database

Turkish Airlines also gets an average score among 22 companies in the aviation industry according to ESG scores, and rating distribution. From 2015 to 2018, the score was BBB, then it turned to be BB since November 2018 (Fig. 13.9). The CSR strategy score is an assessment of how well the company integrates corporate social responsibility (CSR) principles into its business. CSR scores has increased from 26.56 to 57.41 except in 2018 where it decreased to 26.92. New action plans are implemented in reporting and company management over the last years (Table 13.10).

13.4.1.5 Sustainability Reporting

Sustainability report provides companies an overview of daily activities that cause environmental, social and economic impacts and is an important tool for presenting company's commitment to sustainability. Measuring the ESG performance is key to set further goals and manage the changes thay may occur more efficiently. In this context, there are four major benefits of sustainability reporting for organizations.

Sustainability reporting is a useful tool for risk management. Sustainability shapes the future of business operating environment and its corporate perception, increases efficiency and brings resilience into the business. Sustainability reporting may also help to generate savings in organizations. Waste reduction management is one example. Sustainability reporting also helps better decision making and increases stakeholders trust.

Turkish Airlines has published its sustainability reports since 2013. However, the company had started to give wide coverage of environmental information in annual reports since 2008 when it became a Star Alliance member. During 2008–2012, sensitivity to environment and other environmentally important fields such as fuel efficiency had gained serious attention in annual reports. Th?e company has also published an Environmental Performance Report in 2016 and 2018. In 2016, the Environmental Dimensions Report was prepared covering 63 different categories. The company aims to keep these dimensions under control to reduce adverse environmental impacts (Environmental Dimensions of Turkish Airlines 2016).

Turkish Airlines also monitors water, natural gas, energy and paper consumption amounts and sets annual targets to reduce them. There is a 12% reduction in natural gas consumption (4.770.853 sm^3) in 2018 compared to the previous year. Documentation management system is largely electronic. By this system, paper consumption was 2391.703 m^2 in 2018 (Turkish Airlines Sustainability Report 2018). The company carries out waste management activities within the scope of the "Zero-Waste Project". 258 tons packing waste was sent to recycling at Istanbul location in 2018. It is ten times higher than previous year (26 tons in 2017). 124 tons non-hazardous waste was sent to recycling and 115 tons hazardous waste sent to licensed companies. Also, 28 tons of plastic packages, 1225 tons of paper packages and 69 tons of glass packages were sent to recycling. Table 13.11 gives the results for four sub-categories. At the center of the sustainability approach of the Turkish Airlines are stakeholders. Sustainability approaches are shaped by interactions from stakeholders. Table 13.12 gives the sustainability management of Turkish Airlines.

To show the commitment of Turkish Airlines to sustainability, Borsa Istanbul (BIST) Sustainability Index is another indicator. The Index provides competitive advantage for Turkish companies to effectively manage their corporate sustainability risks and opportunities. The index reflects the companies' approaches to sustainability issues, including consumption of natural resources, global warming, health, safety and employment, and makes an independent assessment of their activities and decisions on these issues. Turkish Airlines is included in the Index since November 2015–October 2016 period.

Table 13.11 Brief analysis of sustainability reports of Turkish Airlines (2014–2018)

	2014	2015	2016	2017	2018
Number of pages in sustainability report	136	66	57	98	110
1. Economic					
Economic performance	+	+	+	+	+
Investments	+	+	+	+	+
2. Environmental					
Climate change	+	+	+	+	+
CO_2 emission	+	+	+	+	+
Noise management	+	+	+	+	+
Fuel saving	+	+	+	+	+
Bio-fuels	+	+	+	+	+
Waste management	+	+	+	+	+
Power consumption	+	+	+	+	+
Paper consumption	+	+	+	+	+
Natural gas consumption	+	+	+	+	+
Water consumption	+	+	+	+	+
Environmental policy	+	+	+	+	+
Training and education for environmental awareness			+	+	+
3. Social					
Corporate safety	+	+	+	+	+
Flight security	+	+	+	+	+
Security policy	+	+		+	+
Job creation	+	+	+	+	+
Employees	+	+	+	+	+
Occupational health and safety	+	+	+	+	+
Training and education	+	+	+	+	+
Innovations	+	+	+	+	+
Customer satisfaction	+	+	+	+	+
Social responsibility	+	+	+		
Sponsorship	+	+	+		
4. Others					
Catering	+	+	+	+	+
Awards	+	+	+	+	+
Fleet information	+	+	+	+	+
Strategic priorities	+	+	+	+	+
Risk management	+	+	+	+	+

13.4.2 Pegasus Airlines

13.4.2.1 A General Outlook

Pegasus Airlines was founded as a joint venture comprising of Aer Lingus, Net Holding and Silkar in 1990 with a fleet of two aircraft. The company was purchased

Table 13.12 Sustainability management of Turkish Airlines in 2018

Sustainability management of Turkish airlines		
INTERNALS	Shareholders Financial partners Investors	Minority rightsStrategy Operational and financial performanceCorporate governance
	EmployeesUnions	Business ethicsCultural valuesFreedom of association and collective employee satisfactionBargainingCorporate safetyFlight securityHealth and safety & well-beingPerformance & career development Non-discrimination and diversitySustainable use of resources
EXTERNALS	GovernmentRegulatorsLocal authorities	Social and economical developmentCompliance Customer rightsFinancial performanceCorporate safetyFlight securityHealth and safety ForestrationNoise managementWaste management
	Certification bodies	Environmental managementCorporate safetyFlight securityHealth and safetyQuality management Noise management
	Customers	AccessibilityCustomer satisfaction & service qualityFlight security Customer rightsCorporate safetyInnovative products & services
	Communities	Social and economic developmentSocial responsibility projects
	Non-governmental organizations(NGOs)	Corporate social responsibility projects
	Academic institutionsUniversities	Employment & career opportunities

Source: Turkish Airlines Sustainability Report 2018

by ESAS Holding in 2005 and became the fourth airline as a LCC operating scheduled domestic flights in Turkey. In 2006, it started international flights. Over the period of 4 years (2006–2010), the number of passengers carried on domestic flights has risen rapidly. In 2011, it became the first airline in the world to integrate with Wireless Groundlink End to End Network Solutions system, which performs bidirectional data transfer. By establishing Turkey's new simulator area with a flight training center, the company takes part within the 10% of the world's 582 airlines. The company achieved a great success in aviation by these two technological investments worth about USD 22.3 million.

In 2013, 34.5% of the company's shares were offered to public. Pegasus Airlines became Europe's fastest growing airline according to the Official Airline Guide report and considered to be among the 25 largest airlines in seat capacity in 2013. In 2015, the company added a new cabin simulator, by which preparatory scenarios can

be implemented in case of any emergency. The company flies to 42 countries (123 destinations) with a fleet of 83 aircrafts and an average fleet age of 5.7 years. It has 5257 employees. The number of passengers carried has increased from 8.6 million in 2010 to 30 million in 2018, generating 8.3 billion turnover and TL 507 million annual net profit (Pegasus Airlines 2019).

13.4.2.2 Business Model of Pegasus Airlines

In the aviation industry, approximately 4–5% of growth rate is expected each year. Therefore, serious environmental measures should be taken for the future as a result of such a high expectation. Every year, the fleets of the airline companies grow and the damages caused to the environment increase. CO_2 emissions from aircrafts have serious effects on human, plant and animal lives, climate change and environmental quality. Airbus, Boeing and other aircraft manufacturers continuously work on environmental and passenger-friendly models that consume less fuel. Although LCCs did not take environmental measures into consideration very seriously in the past years, nowadays they spend much efforts to manage this matter.

The vision of Pegasus Airlines is to become the leader in economic airline segment in the region with innovative, responsible and rational approach. The mission of the company, its suppliers and business partners is to provide its customers the right to travel by air. It adapts Low Cost Carrier as a business model. It offers paid catering and refreshment on board. It offers pre-ordered service to the guests before the flight. The reduction of the costs by the abolition of services that generate no revenue for the company make their tickets less expensive in comparison with FSC. Buying tickets are easy, but refunding is not possible in most cases or a penalty fee is applied for the refund. Mobile check-in application allows to pay for extra kilogram for luggage and online sales option is provided.

The company is committed to improving its system in protecting the environment in line with international standards. The aim of the company is to sustain its services to operate efficiently both environmentally and economically. To achieve this goal, the company invests in fuel efficiency projects to reduce greenhouse gas emissions (GHG). Emissions Trading System aims to minimize operational costs. The company also investigates other options such as carbon offsetting possibilities and renewable energy investments. It renews its fleet with more efficient aircrafts because 10% increase in fuel prices result in 3.4% increase in operational costs (Pegasus Airlines 2018).

13.4.2.3 Key Environmental Indicators

As key environmental indicators, we examine carbon emissions, noise emissions and Environment Pillar Score of Pegasus Airlines.

13.4.2.3.1 Carbon Emissions and Fuel Savings

Pegasus Airlines has taken actions in reducing its carbon emission over the last 5 years. Table 13.13 shows flactuations in CO_2 emissions and fuel costs from 2015 to 2018. From 2015 to 2018, increase rate of CO_2 emissions has decreased from 19.45% to 1.3%. Fuel saving data is not available for the company. However, fuel costs have increased from 2015 to 2018 due to the increases in oil prices globally, increase in aircraft number as well as increase in the kilometers of flights. According to the reports issued by 40 airlines on CO_2 emissions in 2017 and 2018, Pegasus Airlines ranked tenth with more than 20 million tons of CO_2 emissions (Fig. 13.10).

13.4.2.3.2 Noise Emissions

The noise pollution in Turkey has dropped according to the Strategic Noise Chart, prepared by Marmara Research Center in coordination with the General Directorate of State Airports Authority (DHMI), covering 40 airports. The main reason is the use

Table 13.13 Pegasus Airlines' CO_2 emissions and fuel cost increase/decrease

Year	CO_2 Emissions	Fuel cost
2015	19.45% Increase	4% Decrease
2016	16.70% Increase	11% Decrease
2017	11.8% Increase	53% Increase
2018	1.3% Increase	80% Increase

Source: Pegasus Airlines CDP Climate Change Information Request (2015–2018)

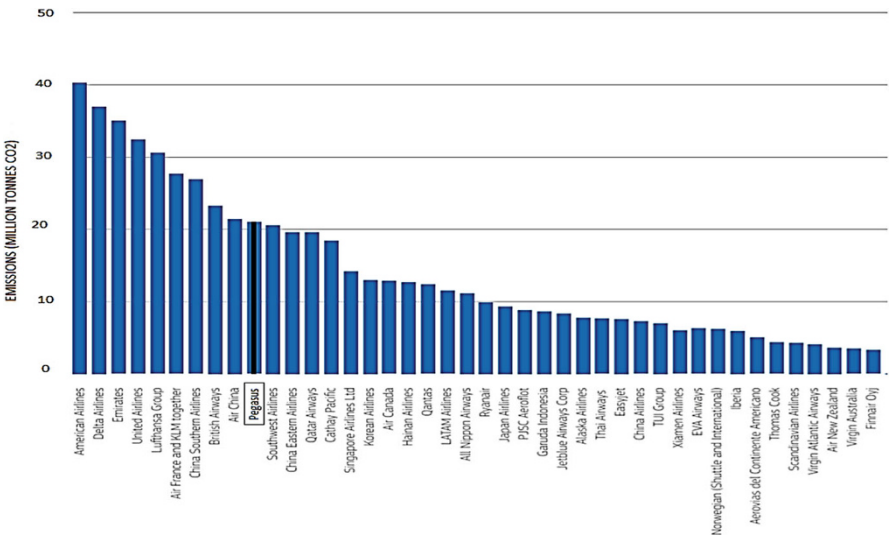


Fig. 13.10 CO_2 Emissions in 2017/2018 (Becken and Pant 2019)

of new generation aircraft (DHMI 2018). There is no statistical data for Pegasus Airlines on the rate of noise emissions. The company is switching its fleet to new and more fuel-efficient aircrafts that keep costs lower. The fleet is the youngest fleet (average age is 5.7) in Turkey and it is one of the youngest fleet in Europe (Pegasus Airlines 2019). The company targets to increase efficiency, take environmental-friendly actions, and reduce noise emissions in the forthcoming years (Aviation Turkey 2019).

13.4.2.3.3 Environment Pillar Score

The Environment Pillar Score of Pegasus Airlines was 14.59 in 2014 which was lower than Turkish Airlines for that year. However, the data is not available for the other years.

13.4.2.4 ESG Combined Score and CSR Strategy Score

The ESG score of the company is 30.83 in 2014 which is lower than that of Turkish Airlines. However, the data is not available for the other years. When the CSR/ESG Ranking of Pegasus Airlines is compared with 19,184 companies, it is difficult to make any comment on the score since there is no data available.

13.4.2.5 Sustainability Reporting

Pegasus Airlines is committed to improve its systems by setting environmental targets, and increasing environmental performance. As mentioned in its environmental policy document, the company is dedicated to prevent pollution. However, Pegasus Airlines does not publish a sustainability report and does not include any valuable information on its environmental and sustainability performance in its annual report.

The company has CDP reports on its website for the years 2014, 2015, 2016, 2017 and 2018. First report published in 2014 is a Climate Change Information Request. The report included some details about incentives for the management of climate change. However, those incentivized performance indicators only focus on two points, emission reduction target and energy reduction target. Risk management process is also simple such as incentives for climate change. It is not integrated into the company risk management framework (Pegasus Airlines CDP Report 2017). The company has an environmental management system certificate (ISO:14001) given by an independent inspection firm. BIST Sustainability Index is another cornerstone for the commitment of the company. Pegasus Airlines is included in the Sustainability Index between November 2016–October 2017 period.

13.4.3 A Brief Comparison of Turkish Airlines and Pegasus Airlines

Turkish Airlines adapts FSC as a business model, while Pegasus prefers operating as a LCC. Both companies are traded on Borsa Istanbul and included in BIST Sustainability Index. Turkish Airlines is transparent and informative in sustainability practices. The company has been publishing sustainability report every year since 2013. Pegasus Airlines does not provide extensive information on key environmental indicators like Turkish Airlines. The company does not publish a sustainability report, but provides CDP reports. Although data on key environmental indicators (CO_2 emission, fuel saving and noise emission) are available in CDP reports it is quite hard to interpret.

Both airlines have performed well in reducing their carbon emissions between 2014–2018. Turkish Airlines has prevented more tons of CO_2 emissions, while Pegasus Airlines has decreased the rate of increase in CO_2 emissions. Both companies aim to reduce fuel consumption. Pegasus Airlines reduces its fuel consumption by means of fuel efficient aircraft and short-haul flights, while Turkish Airlines reduces its consumption by means of fuel efficient aircraft and strategic sustainable decisions. No statistical data for noise emission is available for both companies, but they have young fleet. This may help them in reducing noise emission in the future. Table 13.14 compares Turkish Airlines and Pegasus Airlines in sustainability performance.

Table 13.14 Turkish Airlines versus Pegasus Airlines in sustainability performance

	Turkish Airlines	Pegasus Airlines
Business model	Full service carrier	Low cost carrier
Key performance indicators	Data available	Data available
Key environmental indicators		
CO_2 emission	Data available	Only flactuation data available
Fuel	Fuel saving data available	Only fuel cost flactuations available
Noise emission	Data not available	Data not available
ESG score	Available for each year	Only available for 2014
CRS ranking	Available	Not available
Sustainability reporting	Annual report	Not published
Environmental policy	Explained in detail on website	Briefly mentioned on website
BIST sustainability index	Since 2015	Since 2016

Source: Turkish Airlines and Pegasus Airlines Annual Reports

13.5 Conclusion and Discussion

Sustainability in aviation is a golden target, but it is sometimes not clear how to achieve it. The rapid growth of air traffic creates challenges for sustainability. Airlines have to keep a balance between the targets of transportation (accessibility, safety and enhanced mobility) and the dimensions of sustainability (environmental, economic, and social). This study examines the sustainability performance of two Turkish airline companies carrying out different business models, Turkish Airlines as a Full Service Carrrier, and Pegasus Airlines as a Low Cost Carrier covering the period of 2014–2018.

Turkish Airlines is the national flag carrier of Turkey and travels over 300 destinations worldwide. When we analyze the sustainability performance of Turkish Airlines, major efforts come from the fuel savings, decrease in electricity consumption and natural gas use, among others. The company uses innovative technologies. It also intends to buy wide body Boeing and Airbus models to support sustainable aviation environmentally. The company is transparent and informative in sustainability practices. It achieved approximately 29,608 tons of fuel savings, and consequently 93,267 tons of carbon emission reduction in 2018. The company has admirably increased the level of CO_2 prevention over the years. It had 27,592 tons fuel saving in 2014 and 29,608 tons in 2018. Improvements of the aircraft fleets and strategic decisions on fuel efficiency are the main reasons for these results. Although there is no data available on noise emissions, the company is committed to minimizing it. Environmental Pillar Score (EPS) of the company shows fluctuations over the last 5 years, the average EPS being 54.48 which is in line with the global average.

Pegasus Airlines operates on a Low Cost Carrier business model. The number of passengers carried and the number of landings have increased between 2014–2018. There is also an increase in its fleet and seat capacity except in 2017. As to the sustainability performance, the company aims to reduce fuel consumption and CO_2 emissions with the help of mechanisms such as carbon brake systems. It is the first airline company in Turkey to sign UN Global Compact. Pegasus Airlines plans to buy new aircraft for the reduction of emission and fuel consumption. Unlike Turkish Airlines which publishes sustainability reports every year since 2013, Pegasus Airlines does not do so. The latter company also does not publish extended information on environmental indicators. It has managed to reduce its carbon emissions over the years, but fuel costs have increased from 2015 to 2018 due to the rise in oil prices, increase in the number of fleet size and increase in the kilometers covered by flights. It is hard to find any data on its CO_2 emissions and no data is available for noise emissions. However, the company is switching its fleet to new and more fuel-efficient aircraft to increase efficiency, reduce CO_2 and noise emissions. Pegasus Airlines does not have an environmental pillar score. ESG score is only available for the year 2014, i.e., 30.83.

To sum up, Turkish Airlines follows a consistent and forward-looking strategy in addressing sustainability matters, whereas Pegasus Airlines rarely shares its policies and metrics. Both airlines are included in the Borsa Istanbul Sustainability Index

(BIST). This shows their dedications to sustainability. However, it is quite difficult to make a sound comparison between the two companies, not only due to their different business models, but also the limited publicly available information and data for Pegasus Airlines on its strategies, sustainability reports, ESG scores, and other environmental indicators. Thus, Pegasus Airlines should establish a more reasonable environmental management system focusing on improving its sustainability and disclosing more information on environmental and social performance metrics.

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Part IV
Valuation, Digital Services and Related Topics

Chapter 14
Brand Valuation and Contemporary Methods Used in Determining Brand Value: A Financial Perspective

Ibrahim Erem Sahin

Abstract In today's changing and developing business world, companies are turning towards abstracting benefits from creating value as well as physical differences in order to provide competitive advantage. Brand is one of the intangible assets that adds value and strength to companies. In this context, importance of brand and brand value estimation gain importance day by day for companies. The estimation of brand value is extremely beneficial and important for the stakeholders and parties of companies. Brand and brand valuation have also become an important competitive strategy for companies. For this reason, many academics and practitioners have developed different methods regarding brand valuation. In general, brand valuation is divided into three main categories financial, consumer behavior, and mixed methods (which combines both aforementioned two). These three categories of brand valuation methods have different valuation approaches. There happens not to be any generally accepted brand valuation method that academicians, experts and practitioners agree on. From this point of view, this study classifies crucial brand valuation methods by revealing brand and brand value issues it explains each one considering its advantages and disadvantages.

Keywords Brand · Brand value · Brand valuation · Finance

14.1 Introduction

Responding to developing and changing consumer behavior is very important for businesses in markets where competition is intense. Companies now realize that their intangibles are important as well as tangibles. At this point, the importance of brand, brand management and brand valuation is increasing day by day for companies.

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Stakeholders and shareholders of companies want to know brand value and its monetary equivalent. Determination of brand value correctly will have important benefits for the business.

In this context, in this section, firstly, the concepts of brand and brand value are referred and explained. Then the dimensions that make up the brand value are described in four sub-titles as brand awareness, brand associations, perceived quality and brand loyalty. Usage areas of brand value are identified in eight subtitles. Finally, brand valuation methods are explained. Brand valuation methods were analyzed under three general titles consisting of, finance-based, consumer behavior-based and mixed methods which is combination of both methods. With the thought that there is no generally accepted and agreed brand valuation method in practice, all mentioned methods have tried to be explained in detail as much as possible referring to their advantages and disadvantages.

14.2 Brand and Brand Value

Seeking to distinguish different products from each other or to differentiate the vendor of the product led to the emergence of the concept called "brand". Signs and symbols that are claimed to be used as brands were first seen in bricks, pottery and pots that are presumed to be from ancient Egyptian civilization. It is believed that such signs are used to indicate the ownership of a particular person or groups (Knapp 2000: 87). Throughout the Middle Ages, European traders also used various signs and symbols to identify their trading areas, protect the areas against rival traders and differentiate their products from other products (Ercan et al. 2006: 3).

Brand signs, which were used in ancient times to document ownership of objects and animals, started to be used for commercial products over time. Nowadays, it is not appropriate to define the concept of brand as just a name, sign and symbol. Now, the brand is the meaning of the communication between the manufacturer and the consumer (Tosun 2017: 3). A brand is a name, term, sign, symbol, or design, or a combination of these, that serves to identify, promote and differentiate the products or services of a manufacturer or a seller (Kotler and Armstrong 1989: 248).

Today, it will not be possible to launch a new product without determining a name or equipping it with its own 'personality'. A brand can also be defined as a physical and permanent, visible feature that is applied to an object to differentiate it (Jourdan 2002: 230).

Briefly, 'Brand' is the name given for a product or service from a particular source (Maurya and Mishra 2012: 1, Forbes).

Organisations and investors will identify brands as their most valuable asset for their company. It will be much more important to have its own market than to have factories. The most important way for getting stronger in the markets is to have dominant brands in the market. The strength of a brand is not only limited to consumer markets. In fact, brand value is more important in commercial commodity

markets than consumer marketing. Brand is very crucial from an industrial buyer's point of view (Aaker 2009: 12).

In the twenty-first century, branding is thought to be the only unique differentiator among companies. Brand value is now considered as an important asset.

In order for businesses to be competitive, a strong brand that will attract and retain investors and consumers is needed. It is becoming much more important to be a successful and strong brand in a market where competition is intense, globalized and consumers have limitless options. This situation undoubtedly can be overcome throughout the value creation for consumers. In other words, being a strong brand is possible with a strong brand value that can be created by combining all the components related to the brand (Yaşin et al. 2017: 128).

One of the pioneering studies in the literature related to concept of brand value is the article written by Farquhar (1989). According to Farquhar, a brand is the name, design, symbol or sign that increases the value of the product beyond its functional purpose. Therefore, brand value can be considered as the added value of a brand to the product (Kara and Şahin 2019: 36). Aaker, on the other hand, defines brand value as a form of a series of assets and liabilities associated with a brand, which increases or decreases the value provided by a product or service to a business and/or its customers (Yaşin et al. 2017: 128).

In the literature, brand value is considered as two different concepts in terms of corresponding definitions as "brand equity" and "brand value". Brand equity is the value that includes qualitative dimensions such as brand loyalty, association, awareness, perceived quality, communication channels and patent (Kotler et al. 2005: 556). On the other hand, brand value is the actual value of the brand which is expressed financially and affected by business's financial data such as assets, cash flows and costs (Kamakura and Russell 1993: 9). Financial brand value is not only affected by financial data, but also qualitative brand value which is the value that consumers give to the brand. This is because qualitative brand value contributes significantly to financial brand value (Aaker 1992: 27).

The concept of brand equity is defined as the consumer accepting to pay more for a product that she/he already knows among all the alternative products. The concept of brand value, on the other hand, is defined as a function of the brand capital as well as the amount that firm should have as a result of branded products sales (Gökbayrak 2019: 12).

The concept of brand value can be expressed with three elements. The first element is the monetary value of the brand. This expresses the brand's value as a financial asset. The second element is explained as brand strength. This element underlines the brand's regular consumers and is also explained as brand loyalty. The third element is the image of the brand. These three elements show similarities to the brand value criteria and indicators that are developed by many researchers (Gökbayrak 2019: 12).

Branding basically is the process of transforming functional assets into relationship assets by creating a psychological connection between the brand and the customer. The ability to have a product, service or company with an emotional

significance above its functional value is a source of significant value creation (Haigh and Knowles 2004: 18).

Brand is one of the important marketing topics, but it is primarily in the interest of the financial departments of the companies, since the value of the brands is needed during the merger and acquisition of the companies. However, as a result of the increase in the importance of the brand as a company asset and increase in studies related to the efforts to manage it well by preserving its value, the determination of the brand value has started to be made for many different reasons (Kaya 2002: 4). Brand value is important for accounting as well as it is for marketing and finance. The increasing importance of the brand has revealed valuation methods that are based on different approaches to measure its value (Durgut 2015: 245).

In order for assets or liabilities to constitute the basis of brand value, they must be associated to the brand's name and or symbol. If the brand's name or symbol changes, some or all of the assets or liabilities may be affected or even lost, but some may switch to a new name and symbol. Assets and liabilities on which brand value is based may differ from context to context. However, they can be usefully divided into five categories (Aaker 2009: 27):

1. Brand loyalty
2. Brand awareness
3. Perceived quality
4. Brand associations in addition to perceived quality
5. Other registered trademark assets - patents, trademarks, channel relationships, etc.

14.3 Brand Equity Dimensions

The dimensions of brand value are specified as five elements; brand loyalty, brand name awareness, perceived quality of the brand, brand association and other brand assets (Aaker 1991: 224).

According to this model by Aaker, which is widely used in brand value measurement of products and services, other brand assets means patents and financial contents that can be used to create competitive advantage (Ünal 2008: 27). Keller (1993: 2) included the brand association into the brand image by grouping the dimensions that make up the brand value as brand awareness and brand image. Farquhar, on the other hand, stated the brand image as attitude towards the brand and brand evaluation (Dımbıloğlu 2014: 20). Although the dimensions that make up the brand value may differ in the literature, however in this section, it will be explained under four sub-titles as brand awareness, brand association, perceived quality and brand loyalty.

14.3.1 Brand Awareness

It is very important for brands to create brand awareness in a market with fierce competitive environment and many brand choices. Brand awaraness happens in a situation where a brand first comes to consumers' mind in brand recall and consumers recognize the brand that they have seen or heard in the past by differentiating it from competing brands in that product category. Brand awareness reflects the distinction and attention of the brand in the mind of the consumer. The awareness process starts with the state of not being aware of the brand, then it continues with brand recall, brand recognition and it ends with being the first brand that comes to mind (Ünal 2008: 28). In order for a brand to be valuable and to continuously increase its value, first, the brand must have a very positive and strong awareness from consumer point of view. According to Aaker, brand awareness levels can be listed as follows (Aaker 1996: 114–115):

- Recognition (Situation where consumer has already heard the brand)
- Recall (Situation where consumer recalls the brand)
- The first brand coming to mind (Being the first brand in recalling)
- Brand superiority (Being the only brand recalled in a specific category)
- Brand knowledge (Knowing what brand means, what it represents)
- Brand opinion (Having an opinion about the brand)

Brand recall reflects the potential for a brand to be repurchased by consumers in a produt category. Therefore, brand awareness means more than just consumers' knowing and seeing the brand.

14.3.2 Brand Association

Brand association includes the relationships that are emotionally established with the brand. Brand association creates a process where emotions are involved, and thus, information about the brand can be remembered. These associations for the brand differentiate the brand and provide a basis for purchasing (Kara and Şahin 2019: 42). The positive emotions and attitudes of consumer regarding the brand enable expansion and this increases the value of the brand. Brand association adds value to the brand in consumer mind by representing the brand's strength, utility, popularity and unique features (Keller 2013: 116–117).

The brand association, which creates a basis for purchasing decisions and brand loyalty, can characterize the properties of the product to the consumer, as well as it can express a meaning completely independent from the product (Cheng and Chen 2001: 440).

14.3.3 Perceived Quality

Consumers identify certain criteria and act accordingly when choosing and purchasing products from alternatives. One of these criterion is the quality of the product. Quality, from consumer's point of view, may consist of different factors such as product or service price, durability, reliability, social and economic situations (Demir 2016: 23).

Perceived quality is a partial perception about what is important to consumers. Therefore, it is related to how consumers perceive and accept the brand rather than the real quality of the product. Perceived quality may emerge as a result of consumers' sensory experience of the brand as well as their evaluation on image, price or country of origin of the brand that they have not experienced before (Uç 2016: 11).

The perceived quality factor has a direct effect on the price. High perceived quality will encourage consumers to pay higher prices for the brand's products and services. This situation will contribute positively to brand value for the brands that are perceived as high quality by consumers. Therefore, the effect of perceived quality on brand value, company profitability and success of brand expansion strategy is quite strong.

14.3.4 Brand Loyalty

Consumers' experiences of a product or service may have a positive or negative impact on their future choices. If the experience of consumers about the brand is positive, it is highly likely that they will have a tendency to prefer and purchase the same brand again. This situation will reveal a certain sense of commitment to the brand in consumer mind. Brand loyalty can be considered as a process expressed by the combination of six basic conditions. These are (Jacoby and Kyner 1973: 2):

1. Incoincident effect situation (e.g., past experience)
2. Behavioral response (purchase behavior)
3. Extended period of time (loyalty can be achieved after a long time dedication process)
4. Emergence by decision makers
5. One or more alternative brands are involved (In order to talk about loyalty, consumers should preferre the brand over competitiors)
6. Psychological process function (decision, evaluation)

Brand loyalty means that consumers have positive emotions towards the brand. They prefer the brand they are loyal to more frequently than other brands and continue in this attitude steadily. Brand loyalty can be examined in two dimensions as behavioral and attitudinal loyalty. While behavioral loyalty focuses on the amount

of purchase of a brand, attitudinal loyalty focuses on the strong beliefs of consumer towards the brand (Javargi and Moberg 1997: 169).

14.4 Usage Areas of Brand Value

Although brand is one of the important elements of marketing, brand valuation has been a matter of concern primarily with the financial departments of companies since valuation of brands is first required during the merger and acquisition of the companies (Brand Finance 2011). Because of the increase in the importance of brand as a company asset and increase in studies related to the efforts to manage it well by preserving its value, brand value has started to be realized for many different reasons. Using areas of brand valuation by companies can be exemplified as follows:

- Mergers and Acquisitions
- License and Franchising Agreements
- Brand Purchases and Sales
- Borrowing
- Company Marketing Performance and Budget
- Company Internal Management
- Tax Evaluation
- Lawsuits

14.4.1 Mergers and Acquisitions

With the aggravation of competitive conditions, businesses are seeking to merge, purchase or take over companies from the same or different sectors in order to remain in the market. In merger, acquisition and takeover transactions, besides the value of the firm, brand value is also one of the dominant elements. At this stage, current market share of the firm, business value or stock value and brand value of the enterprise are among the elements that are primarily examined. In mergers and acquisitions, since a significant part of the determined value originates from the brand value of the company gives importance to the studies for measuring the mentioned value (Ercan et al. 2006: 12).

In this process, it is obvious that brand valuation is an important issue since businesses act in order to take advantage of growth, benefit from synergy, distribute risk and reduce investment costs. If the evaluation of the brand value cannot be determined correctly in the merger and acquisition phase, the companies that take over the firms or the businesses that are parties to the merger will suffer significant losses (Brand Finance 2017). In conjunction with merger, acquisition and takeover activities across the globe, brand value emerged as hidden value among company's intangible assets. Due to the fact that brand value could not be determined correctly

in merger and acquisition process, there happened transactions with values far above the book value. From this point of view, accepting the brand as one of the most valuable assets of the company in the merger and acquisition transactions demonstrates the necessity of determining brand value (Ercan et al. 2006: 27).

14.4.2 Licence and Franchising Agreements

Franchising can be defined as a contract based on providing privilege of operating rights of one firm to another firm or a person, in a determined place and process, in return for royalty within the conditions previously determined (Elango and Fried 1997: 68).

The franchising process is structured as transferring the right to sell the product along with the registered trademark or transferring the right to sell product, service, maintenance, registered trademark and corporate identity within the business format. Franchising values are estimated based on brands' potential to generate earnings. For franchising operations to be carried out in a proper way, franchising value must be determined correctly. The determination of this value is extremely important in decision-making process for both investors and those who want to grant franchising rights, and for companies that want to take this right.

Considering franchising stores constituting an extremely effective way in reaching different markets of brand, it is very important to determine the brand value correctly in transferring the franchising license.

14.4.3 Brand Purchases and Sales

One of the methods that companies consider while developing their growth strategies is brand expansion practices. Companies can execute two modes of brand expansion policies. The first is to enter a new market segment with the current brand of companies; the second is to combine its existing brand with a different product category.

Especially with the increasing competition in recent years, increasing costs that firms have to undertake for new product development have led firms to brand expansion strategies. Many companies wish to buy of good quality and well-known brands instead of creating a new brand in order to increase their market share (Ercan et al. 2006: 28). For this reason, if brand valuation could not be done correctly in the brand valuation process, it will have negative impacts in terms of company and the market situation of the brand.

14.4.4 Borrowing

It is possible for businesses to borrow by putting their brands or revenues from brands as collateral to banks or other financial institutions against liabilities. In addition, the brand and the revenues from the brand constitute the basis for the securities to be issued or the loans to be obtained.

14.4.5 Company Marketing Performance and Budget

Brand valuation activity can also be executed to measure the marketing power of the business. When the brand value is expressed in monetary terms, it will be possible to compare it with other intangible assets. Thus, a comparison can be made between investments made in the brand and other investments and, as a result, the marketing performance of the business can be clearly seen (Demir 2016: 27). Another benefit of the valuation is that it will help to understand which brand is more successful and adds value to the firm in a situation where firm has many brands.

14.4.6 Company Internal Management

It can be used by the top management of companies to encourage employees to work in line with the company's objectives or for performance measurements of employees. Moreover, brand valuation can be used in determining the premiums or bonuses to be given to the personnel by company management.

14.4.7 Tax Evaluation

Due to the different practices in tax policies of the countries, some companies may apply different methods in order to take benefit from the tax advantages. A company operating in different countries can be transferred to its association that is established in a country where tax rate is relatively low. The company will reduce the tax burden that it has to pay by making payments to the associated company because it uses the brand name (Demir 2016: 27).

14.4.8 Lawsuits

Firms may need brand valuation at the solution stage of legal disputes they encounter for various reasons. In order to collect the receivables that are in default, creditor companies are requested to determine the value of the brands taken over by foreclosure (Dımbıloğlu 2014: 34). Firms in receivership also demand a valuation of their brand assets in order to pay their debts.

Another situation that requires brand valuation is the determination of financial losses arising from brand rights violations faced by the companies. Due to these legal disputes, firms can file suit and claim compensation in response to the damage or injustice they face. In similar situations, determining the value of the brand is extremely important in determining the losses of brands which have been damaged and whose value has already been evaluated.

14.5 Brand Valuation Methods

The subject of evaluation method to determine brand value has gained importance especially after the 1980s. Experts believe that having an international valuation method is a good way to boost the comparability of brand assets. They also state that organizations should focus on eliminating functional gaps between marketing and finance to measure and develop their brands and marketing performance (Hasan and Khan 2016: 43).

The valuation of the brand is extremely important for all parties involved in business. The accurate brand valuation will facilitate managerial decisions and has also great importance for decisions of employees, investors and credit institutions. Correctly responding to the information needs of the parties involved in business can be possible by evaluating the business as whole and showing real values of both tangible and intangible assets in the financial statements (Aydın and Ülengin 2011: 60).

The brand value may be an important part of an organization's market value. Valuation purposes of the brand value can be divided into three categories: valuations for accounting, valuations for transaction, and valuations for strategic brand management. Brand accounting has been mentioned since the late 1980s and is a relatively new accounting practice. While managers are under increasing pressure to provide shareholder value, intangible assets on the balance sheet have also become a more popular element. Methods based on consumer-based behaviors have been introduced since financial models do not examine the concept of brand value as demanded by the marketing specialist, employees in communication and advertising. That issue has become an important research area for the brand management and brand decision-making professionals, as it clarifies the concept and proposes measurement methods by revealing the factors that are extremely important in the formation of brand value in the eyes of the consumers (Aydın and Ülengin 2011: 60).

Brand valuation methods may differ according to the sectors. It is seen that the sectors that brand valuation is widely used in are finance, retail chains, food and beverage, transportation and communication. Besides, the pharmaceutical and petrochemical sectors need to use a different method in brand valuation because their products are partly necessity goods.

Today, organizations consider brands as trademarks that can be bought and sold and are capable of influencing consumer behavior, and as very valuable properties that can be recorded legally. Two types of transactions can be defined, internal and external transactions, to show that brand valuation can be beneficial. Each of those processes includes two sub-categories. These are securitization and tax planning as sub-categories for internal transactions, acquisitions and mergers for external transactions. Brand valuation is used as a management tool in some cases and can be used to compare the success levels of different brands, clear the brand architecture and brand expansion decisions, and measure the return on investment in marketing expenses (Abratt et al. 2014).

There are two important questions that need to be answered in brand valuation. The first is what is valued, and the second is the purpose of the valuation. An important distinction can be made between technical and commercial valuations. Technical valuations are generally made for the balance sheet reporting, litigation, tax planning, licensing, securitization, mergers and acquisitions, and investor relations. They focus on valuing a time value that represents the value of trademarks or a brand. Commercial values are used for the brand architecture, portfolio management, market strategy, budget allocation, and brand scorecards. Such evaluations are based on a dynamic model of the branded business and aim to measure the role of the brand in influencing the basic variables of the model (Haigh and Knowles 2004: 20).

Methods for calculating brand value are generally divided into three in practice. Those are as follows:

- Financial models
- Behavioral models
- Mixed models

While financial methods and mixed methods mostly involve transactions aimed to reveal the monetary value of the brand, behavioral methods use data and transaction processes to measure brand strength by revealing the psychological effects of the brand (Çelik 2006: 197). In this study, as can be understood from the title of the study, the methods that allow the determination of the brand value as monetary quantity with a financial perspective in brand valuation are discussed in more detail, and the behavioral models in which only psychological effects are tried to be measured are more superficially addressed.

14.5.1 Financial Methods

The main purpose of calculating brand value according to financial methods is to calculate brand value as monetary. Companies may want to calculate the brand value for various reasons. Those reasons can be listed as mergers and acquisitions, the financial analysis, and the request of the management. In such cases, an attempt is made to evaluate the brand by considering only the financial data of the business (Ünal 2005).

Three basic approaches are discussed in determining financial brand valuation methods: cost-based methods, capital market-based methods, and income-based methods (Moisescu 2007: 95) (Fig. 14.1).

14.5.1.1 Cost-Based Brand Valuation

The cost-based valuation method considers all costs that have been incurred to develop the brand since its beginning or how much is required to bring the company into its current state (Ünal 2008: 19). In the cost-based brand valuation method, the value of the brand owned by an enterprise is considered as the sum of the costs incurred for that brand. The total cost can be calculated by using the historic cost-based method or the substitution cost-based method. The historic cost-based method includes the historical cost involved in developing the brand. While applying the historic cost-based method, total expenditures done by the enterprise for the acquisition, the creation by the company, and maintaining its value are calculated and discounted to the present value. Although that method is easy to calculate, sticking

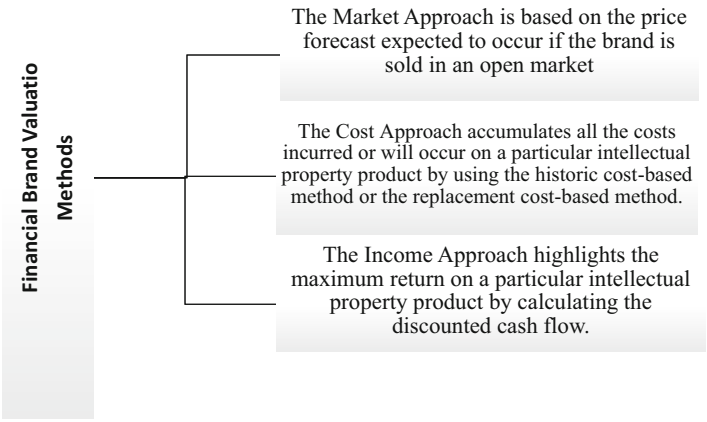

Fig. 14.1 Financial Brand Valuation Methods (Majerova and Kliestik 2015: 550; Brand Finance 2010)

only to brand strategies of the past and ignoring the value of the brand according to both current and future strategies are regarded as disadvantages of the method (Sattler et al. 2002: 9).

The historic cost-based method will be able to provide meaningful information about past expenditures if the enterprise wants to create a new brand, and the time is short, and the cost data can be reached quickly. However, the method will still not be able to answer all questions about the current value of the brand even if cost data has been collected (Ercan et al. 2006: 69).

Although the cost-based method is easily applicable for accountants, however, it has been stated by marketers that they have avoided applying that method because it focuses on the past and ignores current strategies (Tollington 1999: 205).

The substitution cost-based method has emerged as an alternative method to overcome the deficiencies and difficulties of the historic cost-based method. The substitution cost-based method calculates the cost that must be incurred for the brand to be fulfilled in the case that the brand dies out, thereby provides a closer reflection to the true value of the brand (Abratt and Bick 2003: 24). That method refers to the valuation of the brand by bringing together all the costs necessary to bring the brand to its current reputation and position, and gain the current customer potential (Stolowy et al. 1999: 15).

The following formula is used for the cost-based calculation of the brand value:

$$\text{The brand value} = \sum \text{costs related to the brand} - \sum \text{income related to the brand}$$

Alternatively, another method is the Recreation method, which is similar to the substitution method but includes costs associated with the creation of the brand again unlike substitution costs. The distinction between the two is that the value calculated through the substitution cost method does not include obsolescent intangible assets (Sakshi Sharma 2016).

In the cost-based brand valuation method, it is assumed that the brand with more resources transferred and the higher cost incurred will be more valuable. As a result of this situation, while brands that spend a lot for the advertising are advantageous, brands that do not are disadvantageous. That is the weak point of the method. Another criticism of the method is that the brand value of a business that has followed the successful marketing and advertising strategies with a certain budget and increased the value of its brand is likely to be close to the brand value of another business with same budget that has followed the wrong policies, and as a result, not increased the value of its brand (Gökbayrak 2019: 16).

14.5.1.2 The Market Value and the Capital Market-Based Brand Valuation

The brand value in the market-based brand valuation approach is based on the calculation through comparing the market values of brands that are equivalent to the brand. It assumes that there are real market values for brands, and transactions that can be taken as precedents in the market (Kaya 2002: 6). There is an assumption that the value of the brand will also be affected by the shares in the stock market. Under that assumption, determining the value of the brand by considering the value of the company in the stock market is called the capital market-based brand valuation (Akşit 2016: 34–35).

The benefits for customers may be earnings, cost savings, and tax deductions in the market-based valuation method. The benefits for businesses are to discount the expected cash flows to their real values at a rate of return that includes the risk-free utilization rate of the funds, the expected inflation rate, and the risk related to investments. Question marks about whether the data is comparable appear when future incomes are estimated, the appropriate discount rate is selected, and it is generally accepted that the brand is somewhat unique (Duguleană and Duguleană 2014: 48).

It is assumed that each brand is worth the maximum amount that a buyer will be willing to pay to acquire. Based on that, brand value is seen as the total price of stocks that reflect the future potential of a company's brand. The brand value is commonly defined as the present value of all future earnings attributed only to branding.

The advantage of that approach is that it shows how much the third party is willing to pay. Besides, this method has deficiencies and disadvantages. The disadvantages are that the data on similar brands are rare, the periods that brands are compared do not match, and the price paid for a similar brand includes the buyer's specific targets and does not apply to the value of the brand (Sakshi Sharma 2016). Moreover, a transparent and non-manipulative market is needed to create a market identity. For that method to be applied, the mentioned company must be listed on the stock exchange (Abele et al. 2004: 3).

14.5.1.3 The Income (Revenue) Based Brand Valuation

The income (revenue) of a brand is examined in income-based methods. The estimated revenues of the brand that are directly related to the brand during the economic life of the brand are calculated in that method. Those revenues which are foreseen in the future are discounted to the present value and included in possible risk calculations. The value calculated in that way gives the value of the brand in that method. The difficulty encountered in the income-based calculation methods arises from determining whether the expected income to be generated in the future will occur and how much of the increase in the cash flow of the enterprise is due to the

brand. Many methods are used to calculate brand valuation with the income-based method (Gökbayrak 2019: 17).

Some of those methods are as follow:

- The Price Premium Method
- The Relief from Royalty Method
- The Conjoint Method
- The Hedonic Method
- The Crimmins Method
- The Kern's Method
- The Hirose Method

14.5.1.3.1 Price Premium Method

In this method, brand value is calculated based on the unit price difference of two products as one branded and one non-branded by taking into account the sales growth and expected growth rate of the branded firm (Ercan et al. 2006: 78). The Price Premium method estimates the value of the brand based on the price premium it gives to non-branded, poorly branded or generic products or services. Additional cash flows generated through collective premium are determined by referring to the analysis of relative market shares (Brand Finance 2010: 36).

When comparing branded and non-branded products, crucial point to be considered is that the company that owns the branded product should have similar features to the non-branded product in terms of such as packaging and quantity.

According to the premium price method, the brand value is calculated as follows (Ercan et al. 2006: 78):

- The difference between the unit price of a branded product and a non-branded product is calculated as a ratio,
- Then, this ratio is multiplied by the current revenue of the branded company
- It is accepted that the amount found and originating from the brand will continue forever.
- If this amount is constantly expected to increase at the same rate, this ratio is taken into consideration.
- At the end brand value is calculated by placing the forementioned data in the fixed rate growth model.

14.5.1.3.2 Relief from Royalty Method

According to relief from royalty method, which is widely used among brand valuation methods, it is accepted that for any brand that the company does not have it has to pay a certain amount for usage privilege. By determining after the tax payments for the ownership of brand, the amount saved by owning the brand is calculated. Under the relief from royalty approach it is believed that the company

does not have trademarks, but licenses them from another company to the market price. Copyright rate is usually expressed as a percentage of sales. Tax authorities and courts accept this method, and there are numerous comparable license agreements, largely in the public domain (Haigh and Knowles 2004: 21).

14.5.1.3.3 Conjoint Analysis Method

Conjoint Analysis Method is described as an advanced version of the price premium method. This method explores the features of the branded product that make it preferable and measures the share of these features in the total value that customers attach to the product. Conjoint analysis method is used to determine reasons why any brand is preferred, and it allows predicting consumers' product choice decisions (Ercan et al. 2006: 80).

14.5.1.3.4 Hedonic Method

In hedonic method, prices of the products are explained according to the degree of the properties of the products. As a result of the regression analysis, share of the brand in the product price is calculated. In this respect, it is similar to the conjoint analysis method. In the hedonic method, the value of the brand is calculated by subtracting the costs incurred for the brand from the current value of the brand-derived income. As a result, the net income earned by the brand as an intangible asset or the value of the brand is calculated as follows (Demir 2016: 42):

$$\begin{aligned}\text{Brand value} = {} & \text{Brand share of revenues} - \text{Brand share of expenses} \\ & \left(\text{Expenses created by reducing the share of the equivalent non} \right. \\ & \left. - \text{branded product from the branded products}\right)\end{aligned}$$

14.5.1.3.5 Crimmins Method

In the Crimmins method, the brand value is examined in three dimensions. These dimensions are quantity, width and other criteria. In the measurement of the quantity, the price of non-branded product is kept constant, and the price of the branded product is increased and decreased, and different price alternatives are offered to the consumer Kaya (2005). Then, consumers' preferred price over the branded product is determined. At the end the price difference between these two products is considered as the premium created by the brand and the brand value is calculated.

The criticisms on the Crimmins method are similar to the criticisms on the premium price method. Since this method is also a consumer-oriented method, the fact that consumer preferences are not clarified in accordance with the method incorrect results may occur (Ercan et al. 2006: 83).

14.5.1.3.6 Kern Method

The Kern approach, also known as the approach to earning capacity, is to determine the monetary value of a brand by capitalising the value of potential earnings. This method requires estimating future revenue streams and reducing them to their present value with a predetermined discount rate. Therefore, in the case of a brand, its value is determined by reducing brand-based earnings to their present value (Jucaitytė and Virvilaite 2007).

Brand Valuation: (R) × L × CF (Hasan and Khan 2016: 44)
R = Expected annual income
L = License fee rate
CF = Capitalized factor

In the Kern method, it is stated that the brand value is a function of revenue and the brand value can be achieved by making this function perpetuate. The method also includes the license fee in the sector in the calculation of the brand value based on the market-based valuation. For this reason, according to this method brand value is calculated by discounting the amount estimated as a result of multiplying expected revenue and license fee ratio (Zimmerman and Bauer 2002: 35).

14.5.1.3.7 Hirose Method

Hirose method, which is one of the income-based methods in calculating brand value emerged in 2002 as a result of a study conducted by the Ministry of Economy, Trade and Industry of Japan. This method is preferred due to the fact that brand value can be calculated based on financial methods, based on income, and considering other methods it is both easy to apply and the data used are easy to find and calculate (Bursalı 2009). In the method, the brand value can be calculated objectively using the financial data obtained from the annual reports of the companies.

The benefits of this method are explained in two ways (Demir 2016: 45):

- An objective brand valuation model has been developed from the annual reports issued using public financial data.
- The methodology it provides is quite general. In addition, it can easily be used in the valuation of intangible assets other than brands.

In order to measure the brand value of businesses, it has emerged in order to determine a common method and to develop a standard method for all businesses in order to determine different brand values with different methods and to calculate at

least the same criteria in order to ensure the reliability of the results (Gökbayrak 2019: 19–20).

$MD = PV/r \times LV \times EV$
MD: Brand value
EV: Expansion variable
PV: Prestige variable
r: Risk-free interest rate
LV: Loyalty variable

14.5.2 Methods Based on Consumer Behavior

Since financial methods for brand valuation could not meet the expectations of marketing professionals, consumer behavior-based models have been introduced. Brand valuation has become an important area of research for brand management and brand decision-making professionals since it explores the factors that are important information of consumer-based brand value, clarifies the concept and proposes measurement methods. In the calculation of brand value with consumer decision-based methods, determination of the factors that are the basis of the behavior that causes the consumer to buy the product, factors that direct the consumer to the brand are emphasized. These studies also provide guidance to companies for developing strategies that will contribute to the company about the brand in the long term (Aydın and Ülengin 2011: 60).

Behavior-based methods are the methods developed and presented by academicians and researchers working in the field of marketing. The best known of these methods are David A. Aaker, Kevin Lane and Jean-Noel Kapferer.

14.5.2.1 Aaker Method

One of the representatives of behavioral brand valuation models, D. Aaker (1991) sees the brand as a symbol associated with a large number of mental assets and liabilities that help define and differentiate products. He defines the brand value as an asset and liabilities that user receives using products or services of the brand, with a name and a symbol, that is a component or a part. Aaker has identified five determinants of brand value. These are; brand loyalty, brand awareness, perceived quality, brand relationships and other brand assets. This model is a generally mentioned conceptual approach that tries to highlight the determinants that build a brand perspective from the consumer point of view. Quantities such as higher profit margins from the business economics are assumed to be implicit as the results of positive brand value, the psychographic phenomenon does not turn into any monetary equivalent (Jucaitytė and Virvilaitė 2007: 378).

Aaker (1991) believes that brand loyalty is the basis of brand value. He states that loyalty creates continuity in purchasing behavior, thus it provides stability in sales revenues.

14.5.2.2 Keller Method

Keller's assumption is that consumer-oriented brand value depends on brand information and is based on comparison with a non-brand product in the same product category. The consumer-based brand value indicates the special importance of customer in the creation and management of brand value. If the customer reacts differently to a product compared to another brand or a non-brand product, only then a positive customer-oriented value of that brand can be mentioned. The true strength of the brand lies in the consumer's perception ability and experience and knowledge gained from the brand over time (Keller 2013: 1061). Brand value approach should combine brand knowledge with brand awareness and image (Abele et al. 2004: 5).

There are similar problems in Keller's method as in Aaker's method. The biggest deficiency of both methods is the lack of a numerical example regarding estimation (Fırat and Badem 2008, 214).

14.5.2.3 McKinsey Method

McKinsey brand valuation method assumes that brand strength is precisely measurable. McKinsey defines key determining factors for the strength of the brand as performance, personality and asset. McKinsey assumes that quantitative brand strength values are a function of three P's. In McKinsey's brand evaluation system, he states that brand strength values as predictable and measurable (Jucaitytė and Virvilaitė 2007: 378).

14.5.2.4 Kapferer Method

According to Kapferer, brands define, guarantee, configure and balance. Brands also take their values from their capacity to reduce risk and uncertainty. The main focus is on the purchasing model, which depends on the consumer's experience with the brand, along with the brand's quality and price. This can create a customary purchase decision and brand preference.

According to this method, it is assumed that there is a closed contract signed between the consumer and the brand through brand value and consumer develops repurchase behavior as a result of brand loyalty. Kapferer accepts customer repurchase behavior as a financial reward that will minimize costs for the manufacturer, such as finding new markets and retaining existing customers (Ercan et al. 2006: 41).

Although this model is used to indicate the consumer purchasing model, it does not take into consideration that changes in consumer values, competitors' strategies, or other factors that may negatively affect brand value growth (Abele et al. 2004: 5).

14.5.3 Mix Methods

Mixed methods are generally developed and used by marketing research or consulting companies. The purpose of these methods is to eliminate the deficiencies found in financial and behavioral methods. Mix methods are applied by combining financial and behavioral methods aimed at eliminating the disadvantages while taking advantages of the superior aspects of these methods. By means of the method, the market situation of the brand can be analyzed and non-monetary values and monetary values can be transferred to the brand value. There are different ways of mix methods used in practice. Some of the prominent methods are as follows:

- Integrated Approach
- Interbrand Approach
- Brand Finance Approach
- A.C. Nielsen Approach
- Financial World Approach
- BBDO Model
- Semion Brand Value Approach
- Sattler Brand Value Approach

14.5.3.1 Integrated Approach

In their integrated approach Virvilaitė and Jucaitytė (2008), they developed an integrated brand valuation approach that seeks a balance between traditional company-based perspective and customer-based methods. One side of this approach focuses on brand value from consumers' point of view. Aaker's (1991) brand valuation model is used to estimate the value. In the method, each item is graded on a scale between zero and 20, and then the scores obtained are summed and a score out of 100 is acquired. Brand value from company's perspective is on the other side of the approach. Financial asset factors are excluded from the calculation to obtain net brand value. Then, financial factors are also used to obtain the scores of company-based brand value (Abratt et al. 2014).

14.5.3.2 Interbrand Approach

Interbrand is a brand consulting firm that specializes in areas such as brand strategy, brand analysis and brand valuation. Interbrand's methodology is based on three

components. These are; financial performance of branded goods or services, the role of the brand in purchasing decisions and the brand's competitive view (Rocha 2012: 5). While financial analysis focuses on future revenues, brand role analysis distinguishes how much of the income from the intangible assets of the firm is originated by the brand (Ercan et al. 2006: 45).

The firm bases its brand valuation on financial analysis, brand role and brand strength. This approach has been generally accepted since it considers all aspects of the brand. The challenge in the Interbrand approach comes from the difficulty in determining the appropriate discount rate. Interbrand believes that marketing and financial analysis is equally important in brand valuation and performs its analysis in brand valuation over five steps. These are (Kotler and Keller 2016: 339):

- *Market Segmentation:* It is the segmentation of geography, business unit, goods and services so that the data can be separated and used.
- *Financial Analysis:* It is the calculation of the future earnings of the brand by estimating correctly.
- *The Role of the Brand:* It is the measurement of brand effect in the purchasing decisions of consumer.
- *The Brand Strength*: Here, the ability of brand to build loyalty and therefore continuation to generate future demand and profit is measured.

The difficulties of this approach fall within strong impact of subjective components such as factor selection, weight and criteria for determining brand strength, arbitrary scale system for the multiplier, identification of the relevant market and estimation of brand earnings. In addition, the determination of monetary brand value gains after tax makes brand value dependent on the tax system to which it is subject. Furthermore, the data used by this model are estimated values, and created financial brand value is likely to be a trend value.

$$\text{Interbrand's brand value} = \sum (\text{EVA} * \text{RBI})/(1 + \text{r})\ \text{i}$$

EVA: Earnings related to intangibles
RBI: Brand role index
r: Discount rate
i: Number of years (Taşcı and Baş 2018: 718).

14.5.3.3 Brand Finance Approach

Brand Finance, which was established in 1996, is one of the leading brand-consulting firms. Considering the fact that companies can increase their brand values and thus firm values by effectively managing their brands and financial assets. Brandfinance fills the gap between the marketing and financial worlds by maintaining consultancy services with its many branches.

In this method, the brand value is determined by estimating the future revenues from the branded product by determining the contribution of the brand to these revenues. It calculates value of the brand, including price and royalty of brand that arises in cases of selling the brand or using its license (Taşcı and Baş 2018: 718).

Brand Finance valuation method consists of five stages. These are (Tuğay and Top 2015: 223):

Segmentation: It is the first step in brand valuation. Within the scope of geographical distribution, it is the step where situation analysis is conducted regarding consumers and products by considering marketing strategies and recognizing competitors through an appropriate segmentation. The effectiveness of the segmentation process for valuation depends on the following principles (Haigh 2000: 12):

(a) In order for the valuations to be related to the target market, there should be a homogeneous geographical area, homogeneous products and homogeneous consumer groups.
(b) In order to make comparisons, competitor clusters should be defined separately for all segments.
(c) Comparable market research data should be available in accordance with the selected sections.
(d) There should be comparable data of competing brands in accordance with the selected sections.

Financial Forecasts: Considering the sector in which brand is marketed, by examining every factor that may affect the demand for branded products every factor affecting demands for brand in the past is determined. In addition, considering the data such as marketing and sales, financial forecasts based on the market are made.

*Brand Value Added Analysis (BVS Analysis): I*n this step, it is estimated how much of the future gains will be derived from the brand. Considering differences between departments and competitors, contribution rate of brand to demand, meaning consumer's purchasing decisions, and future earnings is determined. Hence, trade-off (comparison, exchange) analysis based on market research is performed (Kaya 2002: 319).

βrandβeta® Analysis: Considering brand's past and current success, risk rating is calculated for the market which brand has a place. Brand finance takes into account 10 basic criteria for βrandβeta® analysis. For each of these basic criteria, a "0–10" scoring is calculated, a total score out of 100 point gives brand's risk rate (βrandβeta®). By using this risk rate discount rate of brand is calculated (Haigh 2000: 16).

Valuation and Sensitivity Analysis: It is calculated by reducing share of brand in intangible assets to present value. On the purpose of determination of effect value that will be caused by change of certain assumptions sensitivity analysis is carried out.

14.5.3.4 A.C. Nielsen Brand Balance Sheet Approach

This method, developed by Schulz and Brandmeyer, is built around a scoring model. The brand balance sheet method is based on a set of criteria with six variables and below it, nineteen variables. All market-related values are displayed in value terms rather than quantity terms. The relative degree of each of the 19 criteria is converted to a standardized scale value to facilitate comparison and operationalization. Scaled criteria are then weighted and scored between 0–500. This score shows the strength of brand and is considered as a reference for the future performance of brand. In the next step, monetary value of brand is calculated by using the income approach.

14.5.3.5 Financial World Approach

The Financial World brand valuation method is a simpler form of the Interbrand method. It calculates brand value by determining income difference between companies, which one has a branded product while other one does not have a brand for same product category (Demir 2016: 60).

The Financial World method considers following five factors into account when measuring brand strength that it incorporates into brand value. These are (Tuğay and Top 2015: 222):

Leadership
Loyalty
Being international
Importance of brand in industry
Legal protection

14.5.3.6 BBDO Model

According to the BBDO (Brand Equity Evaluation System-BEES) model that is developed by the German consulting firm BBDO Consulting GmbH, there are seven elements that make up the brand value. These are (Huber 2001: 42);

- Brand's sales performance and potential,
- Success chance of brand's development,
- Brand's international expansion potential
- Advertising support for brand
- Brand's strength in the industry
- Brand image
- Earnings before tax in the last 3 years

These seven factors are combined to determine the overall factor value. Besides, the following formula is used to determine the brand value.

BV : General factor value
× Weighted average of profits before taxes in the last 3 years.

BBDO method is a multi-factor brand valuation method that takes into consideration the differences between industries. The advantage of this method is that it takes into account the contribution of advertisement to brand. The criticized aspect is that the weight of the factors is distributed subjectively, and it can only be used in the valuation of corporate brands (Ercan et al. 2006: 55).

14.5.3.7 Semion Brand Value Approach

The brand valuation system used by Semion Brand Broker GmbH is another approach based on behavioral and image data in addition to financial values. Semion identifies four brand value factors, whose levels are determined by indicators. These are the company's financial value, brand strength, brand protection and brand image. Semion approach consists of four steps. The first step consists of determining a factor value for each of these four driving factors, based on the criteria that oriented to these four factors. In addition, indicators of each factor are collected to reach a single factor value. In the second step, the obtained values are added together to form a total factor value or weighting factor. In the third step, the average earnings before taxes are determined for the last 3 years and finally multiplied by the weighting factor.

14.5.3.8 Sattler Brand Value Approach

Sattler approach is a brand valuation method that allows long-term brand valuation. In this approach, long-term brand value is determined using a five-step empirical analysis. The first step involves identifying potential brand value indicators. In the second step, experts predict long-term value of brands that are selected for an experiment data collection, and then, based on expert data, long-term brand value prediction is determined using relative importance, combined analysis and regression. After these parameters are determined, they can be used to identify long-term benefits of any brand. The final step involves converting long-term brand benefit to long-term monetary brand value. Long-term monetary brand value is determined as a function of long-term brand benefit.

14.6 Conclusion

Today, companies are turning to the benefits of both intangible as well as tangible assets' in order to survive in a global competitive environment, gain competitive advantage in the market and satisfy changing consumer expectations through continues improvement. In this process, various consumer expectations and intense competition in the market lead companies to create technological competitiveness as well as intense consumer value. Brand is one of the important elements that are used to create value for consumers.

Brand plays an important role in ensuring stability in sales, increasing cash inflows, determining prices, and increasing growth potential by maintaining company's continuity. Brand is an intangible asset that adds strength and value to a company. In recent years, in the process of creating value, intangible assets have gained importance leading to prominence of brand.

The monetary determination of brand value has a crucial role in gaining competitive advantage in today's business world, in mergers and acquisitions, in the relations of the companies with credit institutions and creating shareholder value. With the emergence of brand valuation as a necessity, academicians, financiers and consulting firms, have developed many different valuation methods.

As a result of the difficulty in measuring the effects created by brand due to the distinctive characteristics of industries and companies that have it (brand), and different valuation perspecitves of different disciplines, there is not a unanimous valuation method that is accepted by everyone. In the light of these reasons, this chapter explored concept of brand value and modern methods used in determining the brand value especially from a financial point of view. It is found that for brand valuation, financial-based, consumer-based and mix methods are used. Among these brand valuation methods, the ones that are considered important in practice and more preffered are examined by demonstrating their strengths and weaknesses. This chapter would be useful to targeted readers from finance to marketing and to many others in different industries who are interested in a topic that gains importance day by day.

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Chapter 15
Digital Service Taxes as the Fiscal Result of Digital Transformation

Mustafa Ugur Akdogan

Abstract Modern technology provides us portable, multi-functional devices, and digital applications, which make our lives easier, better, faster, and more fun. It is difficult to imagine how future technology will change our lives but even from today, there is no doubt that the future of technology will continue to affect our lives. In fact, without having clear understanding on the developments, it is impossible to respond to those developments properly. Based on this understanding, it can be concluded that to manage fast-changing digital environment, the authorities must have clear understanding of the effects of relevant digital services. To manage the digital economy, most countries have designated new ministries and administrative authorities for the task. These institutions plan the future of the economy and to introduce related regulations. Besides, international institutions also study on the methodologies to manage the digital transformation. In one side, countries support the use digital data for tax purposes whereas, they also introduce new fiscal policies to generate more revenue over the digital services. In fact, each country may have different types of applications and rules over the taxation of the digital services. Some of them showed fast reaction to protect their fiscal soverenignity, whereas some approached this issue as an opportunity to attrackt the investors of the digital service sector. The OECD invited 130 countries to discuss and negotiate how to adapt an international tax system over the digital service. The main objective of those discussions was to find a way to determine and solve the tax challenges of the digitalization of the economy.

Keywords Digital services · Taxation · Fiscal transformation · Digital transformation

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15.1 Introduction

Charles H. Duell was the Commissioner of US patent office in 1899 whose projection abilities made him unforgettable in history, but unfortunately in a negative way. He stated, "Everything that can be invented has been invented" (Dennis 2011). In retrospect, it could be astounding how a patent office commissioner had such captivating forecasting abilities. However, when we think about the future, it may still be difficult to imagine the next inventions. To understand how fast the world is changing, we do not have to make long lasting time travels. By observing the past two decades alone, it is evidenced that most of the unreachable dreams then have become the facts of today. Yet, ironically, despite all these developments in the entire fields of life, a virus named Covid-19 has managed to stop our bustling lives and locked people in their homes.

As Darwin said, "it is not the most intellectual of the species that survives; it is not the strongest that survives; but the species that survives is the one that is able best to adapt and adjust to the changing environment in which it finds itself" (Megginson 1963). The tough Covid-19 period has showed us that as humans we all are adapting ourselves to the rapidly changing conditions of life by keeping distances among each other and leaving ourselves to the flow of the digital age. By using various digital platforms, software and applications it is now possible to work, get educations, meet with families, socialize with friends from laptops and mobile phones. As a result of our changing lives in the past 20 years, the digital service provider companies have gained more value and are top listed as part of the most valuable companies of the world. With the support of Big data, and Industry 4.0, the nature of conducting business and the principles of economy have changed.

Peter Drucker's one of the famous statement is "What gets measured gets managed", which can also be referred as you can't manage what you can't measure (Prusak 2010). This statement could be interpreted to refer to managing an item properly; a clear understanding of what you want to manage is required. Likewise, to manage fast-changing digital environment, the authorities must have clear understanding on the effects of the digital services.

The objective of this, study is to provide comprehensive fiscal information to support the management of digital services. To meet the objectives, primarily Turkish tax practice; especially as the one of the fastest country that introduced new tax regulations for the digital service providers, was analysed. Moreover, by comparing the approaches of some major countries on the taxation of digital services, the effects of the applicable tax legislation over the establishment places and the location of the digital service provider companies were examined.

Various studies also analyzed the effects of the digital transformation over the social habits and over the changes in business activities. A research, conducted in 2014 by OECD, showed that the number of connected devices in households would be increasing from 1.7 billion to 14 billion by 2022 (OECD, read.oecd-ilibrary.org 2014). However, the figures of today already show that the figures, which were projected 5 years ago, were exceeded significantly and reached 27 billion as of the

end of 2019. Such a rapid increase also leads the revision of the expectations for the market value of the digital services from USD 40 million to USD 3 billion for the next couple of years (Blake 2019; McKinsey and Company 2019).

The countries, that prefer to attract new business leaders across the world, have been amending their regulations and investing in their digital infrastructures to create more supportive environment for the digital service companies. Additionally, they also aim to control the digital activities to protect their own taxation rights and generate more revenue from the digital service companies.

As per the desired balance among the new regulations, most of the fiscal regulations of the countries can be classified under two basic approaches: regulations that aims to use the digital transformation and fiscal policies that aims to generate more revenue over the digital transformation. The following sections, focuses on the digital service taxes using the recentlyintroduced related tax regulations in Turkey. It would then compare and analyze them with the approaches of some major countries; and their reactions toward the digital transformation.

15.2 Fiscal Policies Related to Digital Transformation

The fiscal authorities of the countries are affected by the digital transformation. As per their fiscal and tax policies and objectives, the countries may provide incentives to support and attract the digital service companies. They may also apply additional tax to generate more revenue from those companies in their jurisdictions.

Especially, considering the international service companies, since the borders are more transparent, the determination of the country where the revenue was generated can be more difficult. The digital service companies registered in one country can easily generate their revenues from the technological devices used in other countries. Accordingly, the countries also introduce new regulations to determine the taxation borders against the digital services. Thus, they strongly argue that together with the economic efficiency, tax fairness and sovereignty should also be taken into consideration.

Considering the regulations introduced by most of the countries, it can be stated that the fiscal authorities of the countries, response against this transformation via various policies, some of which can be classified under two sub-topics, like:

- fiscal policies that aims to use the digital transformation, and
- fiscal policies that aims to generate more revenue over the digital transformation.

The details of these approaches are analyzed in the following sections.

15.2.1 Fiscal Policies That Aims to Use Digital Transformation

The fiscal policies that aims to use the digital transformation are mostly related with the regulations introduced to the systems:

- to collect and analyze more reliable data from the taxpayers
- to increase the controlling activities of the Tax authorities
- to ease the difficulties and bureaucracies of tax filing and tax payment systems
- to support the fiscal awareness of the public

By collecting data via e-tax returns, e-invoices, e-ledgers, e-trial balances, e-journals, the track records of companies can be collected and be used by the tax authorities. Moreover, with the support of readily available digital booklets explaining the details of the tax rules, and digital applications where taxpayers can reach their tax status and relevant legislation the level of awareness in the public can be increased. To reach their digital goals, tax authorities must develop strong technological infrastructure and sufficient labor force to train the taxpayers and to maintain the coordination among all stakeholders.

15.2.1.1 The Use of the Digital Platforms for Daily Transactions

Using digital platforms of the fiscal authorities, the taxpayers can also reach their own tax records to control themselves. Some of the information that they can easily reach via digital platforms can be listed as follows:

- their tax number and contact details registered at the tax office,
- tax payment history and outstanding tax debts followed by tax offices,
- electronically filed tax returns and taxes accrued,
- notifications for tax and penalty assessments,
- document notifications,
- memorandums of inspections conducted electronically,
- answers to questions sent via the online system.

Apart from collecting information, taxpayers can also perform some transactions via the digital platforms of the tax authorities, like sending their tax returns, making the tax payments, requesting special tax rulings, applying for official negotiation opportunities to reduce tax penalties, asking for reconciliations, submitting their notifications related to starting a business or address changes, applying for tax certificates of residences (TC Gelir İdaresi Başkanlığı 2018).

Depending on the size of their businesses, some of the taxpayers can even make their accounting postings, issue their invoices, make the calculations (i.e., depreciations, revaluations etc.), keep their ledgers, prepare their tax returns using the digital applications of the tax authorities.

Almost all the fiscal authorities of the countries using those digital systems are enjoying from the technology by reducing the bureaucracies, they were struggling with in the past years.

15.2.1.2 The Use of Digital Platforms for Controlling Transactions

Applying evidence collecting methods and the analysis of the collected evidence is one of the major requirements of auditing activities. It is certain that technology supports fiscal authorities for collecting the data from the taxpayers and for analyzing them as per their priorities.

The tax audit is a process, which officially starts with inspection notification to the taxpayers and which is mainly handled by the tax inspectors, individually. Accordingly, the digital transformation on tax audit can also be considered as the transformation of a labor-oriented process to the technological based system.

It is certain that having available digital data, like e-invoices, e-ledgers are required for such transformation. Process control steps should be determined and depending on the inspection topic, the steps should be clearly identified. Those steps should include the entire control steps which are required to be performed in case of an inspection.

Using those steps the collected data can be analyzed in line with the requirements of the audit, but in a more efficient way, as the accounts, which contains significant volumes of transactions and that create difficulties for the inspectors; like cash and banks, receivables or payables can easily be examined and controlled. Accordingly, it will be more possible for inspectors to focus on more complex transactions, which may require interpretations.

15.2.2 Fiscal Policies that Aim to Generate More Revenue Over the Digital Transformation

The fiscal policies that aims to generate more revenue over the digital transformations are the regulations introduced by the tax authorities of the countries searching for additional taxation over the digital services. As an easy and traditional way of taxation, most of the countries use indirect taxes like VAT or Sales Taxes over the digital services to generate more revenues.

Conversely, as per the opportunities of the industry, the digital service entities may generate their revenues from a country without having physical existence in those jurisdictions. Thus, the fiscal authorities of some countries introduce new regulations to protect their taxation rights and sovereignty. An important milestone for such activities was held in March 2017 by European Union, which 27 member countries of EU came together and discussed the measures to support and manage the digital transformation under EU Council, EU Parliament, and EU

Commission (EU Council 2017). Moreover, OECD and G-20 countries focused on the topic of "Taxation of digital economy" as one of their prior discussion areas. As per the decisions taken during "*G-20 Leaders Summit in Argentina*" in 2018, member countries agreed to search for a common solution to the taxation of digital economy by 2020 (OECD/G20, Toolkit For measuring The Digital Economy 2018). However, many countries including developed countries, such like Turkey also introduced local and unilateral regulations to apply taxes over the income generated from digital services (Bicer 2019).

It is certain that each country may have different goals and may apply various applications and rules. Considering its total population, addictions to use technology, heterogeneous cultural structure between Europe and Asia and well-designed digital fiscal infrastructure, as a G20 country, and as one of the fastest country that enacted a new taxation over the digital services, Turkey's practices are used in this study to understand the reactions of the tax authorities towards the digital transformation processes. Accordingly, the recently introduced tax regulations in Turkey, which can also be considered as the new sources of the Revenue Authorities, can be listed as follows:

- Withholding taxes applied over the payments made to the digital service providers
- Specific VAT regime over the digital services
- Digital service taxes

15.2.2.1 Withholding Tax

With a Presidential Decree numbered 476, Turkey introduced a specific tax on the online digital advertising activities on December 19, 2018, which brought "withholding tax liability" over the payments made to abroad for digital advertising services. The enforcement came into effect from 1 January 2019 onwards.

As per the regulations of the accepted legislation, "the payments made to non-resident providers of cross-border online advertising services or to those who act as an intermediary for the provision of such services will trigger the withholding tax liability, regardless of the taxpayer status of the service provider".

Under this specific withholding tax regulation, only the payments made for online advertising services were covered and other activities in digital sector were not taken into considerations. The withholding tax rates on the relevant payments were decided as follows:

- *15% for payments made to real persons (including non-resident individuals)*
- *15% for payments made to non-resident companies*
- *0% for payments made to resident companies*

Based on this regulation, individuals who do not conduct commercial activities but somehow pay online advertising services to the non-residents were not held liable to apply withholding tax on their payments.

15.2.2.2 Specific Value Added Taxes Regime Over Electronic Services

Effective from first of January, 2018; Turkey introduced new articles related to VAT over electronic services. This amendment was new to Turkey, as prior to this amendment, under Turkish VAT system, the foreign service providers were not asked to submit VAT or make payments directly to the tax authorities. Purchasers of relevant services, who are registered as taxpayers in Turkey were calculating and paying the relevant VAT amounts on behalf of the foreign service providers, as the responsible taxpayer, under the *"reverse charge VAT"* mechanism.

(The Reverse charge VAT system, applicable in Turkey requires the calculation of VAT by resident companies on some of their payments to payments made to non-residents which do not have a permanent establishment or a fixed place of business in Turkey (if the services are rendered in Turkey or benefited in Turkey). Under this system, on monthly basis, the buyer company (as the responsible entity) calculates and pays the relevant VAT amount to the related tax office by on behalf of the relevant foreign or local service provider. The responsible Turkish company also has right to treat this paid VAT as its own input VAT in its ordinary VAT return and offsets it against output VAT amounts in the same month.)

As per the new legislation, VAT rules for sales of electronic services for consideration to non-VAT registered individuals by digital service providers *(who do not have fixed place of residence in Turkey, and who do not have a business place or legal and business center in Turkey)* was changed. Accordingly, non-resident digital service providers are asked to declare and pay VAT over their digital service sales to non-VAT registered individuals. For cross border supplies of digital services to registration threshold was accepted, and 18% VAT is defined for those services. The new amendment in VAT Law, did not affect "business to business sales", and reverse charge mechanism is still applicable for such transactions.

Digital service companies, that are not resident and do not have representative in Turkey and that renders services to and generate their revenue from real persons in Turkey, are also liable to declare the VAT related to these transactions electronically with the VAT Declaration No:3. As per the procedures of the tax filing requirements, the service providers in this scope are required to fill in the form on Turkish Revenue Administration's website (www.digitalservice.gib.gov.tr) before filing the VAT Declaration No.3 for the first time. Upon completing and filing the aforesaid form in electronically, "Special VAT Registration for Electronic Service Providers" are considered as they are registered at Large Taxpayers Tax Office Directorate of Turkey. In case of failure to fulfill the obligations, due to the tax evasion penalties, the companies may face to pay the double of the tax amounts. Moreover, special irregularity penalties can also be imposed for the tax returns, which were not properly filed or were not filed on time.

15.2.2.3 Digital Service Tax (DST)

The Digital Service Tax (DST) has been introduced to the Turkish tax legislation with the Law numbered 7194, which came into force after it is published in the Turkish Official Gazette dated 07.12.2019. Despite of its issuance date, the enforcement date of the legislation was accepted to be 1st of March, 2020. Moreover, for the clarification of the implementation of the legislation, The General Communiqué on the Digital Service Tax", was issued on 20th of March 2020. The Communiqué provides more detailed explanations, clarify the implementation principles of the "*digital service tax*".

The accepted rules under DST were in line with the general framework of the project of OECD, namely BEPS (Base Erosion Profit Sharing) guidelines and apart from some major rules like rates, they were similar to the legislation that was accepted by other OECD countries.

Accordingly, as per the accepted regulations, gross revenue generated from the digital services rendered in Turkey are subject to 7.5% digital service taxes. The definitions of the "gross revenue generated from digital services", "taxpayer", recognized exemptions and the way of the declaration of the Digital Service tax return lead some technical discussions in the tax environments. More details of DST and the technical discussions on the DST can be found in the following sections.

15.3 Discussions on Digital Service Taxes

The aim of the digital service taxes is to collect tax over the digital service income of the non-resident companies that earns their revenue via digital platforms, and without existing physically in that country.

The authorities in the countries were discussing that the as per the nature of the e-business, digital service companies are registered in countries, especially in the ones that provide less tax burden and controls, but can still generate their revenues and profits from their countries. Thus, the Authorities were thinking that unless specific measures and controls are defined for such companies, the new way of doing business can affect their sovereignty on collecting taxes over the generated income from their own countries.

It is certain that the high volume of turnovers also encouraged authorities to take more powerful measures against the digital service companies, which has gross revenue streams. Accordingly, for DST, the targeted companies can be considered as the digital service companies that generate high revenues.

Each country has slightly different proposals or implementations for DST. However, the tax base of DST is generally accepted as the revenues generated from the activities such like;

- *digital advertising,*
- *the transmission of data collected about users for advertising purposes, and*
- *providing a digital interfaces* (Asen 2020).

The applicable rates of the total taxes over the electronic services directly affect the revenues of the tax authorities. However, from the perspective of the digital service providers, since those tax liabilities increase the costs of running their businesses in the relevant jurisdictions, the volume of the taxation, may also affect the decision of the location of the companies. Accordingly, countries that prefers to be the center of the digital service provider companies, introduces low-tax rated systems or even incentives to the relevant entrepreneurs.

Moreover, DST triggered new discussions, especially on the double taxation issues mainly from the perspectives of the existence of any offset mechanism for the paid taxes in other countries or having exception rules over intragroup transactions. In this section together with Turkey, the applications of some other major countries, which had role on the Digital Service Taxes are analyzed.

15.3.1 Turkey's Practice

As it was mentioned in the above sections, Turkey introduced DST to its tax system with the "Law No. 7194" to be enforced from the beginning of March 2020. However, Turkish Fiscal authorities managed to introduce the General Communiqué on the Implementation of the Digital Services Taxes, which explains the implementation details of the legislation after the enforcement date of the legislation on March' 20, 2020.

15.3.1.1 DST's Scope

As per the first article of DST Law, the following income items are defined under the scope of DST:

- *Advertisement services provided through digital platforms (including advertisement control and performance measurement services, as well as data transmission and management services concerning users, and technical services for providing advertisements).*
- *The sale of all types of auditory, visual or digital contents on digital platforms (including computer programs, applications, music, videos, games, in-game applications, etc.) and services provided on digital platforms for listening, watching, playing of these content or downloading of the content to the electronic devices or using of the content in these electronic devices.*
- *Services related to the provision and operation services of digital platforms where users can interact with each other (including services relating to the sale or facilitation of the sale of goods or services among users).*

– *Intermediary services of digital service providers on digital platforms also triggers digital service taxes.*

15.3.1.1.1 Definition of Services

Considering the above stated scope defined in the DST legislation, it can be stated that the covered transactions were broader than most countries. As per the provisions of the law the below stated transactions are accepted as the transactions that falls under the above stated scope of DST:

– The fees generated from listing the web-links of the users in the higher places of the search-engines
– The fees generated from the users that upload, share their advertisement contents in the provided digital platform or environment
– The fees generated from the pop-up advertisements of the digital-game companies
– Technical services for the advertisements

Regarding the second item stated within the covered scope of the legislation, the fees generated from all software and applications that can be used in computers, mobile phones or similar electronic devices, all digital games, the codes, or additional service packages were considered as the revenues generated from the sale of all types of "*auditory, visual or digital contents*" on digital platforms. Accordingly, the sale of antivirus software, the platforms where the sales can be performed via virtual moneys were covered. However, the ticket sales for activities like, concerts, sport activities, cinemas or for travelling purposes (i.e., flight tickets) made from digital platforms were considered as out of scope from DST.

The statement of ". . .where users can interact with each other (including services relating to the sale or facilitation of the sale of goods or services among users). . .", which was used in the third item stated above can be perceived as extremely broad. Thus, one of the important discussions on the covered digital services relates to this intermediate trading activities that are made via digital platforms. Accordingly, in the Communique more detailed explanations were provided regarding this item and the following examples were given:

- Providing digital platforms where the third-party sellers can meet with the potential buyers
- The digital service companies, that sold the goods or services of others from its website as an intermediary agency. (However, providing that the legal responsibilities of the sold goods or services will remain with the seller, the revenue corresponding to those goods or services will not be taken during the DST base calculations. Thus, the only the digital service part of the amounts are subject to DST).
- Revenues generated by the digital platforms, for providing space where individuals share their personal data, CV, photos, experiences etc.

On the other hand it was also clearly stated that if a Company sells its own products in its own website, such e-trading activities will not trigger DST.

15.3.1.1.2 Definition of the Service Location

As per the wording of the legislation, DST is accepted to be applied only over the digital services provided in Turkey. Thus, the definition of the service location from DST perspective is crucial to understand the applicability of DST over those services. Accordingly, in the legislation the definition of "the services provided in Turkey" is explained as the services;

- Which are provided in Turkey
- Which are benefited in Turkey
- Which are provided to the persons in Turkey
- Which are provided for the persons in Turkey

If one of the above stated conditions are met, that service would be considered as the service provided in Turkey.

However, if a digital advertisement service is benefitted and used by the persons who are not located in Turkey, those services are perceived as the service provided outside of Turkey and Thus, do not fall under the scope of DST.

15.3.1.2 Tax Base and Rate

The DST rate is 7.5% that should be applied over the income derived from the services that falls under the aforementioned definitions of DST. The tax base is considered as the turnover generated from the digital services, that is explained in the legislation. Accordingly, it is not possible for companies to reduce the costs, expenses related to those services. In other words, the tax base is not the profit but the revenue generated form the digital services.

It should also be emphasized that, as per the accounting rules, since accrual basis accounting is accepted, for the recognition of revenue, the maturity provided to the customers or the collection ability is not taken into considerations.

Comparatively, Turkey also introduced one of the highest DST rates among other countries. As per the legislation, "*the President of Turkey is authorized to reduce the DST rate to 1% per each service types or collectively, or to increase the rate up to 15%* (Akdogan 2019)".

15.3.1.3 Taxpayer and Tax Responsible

As per the legislation, disregarding the activity location of the digital service providers, all digital service providers are considere as the "taxpayer" of DST. The legal

status of the digital service companies also do not have any impact over the taxpayer status of the companies.

While determining the taxpayer status, there are certain treshholds that bsshould also be considered Accordingly, an exemption is provided for the companies whose digital service income generated in Turkey is less than 20 million or whose global digital service income is less than 750 million. However, during the calculation of the income limits, the consolidated revenues of the entire group companies must be taken into account. The group companies, whose results must be consolidated can be defined as per the International Financial Reporting Standards or Turkish Financial Reporting Standards.

The above definition of the taxpayer of DST leads that all digital companies that generates revenue from Turkey are required to know Turkish taxation rules and to be registered as DST taxpayer in Turkish tax offices (i.e., Under large tax-payers office). Moreover, if their volume does not meet the specified limits, they are required to submit their consolidated reports to enjoy form the provided exemption.

In order to secure their DST receivables, considering the difficulty of collecting DST from the companies that do not have any representative or workplace in Turkey, Ministry of Treasury and Finance has authority to assign parties who are the resident counterpart of digital service providers (Ozmen 2020).

15.3.1.4 Declaration and Payment

DST is accepted as a monthly tax, where the taxpayers and tax responsibles are required to submit their DST returns to the relevant tax offices by the end of the month following the digital service transaction. The DST will also paid within the same tax return submission period. For Turkish resident companies, the paid DST can be considered as expenses during their corporate income tax base calculations.

15.3.1.5 Penalties for Failure to Submit the Tax Declaration and to Make Timely Payment

As stated above, certain procedural and tax payment requirements are introduced to the digital service providers, who may not even have any business place or a contact in Turkey. As per the Tax Procedure Law of Turkey, digital service providers and their representatives in Turkey who do not fulfil their declaration and payment obligations in a timely manner will be informed on this and "The Large Taxpayers Tax Office" which is authorized to levy digital services will send notification to the digital service providers or their representatives in Turkey to make them fulfil their obligations by using communication tools, domain name, IP address on the digital service provider's web pages and information obtained from similar sources through notification methods or e-mails or via all other means of communication.

After such notifications, the taxpayers will be provided with 30 days to fulfill the notified deficiencies. However, in the event that these obligations are not fulfilled

within the next 30 days from the date of announcement, the Ministry of Treasury and Finance will have the right to block the access to services offered by those digital service providers until such obligations are fulfilled. Accordingly, this decision of Ministry of Finance has to be sent to the Ministry of Information Technologies and Communication to be further proceeded and further be notified to the access providers, who have to fulfil the requirements of the decisions within 24 h following the sent notification. In case the obligations are fulfilled afterwards; the relevant notification stages can be suspended, or the access blockages can be removed by the relevant Authorities. As per the DST legislation there is no direct monetary penalties and interest due to non-compliance with the DST law. However, it is certain that having blockage over the systems may directly affect the businesses and may cause more costs for companies in comparison with an ordinary tax penalty.

15.3.2 Other Countries

The OECD invited 130 countries to discuss and negotiate how to adapt an international tax system over the digital services (Reeves 2020). The main objective of those discussions was to find a way to determine and solve the tax challenges of the digitalization of the economy.

As per the approach of OECD, the proposal was to force multinational digital service economy to apply corporate income taxes in the jurisdictions of their consumers or users. However, the countries who were hosting the active management of the digital service companies were reluctant to lose some of their tax revenues to other countries. Despite of ongoing negotiations of the countries, several countries took unilateral measures to tax the digital economy, locally (Kofler and Sinnig 2019).

During the meetings, the European Commission asked to apply 3% tax on the revenues gained from digital services like, "*online advertising services, online market platforms, and over the sales of collected user data*". They were considering that the turnover volume of the industry may reach Euro 750 million and approximately Euro 50 million revenue were expected from the digital service companies originated from EU countries (Comission 2018).

Until EU introduce a common corporate tax approach over the digital activities, a temporary DST was proposed by European Commission. However, some of the EU member states rejected the proposal in the first months of 2019. Accordingly, the new European Commission continued to work on ways to introduce taxes over the digital services and they declared that their efforts would continue until the countries will reach an agreement on the taxation principles of digital economy.

15.3.2.1 OECD Countries in General

Among European OECD countries, as can be seen from the list stated below, a taxation system applicable over the digital services were enacted mainly in six countries. As of March 2020, Turkey, France, Hungary, Austria, Italy, and the United Kingdom have implemented their local DST (Musgrove n.d.). Turkey is also insisting on the registration of the foreign digital service companies to the Turkish tax administration.

Some of the countries, such like The Czech Republic, Slovakia, and Spain are still internally discussing to accept a DST. Moreover, Latvia, Norway, and Slovenia have declared that they have intention to implement digital taxes. On the other hand, due to local and international pressures, Poland finally recently suspended its efforts to introduce digital services taxes (Asen 2020).

However, countries like Germany, Netherlands, Estonia are still waiting to see the effects of such legislation in other countries and still provide lower tax-cost environment for the digital service providers (Karaca 2019).

From the provided list stated below, together with European countries, the approaches of some other countries over the digital service taxes can be found (the list was provided starting from the applicable highest rate to the lower rates) in Table 15.1.

As can be seen from the chart, the countries have different approaches over the taxation of the digital services. For example, India applies another tax namely balance tax to collect tax over the digital products, whereas Israel introduced a specific definition of "significant digital presence" in its legislation. The definitions, exemptions, implantation rules of the taxes applicable over the digital services can change among the countries.

15.3.2.2 French Practice

During "Group of 7" (G7) meeting, which was held in France on 17–18 July 2019, the French Minister of Finance, raised their argument by stating that the negotiation should be accelerated at the OECD level on the taxation of "tech giants," and said "*France will only withdraw its digital services tax if and when a credible decision is made at the OECD level (considered a possibility as early as late 2020)*" (Alderman 2019). French authorities were believing in that the digital economy should mainly be taxed at the locations where the customers, that spent money is located. Accordingly, they were acting as one of the strongest defenders of the rules also in EU Commission discussions. Accordingly, until a conclusion is reached over the discussions of the taxation of digital economy, in line with the proposals of EU, France introduced the DST and accepted the tax rate as 3%. The new legislation was accepted in July 2019, but the enforcement date was accepted to start from January 1, 2019. However, France also accepted to postpone the implementation of DST until the end of 2020.

Table 15.1 The approaches of European countries over the digital service taxes

Country	Rate (%)	Status
Turkey	7.5	Enacted
Hungary	7.5	Enacted, but temporarily the rate was reduced to 0%
Czechia	7	Proposal at Parliament
India	6	It is applied as "balance tax" over the advertisement revenues that exceed certain limits
Austria	5	Enacted
Pakistan	5	Enacted
Belgium	3	Draft Proposal At Parliament
France	3	Retroactively enacted from Jan'01 2019
Spain	3	Draft Proposal was refused in the Parliament
Italy	3	Enacted starting from 2020
Canada	3	Planned to be enacted starting from April 2020
UK	2	Enacted
Ireland	–	They are working on the a legislation in line with the framework developed by OECD
Denmark	–	They are working on the a legislation in line with the framework developed by OECD
Finland	–	They are working on the a legislation in line with the framework developed by OECD
Sweden	–	They are working on the a legislation in line with the framework developed by OECD
Russia	–	Working on the draft legislation
Poland	–	At first the Government declared that they will introduce the new tax system for digital services but then they pulled it back to work more on the regulations.
Israel	3–5	The Parliament is working on the rules similar to the regulations accepted in France
Egypt	–	Still stays as a draft regulation

The scope of digital services tax is accepted as the gross revenues derived from digital activities of which French "users" contributes to that business. Accordingly, the revenues generated from online marketplaces and online advertising services (including the sale of user data in connection with internet advertising) are covered within the scope of DST. In general, the law was covering the entire digital business models together with the unique digital service companies that was generating revenue in France (KPMG 2019).

As per the French practive, mainly two types of digital services were covered. As the first type of digital services, providing digital contents, communication services, electronic payment systems, the electronic platforms or interfaces where the users interact with each other were covered within the scope of the DST Law.

Secondly, the below stated services are also considered as the digital services that trigger DST:

– the provision of services to advertisers that aim at placing targeted advertising messages on a digital interface based on data collected about users and generated upon the consultation of such interface.
– The advertising services based on users' data (both the purchase of advertising messages and the storage of them, monitoring activities, advertising data management services, preparation of digital performance dashborards, were accepted under this topic).

The digital service companies, which have less than Euro 750 million turnover for their consolidated worldwide income or a local revenue of Euro 25 million are provided with exemption from digital taxes.

15.3.2.3 UK Practice

The digital service tax rate is proposed to be 2% in UK. The base of DST must be calculated considering the income generated from *digital search engines, social media platforms, and online marketplaces*, which are provided by large digital service companies. During the determination of the large multi-national enterprises, regulations and treshholds related to the volume of the income were addressed. Accordingly, the companies whose total global and local revenues are higher than £500 million and £25 million, respectively are accepted as they fall under the scope of the legislation. Moreover, as an exemption to the above, the first £25 million of the companies were also considered as DST exempt revenues of the companies (UK HM 2020).

The tax is planned to be enacted starting from April 2020. However, British government also declared that the accepted rules will be in force until the countries reach an common international understanding on the global taxation principles of the digital services.

As per the DST regulations, the revenue arises by virtue of a UK user using the service, trigger DST. It is also regulated that for the cases, where one of the parties to a transaction on an online marketplace is a UK user, all of the revenues from that particular transaction will be treated as derived from UK users. Moreover, when the transaction involves accommodation, land or buildings in the UK, revenue from that transaction will be treated as derived from UK users. When the transaction involves accommodation, land or buildings not in the UK, revenue from that transaction will only be treated as derived from UK users if the consumer of the relevant service is a UK user. Moreover, for the advertising revenues, when the advertisement is viewed or otherwise consumed by a UK user, they will be perceived as if they are derived from UK users. As exemption to DST, iti is also stated that, if a user in respect of a marketplace transaction is normally located in a country that operates a similar tax to the Digital Services Tax for a UK user, which triggers DST also in UK, the 50% of the revenues will be considered during the tax calculations.

15.3.3 The Criticisms Against DST

As per the current corporate tax structure, the digital service enterprises are taxed over their profits at the locations where those enterprises are registered. However, the value of those companies can be derived from other countries, where the users of those digital services are located. This cause a misalignment between the jurisdictions where the digital services are taxed and used. To solve this mismatch DST, in general are designed by the countries, where the users of the digital services are located.

However, the structure of DST is one of the most important challenges raised against this regulation, as the tax is applied over the turnovers rather than the generated profits. Although DST is designed as a kind of direct tax, it still leads an unfair taxation, as it does not consider the associated costs, or the expenses incurred to generate those revenues. Thus, for a taxation system that is introduced to adjust the unfairness of the income tax mechanism, the tax burden is considered as significantly high. Due to high salaries and operating costs, the digital companies may face with losses, however even for a loss-making company, DST is a burden to be fulfilled in other countries. Traitionally, taxes applied over turnovers are perceived as inefficient taxes, which negatively effects the economic growth of the coutnires, and generally have an unfair nature (Bunn 2018).

Another criticism against DST, is the difficulty of the management of those taxes in other countries. The countries have different types of approaches, applicable tax rates, exemptions related to DST. Thus, assigning liabilities to a foreign company, which does not have any existence in that country and which, operates only from a virtual environment is not easy for those enterprises to manage and fulfill. The procedural requirements, applications may cause additional costs for those digital service providers, which cannot be reduced from their calculated DST.

DST can also be considered as the duplication of tax over the same source. The profits of the digital service providers are still being taxed via income taxes. However, without having offset opportunity, applying additional tax, like DST, over the same source is also against the international tax principles.

Moreover, DST is designed as a tax, which is applicable over a single sector and limited activities. Differentiating an industry, negatively from the global economy can also be considered as an unfair approach.

15.3.3.1 Discussions on DST—U.S. Introduced New Tariffs Against the Digital Services Taxes of Europe

U.S was not in favor of the application of DST, as it was expected that, DST will mainly impact U.S. companies. When DST discussions began in Europe and with the introduction of DST rules in some countries (i.e., France) the U.S. Authorities (i.e., USTR) filed an investigation namely “Section 301” to prove that the accepted taxes were against U.S. trading and business environment. As per the prepared report

of inspectors, which was announced in December 2019, the application of DST was considered as a transaction that cause tax discrimination (Lowry 2019).

Based on this argument, as a counter action, the U.S administration decided to apply additional tariffs on some products. As the result of the discussions, the U.S. and France came to an agreement that the French digital services tax would not be collected until the end of 2020 (although DST will be accrued in 2020, the collection date was postponed). The countries also agreed to work at the OECD level to find a common acceptable way for the taxation of the digital services.

The US administration has also threatened other countries, which have plans to accept digital service taxes, using the "additional tariff" argument. Accordingly, most of the countries either suspended the enactment date of DST legislation or postponed the applications or even refused the introduction of the Law (i.e., Hungary, Spain, Belgium). However, Turkey still remains as one of the countries that insist on the application of DST.

15.3.3.2 A Digital Service Country: Estonia Practice

Estonia is a Baltic country of four million hectares, half of which is forest. As the result of their investments for the last two decades, the government of Estonia, currently present themselves as a digital republic (Heller 2017). Estonia announce that they are the world leader on digital capability, and ease of doing business. They support digital service sector to maintain competitive environment which allows solutions and services to be researched, developed, and delivered globally.

Due to their capabilities in the research, development and application of software, high-tech systems, digital identity technologies and telecommunications, Estonia define themselves as the world's most advanced digital society and recognized leader in digital skills, infrastructure, and legislation (Republic of Estonia n.d.).

As a digital sector supportive country, despite of being its EU membership, Estonia has not yet accepted Digital Service taxes. Instead, the authorities still introduce more supportive regulations to attract foreign digital service companies to invest in Estonia.

15.4 International Regulations to Identify the Country that Hold the Taxation Rights

15.4.1 Treaties to Prevent Double Taxation

The countries sign treaties to prevent double taxation on the same source of income. Such treaties, also called as bilateral tax agreement, is an arrangement between two countries that solves the problem of double taxation that can occur when a transaction trigger taxation in both countries.

OECD and the United Nations promulgate widely used model of tax treaties. As per the standard model of such Treaties, together with the definitions of tax resident, working the taxation of income like commercial income, dividends, royalties, interest, capital gains, independent services, salaries are regulated. When an individual or business invests in a foreign country, the question of which country should tax the investor's earnings are answered via the tax Treaties. The source country, where the revenue is generated and the country, in which the taxpayer is resident agree on which country should tax the investment income to prevent the same income from getting taxed twice (Kagan 2018).

However, the standard model of Double taxation treaties remains inadequate to solve the discussions related to DST as the definitions of business place, that is crucial for understanding the country that holds the taxation rights is not sufficient the cover the revenues generated form digital services. Moreover, one of the most important aspects of the tax treaties is the policy on withholding taxes.

Although for traditional business transactions, there was still some difficulties to ascertain which country is holding the taxation rights due to the difficulties of understanding if the income is generated from a fixed place, or how the duration of stay in another country is calculated; the life became more complex as determining the location of the business place for digital services is much more difficult. Thus, a revision of the standard model based on the needs of the todays' and foreseeable future became an urgent requirement for the countries to solve the double taxation problems.

15.4.2 Agreements on Digital Service Tax and Transfer Pricing Rules

Considering that each country has its own taxation rules, the international business sometimes may face with higher tax burden in some countries, whereas they were enjoying exemptions or incentives in another. Thus, by using their international structure, they may aim to reduce their tax costs by shifting their profits to the low-tax areas. As a security policy against such transactions, transfer pricing regulations were accepted by most of the countries, which requires that the transactions between related parties must be carried out in line with the arm's length principle. Accordingly, "fair market values" should be considered during commercial and non-commercial transactions between related parties.

In case of violation of the transfer pricing rules by entering into transactions regarding the sales or purchase of goods and services with related parties where the prices are not set in accordance with the arm's length principle, then related variance between the applied prices and the market benchmarks are considered to be distributed profits to other party in a disguised manner.

The violation of transfer pricing rules, also referred to as base erosion and profit shifting (BEPS), became a key priority of governments. In 2013, OECD and G20

countries, worked to address potential measures against BEPS. The Action Plan was aiming to ensure that profits are taxed where economic activities generating the profits are performed and where value is created (OECD/G20, Base Erosion and Profit Shifting Project Addressing the Tax Challenges of the Digital Economy—Public Consultation Document 2019).

As per the agreed BEPS project, several rules to prevent tax avoidance were accepted, such as "*controlled foreign corporation (CFC) rules, patent box nexus rules, thin-capitalization rules, transfer pricing regulations, and cross-country reporting requirements"*. Many countries have already enforced those policies. However, the studies on the taxation of the digital economy did not reach to a conclusion together with those measures.

Accordingly, afterwards, OECD released a new schedule to work on the tax issues related to the digital sector in May 2019, where public discussions and negotiations with more than 130 countries had taken place. The started discussions have not yet been finalized but the scope of project, which is also referred as "BEPS 2.0", the main objectives were set under two topics as Pillar 1 and Pillar 2.

- *Pillar 1: addressing the tax challenges of the digitalization of the economy*
- *Pillar 2: addressing tax avoidance through a global minimum tax*

The discussions on the new approaches are still ongoing and the reports of OECD is expected to be finalized in the last quarter of 2020. The details of the discussion topics can be found below (EY Global 2019; OECD 2019a, 2019b).

15.4.2.1 Pillar 1: Tax Challenges of the Digitalization of the Economy

As per traditional global tax approach, the corporate income tax liability of the multinational companies is usually taxed, at the jurisdiction where production is done, rather than where sales arise. However, Under Pillar 1, a new approach is introduced, known as "Unified Approach," which will force taxpayers to pay more taxes at the jurisdiction where their customers locate, and their sales occur. The approach was mainly covering digital service sector and also other consumer-facing businesses.

The proposed approach was recommending setting thresholds over the country specific sales that provide tax revenue also to the jurisdictions with smaller economies. Accordingly, the definition of net profit allocation rule, which is defined under transfer pricing methodologies are extended. Accordingly, disregarding having physical presence in a country (i.e., via permanent establishment or separate subsidiary), for some portion of the revenues generated in that country is taxed in that country.

15.4.2.2 Pilar 2: Tax Avoidance Through a Global Minimum Tax

Under "Pillar Two" of OECD, the Members have agreed to find a way that leaves jurisdictions free to determine their own tax system, including whether they have a corporate income tax and where they set their tax rates. However, it will be also a requirement for those countries to consider the right of other jurisdictions to apply their own rules, where income is taxed at an effective rate, below a minimum rate. These members are of the view that profit shifting is particularly problematic especially over the profits generated from intangibles, like the digital economy.

As noted above, under the OECD's Pillar 1 (digital economy), multinational digital service companies will be held liable to pay taxes in other jurisdictions, even if they do not have a physical presence in those locations. Moreover, with the Pillar 2, under the terminology of "GLoBE", the determination of a minimum tax rate is recommended. For purposes of determining the applicable effective tax rate, blend of different tax rates ranging from the entity level, the jurisdictional level, and the global group level is still under discussions (EY Global 2019).

15.4.3 Regulations to Prevent Treaty Shopping

By using the different applicable tax rates accepted in Double Taxation treaties, which provides favorable tax rates in comparison with the local tax rates or effective tax rates applicable for the multinational companies, the taxpayers may engage in treaty shopping strategies by claiming treaty benefits in situations where these benefits were not actually intended to be granted to them. Using this mechanism, the income may escape from taxation as whole or be subject to inadequate taxation.

Due to such risks, the jurisdiction of residence of the ultimate income beneficiary will be reluctant to enter into a tax agreement with the jurisdiction of source, because residents of the jurisdiction of residence can indirectly receive treaty benefits from the jurisdiction of source without the need for the jurisdiction of residence to provide reciprocal benefits (OECD 2019a, 2019b). This might be relevant for the cases where the foreign company has claimed not to have a taxable presence in that country in the form of a permanent establishment (PE) or when there is indeed a taxable presence in the form of a PE or a group company, but the relevant taxable income is reduced by deductible payments. Accordingly, to prevent such risks, the countries sometimes renew their Tax Treaties or made addendum protocols and introduce regulations to their local legislation for the determination of the "beneficiary owner" from the provided opportunities in the Treaties.

Especially under current discussions for the taxation of digital services, the introduced systems to apply taxation at the country of the users or the variety of the tax rates among countries may also lead further discussions and measures from treaty shopping perspective.

15.4.4 Controlled Foreign Company (CFC) Rules

As another security tool to protect the taxable income in the home country, most of the countries recognized CFC rules in their own regulations against multinational companies. The Fiscal authorities realized that the multinational companies can easily establish subsidiaries in other countries, which has lower taxation rates. Accordingly, even though they may have legal presence in those countries, the main purpose of having those entities in those locations can be just to recognize or transfer some of their taxable revenues to those jurisdictions to reduce the entire tax burdens.

As a protection measure against such artificial movement of the equity, which is mainly performed for tax purposes, the countries introduce CFC rules. The details can change for each country but under a general perspective, CFC rules applies, where:

- a resident company has control over the non-resident company
- majority of the gross revenue of the foreign subsidiary is composed of passive income (i.e., royalty income, rental income, interest income);
- the non-resident company is subject to an effective income tax rate lower than a certain rate (i.e., 10%) on its commercial profit;
- gross revenue of the CFC exceeds certain amounts

The newly introduced regulations, like DST may also lead for the establishment of new companies in other jurisdictions that provides lower or no taxation on such services. Since CFC was mainly considering the income taxes, the CFC rules, accepted so far may not be sufficient to cover the DST or similar taxes. Moreover, another discussion may stem from the definition of passive income, as digital services are not covered within the content of digital services.

15.5 Conclusion

As Darwin said, it is not the strongest of the species that survives, nor the most intelligent that survives. It is the one that is most adaptable to changes. The tough Covid-19 times showed that as human beings we are all adapting ourselves to the rapidly changing conditions of life by putting distances among each other and leaving ourselves to the flow of the digital age. By using various digital platforms, software, and applications it is now possible to work, have educations, meet with families, socialize with friends from the laptops and the mobile phones.

The way of doing business is changing and accordingly this also lead new discussions on how the taxation of the digital business should be made. For the multinational digital transactions, the countries, in which the customers are located and that are the sources of the generated revenues are searching for new tools to introduce new taxation models or change the existing methodologies, whereas the

countries, which the digital service companies are mainly located still tries to protect the current system as the profits are disclosed and taxed in their jurisdictions.

The bilateral tax treaties are insufficient to cover the double taxation problems. Thus, the international organizations are still working on the potential solutions. However, until a conclusion is reached, some of the countries are introducing their own solutions like the application of Digital Service Taxes. Turkey was one of the fastest countries that enacted the regulations, and which is currently applying the highest rate of DST. The fairness of this tax leads more discussions among countries. As the digital service sector is growing significantly, agreeing on a taxation mechanism acceptable for all parties may still take some time.

OECD performs as the main solution-finder to this bottleneck. Apart from all its negativeness with its disasters and illnesses, hopefully the year 2020 can also be remembered as the year that the best solution for the taxation of the digital service sector was introduced.

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Chapter 16
An Applied Approach to Valuation of Securitized Balance Sheet Assets Based on Monte Carlo Simulation with Special Reference to Turkish Finance Sector

Tamer Aksoy and Nuray Yuzbasıoglu

Abstract In this study, it is examined whether Monte Carlo Simulation is an appropriate method in mortgage backed securities asset pool calculations. By simulating different combinations of input variables affecting the mortgage-backed securities asset pool, the future earnings, the total amount of interest, and the minimum and maximum values of the amount of total interest to be distributed are estimated. Six different scenarios were used in the assessment of the asset pool. At the end of the simulation obtained for the scenarios, the minimum, and maximum earnings, total amount of interest and total amounts to be distributed obtained from the asset pool that have been estimated. In conlusion, the study revealed that Monte Carlo Simulation is a convenient and useful method in asset pool calculations and evaluations for mortgage-backed securities.

Keywords Securitization · Mortgage-backed securities · Balance sheet · Asset pool · Monte Carlo simulation

16.1 Introduction

Nowadays, the globalization process has enabled different nations to rapidly reach technological developments and innovations in any field. Financial globalization has enabled the free movement of finance among countries and increased capital

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movements. Therefore, the globalization of financial markets has caused the financial instruments used in the markets to expand and diversify. In particular, the mortgage-based securitization process has gained influence in the world financial markets recently.

Mortgage-based securitization (MBS), the asset pool created by collecting mortgage-backed loans of various types, rates, and maturities to their customers in a pool, and the sale of this pool to other securities issuing institutions and the securitization of this pool by the purchasing institution. Mortgage backed loans, one of the bank balance sheet assets, are also one of the most important instruments of securitization (Eroğlu 2010: 23). It is observed that mortgage-backed loans and mortgage bonds are used as a widespread and increasingly growing funding instrument. Mortgage-based securities constitute the second most important source of funds in bank balance sheets after deposits. Unlike the USA, the majority of Institutions operating in the EU Mortgage Markets consist of various types of banks. As mortgage loans are kept on bank balance sheets, mortgage-based markets and mortgage-based securities are directly affected by Basel II regulations (Aksoy 2006: 94–95). With Basel II criteria, the risk weight of mortgage-backed loans has been reduced in parallel with the decrease in risk weighting in other balance sheet assets. This has had the effect of decreasing the loan/funding cost, increasing the loan volume and consequently reducing the minimum capital requirement of credit institutions (Aksoy 2007: 84–85).

The mortgage financing system, which is frequently used in the USA and developed countries, basically operates as follows: Mortgage housing finance institutions usually provide funds by selling their mortgage-backed loans in the second-hand market or by issuing securities based on these mortgage loans. Thanks to this method, liquidity is created for mortgage loans and the integration and deepening of mortgage and capital markets is ensured (Aksoy 2005: 188–189). Expressed as the transaction of selling papers to investors, MBS has a long history in financial markets. MBS transaction is generally based on the housing finance system. This type of securitization is widely used, especially in developed countries. The success of the system depends on the success of the organization funding the system. The increment of MBS investments in recent years in both in Turkey and the world are remarkable. Investors demand for such securities is increasing. The reason for this is that they are government-supported and reliable investments. In the MBS system, by collecting the mortgaged housing loans in an asset pool, various classes of securities are issued based on the cash flows that include the principal and interest payments of the loans. MBS are securities backed by an asset pool. In the MBS transaction used by the public and private sectors, at the time of issuance, even if the cash flow subject to issuance is partially available or not available, securities can be issued from now based on future cash flows. In this transaction, the terms of the assets in the asset pool are not similar. Loans consisting of different maturities and interest rates constitute the asset pool. The selection of loans to be found in the asset pool in the MBS transaction is made according to the expected returns and risks. Risk calculation is based on deviations in expected returns. Calculation of return depends on how much the risks of receivables can be eliminated. Changes in interest, restructuring, early

repayment of the loan and non-payment of the loan pose risks to the cash flows in the asset pool. Therefore, the risk will be eliminated with the least negativity by taking precautions against possible risks that may occur. For this, it is important to be able to estimate the minimum and maximum values of the yield that can be obtained. By analyzing the different situations that may occur in the asset pool, the minimum and maximum return of the pool can be estimated, and the losses that may occur in the face of the risks that may occur can be determined and thus the negative effects that may be encountered in the event of the risk can be minimized.

It is important to be able to estimate the minimum and maximum values of the yield that can be obtained. By analyzing the different situations that may occur in the asset pool, the minimum and maximum return of the pool can be estimated, and the losses that may occur in the face of the risks that may occur can be determined and thus the negative effects that may be encountered in the event of the risk can be minimized. The minimum and maximum return of the pool can be estimated by analyzing the different situations that may occur in the asset pool, and the losses that may occur in the face of the risks can be determined, thus the negative effects that may be encountered in the event of the risk can be minimized. MBS asset pool cash flow is based on the interest and principal payments of the mortgage loans that make up the pool. Since these cash flows are long term, their realization as predicted over time involves some concern. To minimize this concern in terms of the asset pool, it is necessary to ensure that the calculations made for the future are as close to the truth as possible. Different methods continue to be developed to obtain correct estimates and take correct decisions in MBS issues. One of these methods is Monte Carlo Simulation (MCS) that the essence of the simulation is based on the principle of obtaining different combinations for output variables by giving random distribution to input variables (Sakarya and Yildirim 2017: 51). Thus, the MBS asset pool is a method used for the analysis of uncertain situations that cash flows may face in the future. In this study, calculations are made by considering six different scenarios for the MBS asset pool cash flows, and the calculation results are compared with the MCS estimates. The minimum and maximum returns, total interest amount and total amounts to be distributed are estimated from the asset pool with MCS. Consequently, it was concluded that the MCS method useful in the evaluation of MBS.

16.2 Literature

Mortgages have cash flows over their lifetime, which means they are a mix of short-term, medium-term, and long-term periods. Cash flows continue throughout the maturity of mortgage-backed securities. Although the interest in MBS is increasing day by day, studies on MCS for this purpose are not yet in the desired number. McConnell and Manoj (1993) have been able to create tools that meet the needs of specific clients of investors with different maturity preferences by restructuring the MBS asset pool cash flows. Algebraic equations were formed in the created asset pool cash flow calculations and they used MCS in the solution of these equations.

Zenıos (1996) analyzed the level, structure, and history of interest rates, market perception of future interest rates, total and disposable consumer income values with MCS, and estimated interest rates at monthly intervals for 30 years as variables of the MBS asset pool. Akesson and John (2000) analyzed a pool of various asset types and stated that early repayment has negative effects on cash flows. Borrowers can prepay mortgages for a variety of reasons. In the event of early repayment, the lender loses the foreseen interest payments. In such a situation, if interest rates change in the future, there is a concern about the cash flow of the asset pool (Acheampong 2003). This concern makes mortgage-backed securities risky.

In the face of this concern, MCS has been an appropriate method for evaluating future cash flows. Besides, the long-term nature of MBSs also creates concern in cash flow (Goncharov et al. 2007). The long-term cash flows of the pool could be predicted with Monte Carlo Simulation (Green 2013). Also, pools contain secured mortgage obligations. This is another reason for concern. In this case Davıdson and Levın (2014), suggested that the MCS method is convenient.

It has been observed that the MCS method is a preferred method for evaluating different interest rates of the pool, as it provides an opportunity to examine a wide spectrum (Fabozzı et al. 2007). Thus, it is understood that the history of interest rates is significant, and it is a suitable method for valuing interest rate sensitive instruments Lutzenkirchen et al. (2014) analyzed the loans in the asset pool subject to securitization with MCS and obtained estimation results for different combinations. It has also been applied in pricing complex instruments such as mortgage-backed securities (MBS) (Pang et al. 2015).

The strength of MCS is not only the analysis of concern situations but also its strong path dependency and high dimensionality. The Road dependency term describes the set of possibilities that the change in interest rates to be high, medium, and low over time will follow. The change in interest rates reveals different paths that were unknown at the beginning but may occur in the future. However, the simulation may take a long time to achieve convergence in the evaluation of all roads (Pang et al. 2015).

It has been clearly understood from the above explanations MCS is a convenient and common method to be used in the analysis of MBS pools because it is random and path-dependent. MCS is used for this reason in this study to estimate the asset pool minimum and maximum return, total interest income and total interest amount to be distributed (to be paid on the security to be issued).

16.3 Asset Pool of Securitized Assets Backed by Mortgages

In a narrow sense, securitization can be defined as the lending institution sells its receivables arising from the loan and the financing of the loan by the investors who purchase the securities issued based on this receivable. With this method, credit institutions that reduce the risky assets in their balance sheets are able to fulfill the equity adequacy requirements more easily. In narrow definition, it is meant the

process of converting the illiquid assets of savings institutions (banks) and other intermediaries into securities by packaging. The most prominent example of securitization in a narrow sense is mortgage and asset-backed securities (Aksoy 1998: 17).

The rate of return provided by mortgage-backed asset issues is a significant factor for both investors and securities issuers. While making securitization based on mortgage loans, the price calculations of the securities to be issued should be performed most realistically. In this respect, the stage of creating an asset pool is of great importance. The structure of the asset pool depends on the interest, capital, and early repayment of the loans (Fabozzi and Mann 2010: 124).

Debt receivables in asset pools may have different interests and maturity structures. This can prevent a significant reduction in asset pool revenues in the event of any early repayment, structuring and non-repayment of the loan. Thus, asset pool cash flow estimates can be more easily predicted. This should be taken into account when making estimates of asset pool cash flows in terms of maturity risk since the payment of mortgage-backed debt receivables (loans) is likely to be non-payment (default) in the first years. The type of loans (fixed or variable rate), maturity structure, risk, and priorities of capital-interest payments may differ. In such a case, MBS issues should be made by considering the status of the asset pool.

While creating MBS asset pools, attention must be paid to ensure that the interest and maturity structures of the loans in the pool are free from risks such as non-repayment and early repayment of the loan. The low-risk asset pool will provide high returns. When calculating the interest (return) to be applied to the securities to be issued from MBS assets, it will be appropriate to determine the lowest mortgage loan in the pool.

When the head institution transfers the mortgage-backed asset pool to the special purpose institution, all the claims and rights regarding the asset pool pass to the special purpose institution. The structure of the asset pool is extremely significant for both the institution that will issue the security and the investor who will buy the security. The securities to be issued based on the asset pool must be reliable and profitable. The securities to be issued may vary according to the nature of the rights to be provided to their owners (Kravitt 2013: 1; Simkovic 2013: 216).

16.4 Research Methodology

16.4.1 Analysis Method: Monte-Carlo Simulation

The main purpose of the research is to accurately determine the future return, total interest amount, interest amounts to be distributed (the amount of interest applied to the security to be issued) using the MCS method of the mortgage-backed asset pool, and to provide the institutions that will issue the securities with an idea about the decisions they will take in their issuance.

MCS can be applied to this system if the system under investigation contains elements that show future possibilities, MCS is a probability calculation method used to predict future events by making use of past and current data (Williams et al. 2008: 401), and it is studied with random numbers (Şener and Şener 2019: 296). It is a suitable method for situations with uncertainty, situations with one or more variables (Roques et al. 2006: 5). MCS calculates the probability of occurrence of possible future situations in a system. The data to be used in the simulation is the result of analyzing the data obtained from the past, current, or recent past. This simulation focuses on the analysis of the situation, not the solution to a problem. When applying to a problem, the first random numbers are assigned to the variable at certain intervals. Due to the random distribution of input variables, predictive variables are formed with different combinations (Ross et al. 2010: 210). Therefore, the method is useful in analyzing situations involving combinations.

MCS has three main objectives (Burley and O'Sullivan 1986: 122):

- Describe the actual system
- Identifying imaginary systems
- To design an advanced system

The process steps followed while applying MCS are as follows (Fabozzı et al. 2007: 210).

- Determining input variables
- Entering interest rates using historical and current data
- Estimating the rate of early repayment probability
- Estimating asset pool interest yield
- Estimating the amount of interest to be paid (distributed) on the security to be issued
- Estimating the cash flow of the asset pool
- Estimating asset pool return

In securitization transactions, whichever type of asset subject to securitization used is essentially the same process. The first thing to do is to create the asset pool.

In this study, financial models have been created in line with different scenarios to estimate how the total interest amount to be paid (interest to be distributed) will be affected by various future situations based on the return of the asset pool, total interest income and asset pool. Because the most comprehensive and powerful parameter of asset pools, these are the risks arising from changes in interest rates.

16.4.2 Research Input Parameters and Assumptions

Mortgage-backed asset pool to be used in calculating the value of the input parameters, has been created taking into account the calculations to be performed in Turkey. Loans in the asset pool are assumed to be 5 and 10 years. The assumptions about the pool are grouped under three headings. These are the variables of income

Table 16.1 Variables used in MCS

Input variables	Lower limit	Upper limit	Units	Distribution type
Scheduled principal	140.000	2.770.000	TL	Normal distribution
Total number of periods	60	120	Month	Normal distribution
Mortgage payment	2.370	51.572	TL	Normal distribution
Early payment period	3	30	Month	Normal distribution
Early repayment rate	3	4	%	Normal distribution
Mortgage loan interest rate	11.88	14.25	%	Normal distribution
Mortgage loans remaining maturity	0	120	Month	Normal distribution
The number of repetitions	100	5.000.000	Input Variables	Normal distribution
Outputs				Normal distribution
Scheduled principal	663	22.114	TL	Normal distribution
Interest monthly payment	1.707	29.458	TL	Normal distribution
Interest to be distributed monthly payment	1.253	21.078	TL	Normal distribution
Monthly early repayment rate	0.00008	0.01775	%	Normal distribution
End of period mortgage balance	5.268	2.690.867	TL	Normal distribution
Mortgage payment	2.370	51.572	TL	Normal distribution
Total interest	1.348.900	1.547.900	TL	Normal distribution
Interest distribution	995.070	1.116.500	TL	Normal distribution
Total profit (Gainings)	180.970	431.400	TL	Normal distribution

Source: Calculation data prepared by researchers

distribution (income), interest distribution and total interest distribution. The variables used in our study are given in Table 16.1 and all variables are defined as normal distribution.

Matlab© (Matlab Student Software 2020) package program was the applications used to run the simulation codes we prepared. There is no ready-made interface and an m-file that has been created. In Fig. 16.1, the codes in this m-file and a figure

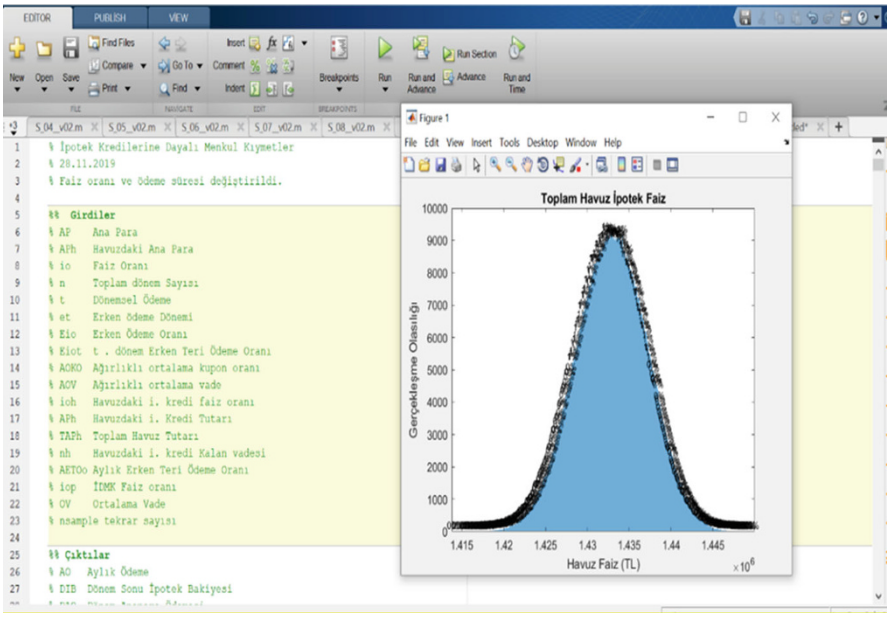

Fig. 16.1 Code with Monte Carlo simulations and a working example. **Source:** Calculation data prepared by researchers

obtained as a result of running the code are given as an example. As can be seen from the original screenshot below, the results obtained are also of normal distribution type.

In the simulations, securitization parameters based on mortgaged housing loans are evaluated to determine cash flows. For this purpose, six scenarios were created. These are;

- Asset pool based on the fixed rate assumption
- Asset pool based on fixed rate early repayment assumption
- Asset pool based on the fixed rate structured assumption
- Asset pool built on the assumption of non-repayment of fixed rate loan debt
- Asset pool based on the 6-month floating rate assumption
- Hydride asset pool based on the assumption that all scenarios are realized

The data to be used in the scenarios consist of mortgaged housing loans with a 5 and 10-year term of ten customers used in different months of 2020. Interest rates applied to loans vary according to scenarios. Table 16.2 contains customer data to be used in asset pool calculations.

In all scenarios, the results will be presented comparatively by calculating the interest amount to be distributed, interest income and the amount of return and by performing MCS. In order to determine the effect of the number of cycles on the results, a convergence analysis has been made as seen in Tables 16.3, 16.4 and 16.5. During the analysis, starting from 100, up to 5,000,000 cycles were examined.

Table 16.2 Data of asset pool customers

Customer	Year	Amount of loan	Month	Loan interest rate (Year) (%)	Interest of securities to be issued
A1	2020/2	160.000	120	12.80	
A2	2020/3	140.000	60	13.86	
A3	2020/4	150.000	120	12.55	
A4	2020/5	240.000	60	11.88	
A5	2020/6	400.000	120	12.15	
A6	2020/7	280.000	60	13.45	9.40
A7	2020/8	320.000	120	12.45	
A8	2020/9	250.000	60	13.55	
A9	2020/10	450.000	120	13.85	
A10	2020/11	380.000	60	14.25	
	TOPLAM	2.770.000			

Source: Calculation data prepared by researchers

Table 16.3 Change graph of simulation result (total return achieved) based on number of cycles

The number of cycle	100	1000	10.000	100.000	1.000.000	5.000.000
Upper limit	4.14	413	4.13	4.13	4.13	4.13
Lower limit	4.20	4.20	4.20	4.20	4.20	4.20

Source: Calculation data prepared by researchers

Table 16.4 Change graph of the simulation result (total interest to be distributed) based on the number of cycles

The number of cycle	100	1.000	10.000	100.000	1.000.000	5.000.000
Upper limit	1.070	1.069	1.069	1.069	1.069	1.069
Lower limit	1.086	1.087	1.086	1.086	1.086	1.086

Source: Calculation data prepared by researchers

Table 16.5 Change graph of simulation result (total interest income) based on number of cycles

The number of cycle	100	1000	10.000	100.000	1.000.000	5.000.000
Upper limit	1.484	1.483	1.483	1.483	1.483	1.483
Lower limit	1.507	1.507	1.507	1.507	1.507	1.507

Source: Calculation data prepared by researchers

Although it was observed that the change in values after 100,000 cycles was very small, simulations were carried out with one million cycles so that the normal distribution can be seen clearly on the simulation graph. In this way, it has been ensured that more of the different situations in the distribution are visible on the graph.

16.5 Findings

Different results were obtained from different scenarios involving cash flows of the asset pool, changes in interest rates, non-repayment of the loan, structuring or early repayment of customers. This suggests that loan structuring, early repayment, and credit default affect asset pool revenues. The minimum and maximum values of the income, interest amount and interest amounts to be distributed are calculated with MCS (Dana 2020).

Fixed rate mortgage backed asset pool, loan balance of 10 customers is 2.770.000 TL in total. The mortgage pool consists of 60 and 120-month term loans. The formulas used in asset pool calculations were used from the literature (Fabozzi and Mann 2010: 200–217). The first column of Table 16.6 is the loan balance of the asset pool. It decreases due to the principal repayments paid each month. As it is assumed that there are loan entries up to 10 months into the asset pool, the pool balance increases up to the tenth month. After the 11th month, the pool balance decreases. While the pool balance was 2.690.867 TL in the 10 months, it decreased to 2.667.732 TL in the 11th month.

The early repayment rate in the second column of the asset pool in Table 16.6 is the rate determined by the lender against the possibility of the customer using the loan to close the loan debt early in the future. Early repayment calculation Central Bank of the Republic of Turkey (CBRT) market interest rates and interest rate statistics are calculated based on the data. It has been determined that the average difference between the housing interests and market rates within the period is around 3%. The prepayment rate starts at 0.1% in the first month and increases to 3% by increasing it by 0.1% per month for 30 months and continues to be constant until the end of the period.

$$\text{Early repayment rate} = \%3 \times \frac{1}{30} = \%1 = 0.001$$

$$\text{Early repayment rate} = 1 - (1 - 0.01)^{\frac{1}{12}} = 1 - (0.99)^{0.08333} = 0.00008$$

The third column of Table 16.6 contains the periodic payment amount, which is the sum of interest and principal of the loans collected in the pool. The periodic payment in the third column of the asset pool is calculated as follows.

$$\text{Monthly payment}_1 = 160.000 \left[\frac{\left(\frac{0.1280}{12}\right)\left(1 + \left(\frac{0.1280}{12}\right)\right)^{120-1+1}}{\left[\left(1 + \left(\frac{0.1280}{12}\right)\right)^{120-1+1} - 1\right]} \right] = 2.370 \text{ TL}$$

In the fourth column of Table 16.6, monthly interest is calculated for mortgage housing loans in the loan pool.

Table 16.6 Mortgage backed asset pool

Month	(1) Starting balance	(2)Early repayment rate	(3)Mortgage payment	(4)Interest monthly payment	(5)Interest distribution	(6)Scheduled principal	(7)Prepay-ment	(8)Total principal	(9)Cash flow
1	160.000	0.00008	2.370	1.707	1.253	663	13	676	2.383
2	299.323	0.00025	5.617	3.316	2.345	2.301	38	2.339	5.655
3	446.984	0.0005	7.817	4.859	3.501	2.958	75	3.033	7.891
4	683.952	0.00083	13.140	7.201	5.358	5.938	131	6.069	13.270
5	1.077.882	0.00125	18.911	11.187	8.443	7.723	219	7.943	19.130
6	1.349.940	0.00175	25.342	14.243	10.575	11.099	329	11.429	25.671
7	1.658.511	0.00234	30.011	17.441	12.992	12.570	464	13.034	30.475
8	1.895.477	0.00301	35.761	20.125	14.848	15.636	617	16.253	36.378
9	2.329.224	0.00376	42.696	25.144	18.246	17.551	805	18.357	43.501
10	2.690.867	0.00460	51.572	29.458	21.078	22.114	1.022	23.135	52.594
11	2.667.732	0.00544	51.553	29.203	20.897	22.349	1.234	23.583	52.787
66	904.202	0.01775	32.738	9.737	7.083	23.001	2.234	25.235	34.972
67	878.967	0.01775	32.655	9.455	6.885	23.200	2.169	25.370	34.824
68	853.597	0.01521	27.440	9.171	6.687	18.269	2.118	20.387	29.558
69	833.210	0.01521	27.371	8.944	6.527	18.427	2.066	20.492	29.436
70	812.718	0.01268	19.379	8.716	6.366	10.663	2.033	12.696	21.412
71	800.022	0.01268	19.329	8.580	6.267	10.750	2.001	12.750	21.330
72	787.272	0.01268	19.280	8.443	6.167	10.837	1.968	12.805	21.249
73	774.466	0.01268	19.232	8.307	6.067	10.925	1.936	12.861	21.167
74	761.606	0.01268	19.183	8.169	5.966	11.014	1.903	12.917	21.086
99	420.309	0.01268	18.003	4.517	3.292	13.487	1.031	14.518	19.035
100	405.791	0.01268	17.958	4.361	3.179	13.596	994	14.591	18.952
101	391.201	0.01268	17.912	4.205	3.064	13.707	957	14.664	18.869
102	376.537	0.01268	17.867	4.048	2.950	13.818	920	14.738	18.786

(continued)

Table 16.6 (continued)

Month	(1) Starting balance	(2)Early repayment rate	(3)Mortgage payment	(4)Interest monthly payment	(5)Interest distribution	(6)Scheduled principal	(7)Prepay-ment	(8)Total principal	(9)Cash flow
103	361.799	0.01268	17.821	3.890	2.834	13.931	882	14.813	18.703
104	346.986	0.01268	17.776	3.732	2.718	14.044	844	14.888	18.620
124	40.988	0.00761	13.417	454	321	12.963	71	13.034	13.488
125	27.954	0.00507	8.965	314	219	8.651	49	8.700	9.014
126	19.254	0.00507	8.942	218	151	8.724	27	8.751	8.969
127	10.503	0.00254	5.343	121	82	5.221	13	5.235	5.356
128	5.268	0.00254	5.329	61	41	5.268	0	5.268	5.329
129	–	–	–	–	–	–	–	–	–

Source: Calculation data prepared by researchers

$$\text{Monthly interest payment}_1 = \frac{0.1280}{12} \times 160.000 = 1.707 \text{ TL}$$

Applying the interest rates applied to the security to be issued based on the asset pool in accordance with the market conditions is of great importance for both the issuer and the investor. In this respect, the asset pool return, the total interest amount and the interest amounts to be distributed, the predictions made for the future will be useful in determining the interest rates to be applied to the securities to be issued. The interest amount to be paid for the security issued in the fifth column of Table 16.6 is calculated below.

$$\text{Monthly interest payment to be distributed} = \frac{0.940}{12} \times 160.000 = 1.253 \text{ TL}$$

The monthly principal amount for each month is calculated by subtracting the interest calculated from the periodic payment amount. In the sixth column of Table 16.6, the first month principal payment of the asset pool is calculated as 663 TL.

$$\text{Monthly principal payment} = \text{Monthly total payment} - \text{Monthly interest payment}$$

$$\text{Monthly principal payment} = 2.370 - 1.707 = 663\text{TL}$$

It is unfavorable for the creditors if customers repay the loans they have used earlier than planned. The early repayment situation causes a decrease in the interest income of the lender. In the seventh column of Table 16.6, the asset pool is the early repayment in the first month and is calculated below.

$$\begin{aligned}\text{Monthly early repayment} = {} & \text{Early repayment rate} \\ & \times \left(\text{Previous month's closing balance}\right. \\ & \left. -\text{Related month's principal payment}\right)\end{aligned}$$

$$\text{Monthly early repayment} = 0.00008\ (160.000 - 663) = 13 \text{ TL}$$

Calculation of the total principal amount of the asset pool of Table 16.6 is calculated as follows.

$$\text{Total principal payment} = \text{Principal amount} + \text{Early repayment amount}$$

$$\text{Total principal payment} = 663 + 13 = 676 \text{ TL}$$

Payments for securities issued are made with the cash flows obtained from the asset pool. Monthly (periodic) payment amounts are collected and transferred to investors who purchase securities after the expenses are deducted. The asset pool cash flow is 2383 TL. The securities holders will be paid after deducting expenses from this amount.

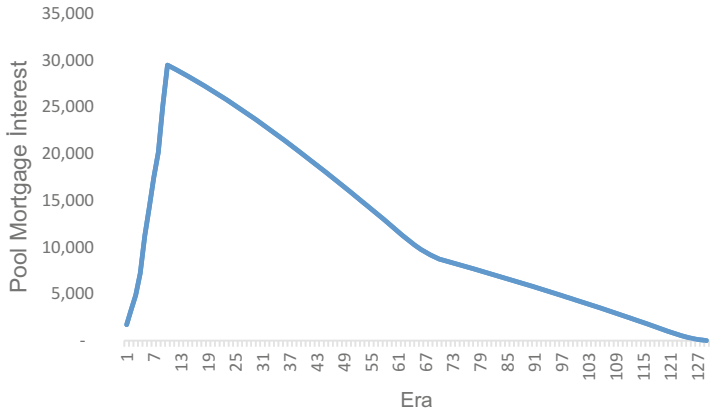

Fig. 16.2 Fixed rate asset pool Interest Distribution. **Source:** Calculation data by researchers

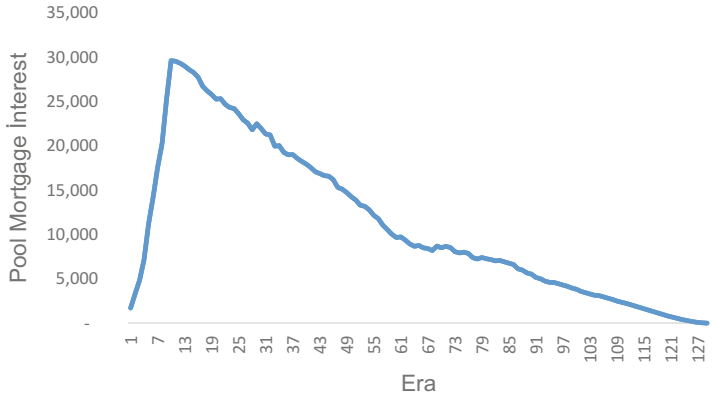

Fig. 16.3 Six-month variable interest rate asset pool interest distribution. **Source:** Calculation data by researchers

The asset pool return (income obtained) in Table 16.6 was calculated as 431.300 TL, the total interest amount as 1.547.900 TL, and the interest amount to be distributed as 1.116.500 TL. Under the assumption that interest rates change every 6 months, the asset pool return is 391.900 TL, the total interest amount is 1.442.800 TL, and the total interest to be distributed is 1.050.900 TL. Under the assumption that loans in the asset pool have floating rates, fluctuations in interest rates caused a decrease in asset pool revenues. Fixed and floating rate asset pool total interest income graphs are shown in Figs. 16.2 and 16.3 below.

The results and figures for the mortgage-backed 6-month floating-rate asset pool MCS are presented below.

In Fig. 16.4, the 6-month variable-rate asset pool total obtained income (return) distribution is with a probability of 0.1%, with a minimum return of 325.750 TL. The maximum total return of the pool is estimated to be 513.320 TL with a probability of

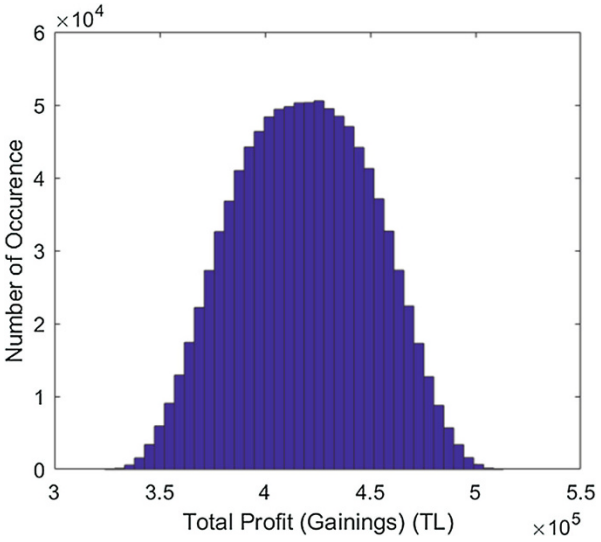

Fig. 16.4 Total profit (Gainings). **Source:** Calculation data by researchers

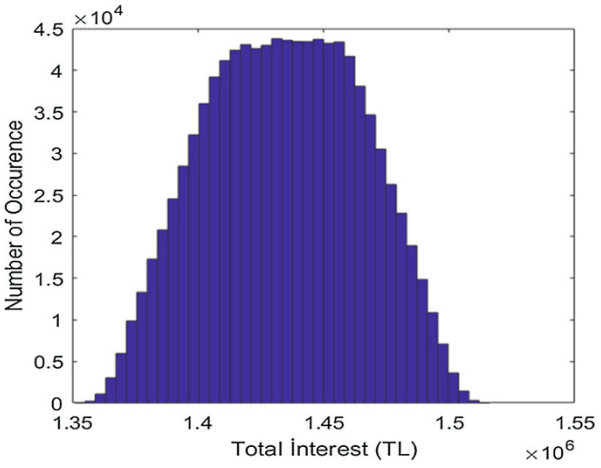

Fig. 16.5 Distribution of total pool mortgage interest. **Source:** Calculation data by researchers

2%. As a result of the simulation, the total return of the asset pool is expected to be in the range of 3.86–3.88 TL with a probability of 51%. MCS calculations are in the table below.

The minimum return of the 6-month variable interest asset pool total interest income distribution in Fig. 16.5 is 1.348.900 TL with a probability of 1%. The maximum interest income of the pool is estimated as 1.519.800 TL with a probability of 1%. As a result of the simulation, the interest income of the asset pool in Fig. 16.5 is expected to be between 1.4–1.45 TL with a probability of 45%.

The 6-month variable interest asset pool in Fig. 16.6 will have a minimum return of 995.070 TL with a probability of 1% of the total interest distribution. The maximum amount of interest to be distributed for the pool was estimated as 1.036.100 TL with a probability of 2%. As a result of the simulation, the interest

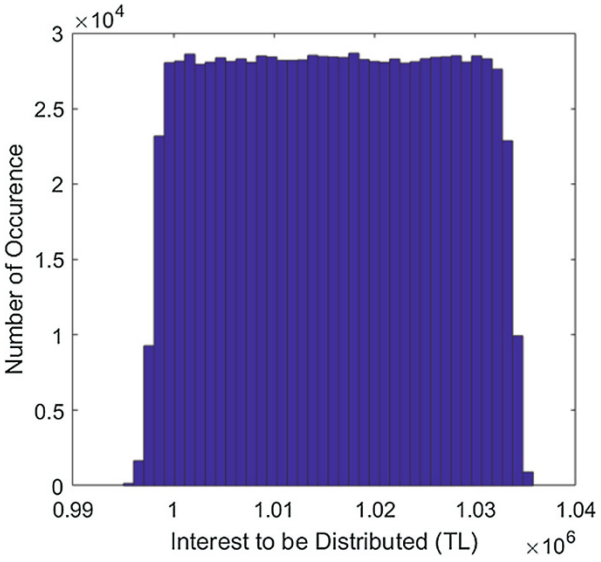

Fig. 16.6 Total Interest Distribution. **Source:** Calculation data by researchers

Table 16.7 Six-month asset pool results

	Profit (gains)	Interest distribution	Total interest
Calculated	391.900	1.050.900	1.442.800
MCS Min	325.750	995.070	1.348.900
MCS Max	413.320	1.036.100	1.519.800

Source: Calculation data by researchers

amount to be distributed in the asset pool in Fig. 16.6 is expected to be in the range of 1–1.03 TL with a probability of 11.8%. The asset pool results of the 6-month variable interest scenario are included in Table 16.7.

The better the probability of deviation when reaching a targeted result in a given time period is predicted, the more successful the action will be. As can be seen in Table 16.7, the percentage actual relative error of the calculated and estimated values is between (391.900 – 325.750)/391.900 * 100 = %16.8 and (391.900 – 513.320)/391.900 * 100 = %30.9. This is a crucial and reliable result in terms of risk management for the institution that will issue the security. The less risk it contains in the asset pool the better quality it will be. If the risks are manageable and the asset pool risk can be managed, the asset pool return will be far higher.

Various scenarios have been developed to observe how changes in interest rates, early repayment, non-repayment of the loan or restructuring affect the asset pool revenues and in which cases the asset pool will be more profitable. In order to confirm the accuracy of the simulation results, analytical calculations of each scenario have been made and the comparison of the simulation results was made. The reliability of the simulation results has been demonstrated as a result of the comparisons made. A complete comparison of the calculations and the result of MCS obtained for the different scenarios investigated is given in Table 16.8 The

Table 16.8 Simulation results for scenarios

Scenario	Profit (gains)	Percentage of actual relative error	Interest distribution	Percentage of actual relative error	Total interest	Percentage of actual relative error
1_ **Calculated**	431.300		1.116.500		1.547.900	
2_ **Calculated**	404.480		1.078.000		1.482.500	
2_MCS Min	413.850	2.3	1.069.900	0.7	1.483.800	0.1
2_MCS Max	420.490	3.9	1.086.700	0.8	1.507.200	1.6
3_ **Calculated**	303.400		1.107.500		1.410.500	
3 MCS Min	293.540	3.2	1.082.300	2.2	1.375.900	2.4
3 MCS Max	318.430	4.9	1.109.400	1.7	1.413.800	2.3
4_ **Calculated**	197.350		1.071.900		1.486.700	
4_MCS Min	180.970	0.8	1.062.700	0.8	1.473.900	0.8
4_ MCS Max	209.000	0.5	1.079.900	0.7	1.497.900	0.7
5_ **Calculated**	391.900		1.050.900		1.442.800	
5_MCS Min	375.750	4.1	995.070	5.3	1.348.900	6.5
5_MCS Max	413.320	5.4	1.036.100	1.4	1.519.800	5.3
6_ **Calculated**	323.200		1.089.600		1.412.600	
6_MCS Min	307.580	4.3	1.077.900	1.07	1.365.800	3.3
6_MCS Max	340.750	5.4	1.096.800	0.66	1.491.400	5.5

Source: Table data calculated by authors

table includes the estimation results of the yield, interest to be distributed and mortgage interest income.

Changes in interest rates are the determinant of asset pool revenues. When the results of sample application are examined, the highest return is obtained from scenarios 1 and 5, and the lowest from scenarios 3 and 4, which is seen in Table 16.8. Whereas the upward movements in the interest rates are seen positive in terms of the asset pool, the downward movements present negativity

There have been changes in the asset pool data because of reasons such as changes in interest rates used in the scenarios, restructuring early repayment and non-repayment of the loan. As can be seen from the table, the biggest deviation has been observed in the fourth scenario. This is because some customers in the asset pool have not repaid their overdue loan debts. Such a situation has caused a decrease in asset pool revenues.

Percentage real relative error analysis is considered significant for comparison in numerical solutions. The values obtained from the asset pool calculation, namely the measurement values, have attempted to determine how close they are to the real value as a result of the real relative calculations.

In this study, the results found in the scenario calculations have been obtained by numerical methods and the results are not absolute values but approximate. The fifth scenario shows that the largest deviation in the interest estimates to be distributed is 5.3%. There is a 6.5% deviation in interest estimates in the fourth scenario (Huanga et al. 2019: 9–11). It has been observed that the calculated deviation values are within acceptable limits in the organization's future decision-making processes and risk analysis. Because the MCS method involves repetitive operations by nature, it has been considered that in case the number of transactions increases, the calculation time will increase and analysis, it has been determined that by conducting a convergence, the most appropriate number of repetitions required for the practical application of the method should not be less than 100,000, but to obtain a result suitable for normal distribution, at least 1,000,000 cycles should be used.

16.6 Conclusion

Certain fluctuations in the financial markets create risky effects for both securities issuers and investors. Making the right decision is difficult in an environment of uncertainties, especially in the correct planning for the future, some methods can be used to minimize these risks. Although mortgage-backed securities are low-risk investment tools compared to other investment instruments, the asset pool of mortgage-backed securities is affected by interest rate changes. Besides, the decrease in cash flows of the customers in the asset pool due to reasons such as non-payment, early repayment or restructuring is a risk for the mortgage-backed securities issuer. Because there are future uncertainties, it is difficult to calculate the risks. However, some methods are used to make accurate prediction. One of these methods is Monte Carlo Simulation, which analyzes how the mortgage-backed security asset pool

return, total interest income and the total interest amount to be distributed on the securities to be issued. Future interest fluctuations, early repayment, loan structuring and non-payment affect these. Asset pool calculations provide the issuer with information about the interest rate to be applied to the security to be issued and the income to be obtained as a result of this issue. In this study, we investigated the asset pool in six different scenarios since it is insufficient to evaluate the asset pool calculations in a single case. According to the simulation results, the first scenario suggests that fixed rate securities and regular payments give the highest return in the asset pool. In the future, it is possible to encounter all of the asset pool early repayment, restructuring, non-payment of the loan. Therefore, it would be more appropriate to use the asset pool estimates of the sixth scenario, which includes all probabilities in the future return estimates in the created asset pool scenarios.

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Chapter 17
Green Human Resource Management and Corporate Social Responsibility for a Sustainable Environment: A Bibliometric Review

Ihsan Aytekin

Abstract As heavy industrial activities might lead to damages in the natural environment, different walks of life expect businesses to balance business-related activities and environmental sustainability. The increasing pressure has triggered the development of corporate social responsibility (CSR) and green human resource management (GHRM) practices in organizations, as well as the researchers' involvement. Due to its interdisciplinary nature and reaching a certain maturity, uncovering mainstreams and new trends in the field is important for both researchers and practitioners. In this study, based on the Web of Science database (WOS), reviewing the articles published from 1990 through 2020 on GHRM and CSR within the context of the environment, determining the main themes by making a taxonomy of the field, revealing new trends in the field and finally discussing the consequences of organizations' environmental strategies and practices in terms of businesses and environmental impacts have all been aimed. A co-word analysis was performed for content analysis with VOSviwer software. As a result of the analysis, six thematic areas related to the area named *green HRM for a sustainable environment, individual outcomes of green HRM and CSR practices, green recruitment and environmental sustainability, organizational outcomes of HRM and CSR, CSR* and *corporate governance, sustainable applications for environmental sustainability* were determined. Based on the concepts in the thmematic areas and related literature, a general distal-proximal antecedents and outcomes framework of the green literature variables is provided. In the second stage, emerging concepts and trends in the field were determined by making an overlay analysis of the keywords. In general, green HRM terms are quite new. In the third stage, co-authorship analysis was made for the social network analysis between authors and countries and the intellectual structure of the field was examined and discussed.

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17.1 Introduction

As heavy industrial activities might cause damage in the natural environment, different walks of life, including employees, regulatory public institutions, stakeholders and customers, expect businesses to strike a balance between business-related activities and environmental sustainability and to take measures to protect and improve the environment (Molina-Azorin et al. 2009). Due to these expectations formed in the majority of society, businesses consider and prioritize responsibility activities as a strategic element in order to gain economic, environmental and social benefits (Diaz-Carrion et al. 2020; Wang and Bansal 2012). Society has this expectation from businesses based on the assumption that the business world largely causes environmental damage. Therefore, the solution must come from the business world itself (Moscardo et al. 2013; Schaltegger and Burritt 2010). Businesses are trying to create a strong green organization image by responding to this expectation with effective environmental strategies and practices (Mousa and Othman 2020; Ng et al. 2019). With this image, organizations gain appreciation from those whose expectations are met, increase both individual and organizational performance by positively influencing employees' perceptions and attitudes (Dumont et al. 2017; Kim and Kim 2020) and also gaining competitive advantage (Mousa and Othman 2020; Singh et al. 2019).

Environmental business activities are generally handled within the framework of sustainability (Moscardo et al. 2013). The concept of sustainability is used in a wide area from economy to ecological studies, at different levels (e.g., unit, organization) and in different meanings (Figge and Hahn 2004). Although it does not have a clear definition, it can be said that it includes the understanding and activities developed for environmental sustainability, protection of the environment and perception of leaving it to future generations, and also it is one of the main components of CSR (Ehnnert 2009; Figge and Hahn 2004; Shafaei et al. 2020; Su et al. 2020).

From the point of view of environmental management and sustainable environment, it can be said that the CSR and GHRM concepts stand out. CSR deals with the responsibility activities of businesses with a wider perspective than environmental activities and includes social responsibility activities in addition to the environment (Kim and Thapa 2018). GHRM focuses entirely on environmental responsibility activities, expressing the implementation of classical human resources management functions throughout the organization with the sensitivity to protect and develop the environment (Shafaei et al. 2020). Emerging as a new trend, GHRM focuses on reducing the negative consequences of business activities on the environment and increasing sustainability performance by integrating environmental management systems and practices with sustainable performance (Mousa and Othman 2020).

Although GHRM and CSR are different concepts, environmental sustainability is a common issue in two areas (Su et al. 2020). For this reason, studies in the field of GHRM and CSR were included in the analysis in this study. However, since it is a multidimensional structure, CSR articles were examined in detail, and articles that did not include the environmental dimension as a variable were excluded from the analysis as well.

In recent years, there has been a notable increase in the review studies in the literature related to environmental sustainability (e.g., Herrera and de Las Heras-Rosas 2020; Kainzbauer and Rungruang 2019; Khan and Muktar 2020; Voegtlin and Greenwood 2016; Yong et al. 2019). Almost all of these studies have focused on a specific area, namely either GHRM or CSR. However, both scientific disciplines deal with the activities of businesses to protect the environment within the scope of environmental sustainability.

The main purpose of this study is to investigate the new trends, main themes and intellectual structure of the discipline within the information produced regarding the environmental sustainability in the fields of GHRM and CSR with a holistic approach and to do the taxonomy of the field.

According to Jackson and Seo (2010), the number of environmental studies in the field of management is low and more studies need to be carried out in this area. As Jackson and Seo (2010: 278) stated, "the topic of environmental sustainability is not reflected in the research agendas of most areas of management scholarship. The field of HRM is one of the minimally engaged areas of specialization". Although environmental sustainability is of strategic significance to businesses and directly affects businesses' financial, economic, and ecological outcomes (Renwick et al. 2013; Wang and Bansal 2012), it is surprising that researchers in the field of management seem to show little interest. This study contributes to field researchers, especially those in the field of management, as it summarizes the studies in different disciplines related to the environment. It also reveals new trends and fields of study, emphasizing the strategic importance of environmental activities in terms of business.

17.2 Green Human Resource Management

Since businesses are increasingly competitive, they have to use all their resources effectively and efficiently. Human capital among resources is critical for businesses to implement their policies and practices successfully, achieve high efficiency in their activities, overcome difficulties, evaluate opportunities, gain competitive advantage, and ensure sustainable performance (Mousa and Othman 2020; Sheehan 2014).

On the other hand, businesses have to achieve an optimum balance between resource consumption and economic growth in terms of economic, social and environmental performance. This is directly affected by their commitment to environmentally friendly policies and activities and their successful implementation (Mousa and Othman 2020). The fact that policy and implementation success

depends mostly on human resources makes the institution's human resources critical for sustainable environmental activities as in other fields. At this point, businesses try to achieve their social, environmental and economic performance goals by integrating their human resources functions with environmental sustainability (Du et al. 2011; Jabbour 2013).

GHRM is human resources applications aimed at protecting the environment and contributing to sustainability (Mousa and Othman 2020). It is defined as "human resources practices that focus on environmental sustainability through creating green employees, who can recognize and appreciate organization's environmental initiatives" (Shafaei et al. 2020: 1043). To put it more clearly, GHRM refers to implementing traditional human resource management functions with the sensitivity of environmental protection and focusing on practices including green recruitment, green training, green performance appraisal and green reward systems. This GHRM practice is critical in the success of businesses' environmental strategies, environmental management and environmental sustainability activities within the scope of CSR (Renwick et al. 2013; Shafaei et al. 2020).

There are many studies in the literature on GHRM antecedents and outcomes (e.g., Dumont et al. 2017; Jabbour 2013; Paille et al. 2014; Ren et al. 2018; Renwick et al. 2013; Shafaei et al. 2020; Wang and Bansal 2012). With a general evaluation according to these studies, GHRM has both organizational and individual premises and outcomes. At the organizational level, societal press, organizational environmental culture, and leadership support predict GHRM. GHRM positively affects the environmental, social and economic performance of the organization. On the individual level, GHRM positively affects the individual's perception, feelings, attitudes, and behaviours towards their job and organization. This situation gives rise to individuals' positive outputs such as organizational commitment and job satisfaction which reflects positively to the organizational performance. For instance, according to Dumont et al. (2017) and Renwick et al. (2013), GHRM practices affect the employees' perception of the organization, such as organizational commitment, job satisfaction, motivation, organizational citizenship behaviour for the environment (OCB-E) and organizational identification. It feeds outputs and ultimately reflects positively on both individual and corporate performance.

17.3 Corporate Social Responsibility

In the business context, CSR refers to a company's voluntary participation in activities in the economic, social and environmental well-being of society (Du et al. 2011). CSR is a topic that has attracted considerable attention in the literature. There is no unity of definition in the field where there are studies from different scientific disciplines. According to Voegtlin and Greenwood (2016), CSR varies according to time, region, country, culture, type of organization and paradigm, and can mean very different meanings for different people. However, it is generally accepted that CSR consists of three sub-dimensions: social sustainability,

environmental sustainability and economic sustainability (Herrera and de Las Heras-Rosas 2020; Kim and Kim 2020; Turker 2009). For example, according to Kim and Kim (2020), CSR emphasizes responsibilities in the natural environment, society and economic fields. The CSR scale developed by Turker (2009) consists of statements about society and the environment. Green management came to the fore as one of the three most important themes in the bibliometric content analysis study of Herrera and de Las Heras-Rosas (2020) on CSR and HRM. In this study, CSR is dealt with an environmental aspect, not with a broad framework.

The literature states that the environmental and social activities of the organization have positive results at both organizational and individual (employee) levels. From an organizational level point of view, CSR activities significantly and positively affect the organization's customer loyalty, positive reputation before society, and economic and financial performance (Brammer and Pavelin 2006; Deng and Xu 2017). When viewed at an individual level, CSR activities strengthen the organization's image in the eyes of society and employees and positively affect the perception, feelings, attitudes and behaviours of the employees concerning the organization. According to Ng et al. (2019), they care about the environment and society, business activities; employees feel proud of the organization and increase their organizational commitment, which leads them to develop positive work-related behaviour (e.g., decreasing turnover intention).

17.4 Bibliometric Methods for Literature Review

The literature review provides a systematic presentation of the information produced in a certain scientific discipline by collecting, systemazing and presenting it (Caputo et al. 2019). Compiling, classifying and interpreting past studies on a particular scientific discipline is considered one of the most critical milestones for developing that field (Zupic and Čater 2015). It is especially important to ensure clarity by forming taxonomy of interdisciplinary areas in which there are different streams (Lee et al. 2014). With review studies, in-depth analysis of many published articles is provided to understand specific topics, mainstreams, basic concepts, conceptual and intellectual structures in the field. In addition, it contributes to the advancement of the field by revealing new theoretical structures and research areas (Tranfield et al. 2003).

According to Callahan (2014), there are four different literature review approaches: systematic literature review, structured literature review, partially structured literature review, and critical literature review. These approaches and meta-analysis studies are frequently used in different scientific disciplines, especially in management sciences, and provide significant contributions to the relevant field (Lee et al. 2014).

However, these approaches have been criticized because the preparation and writing process takes too much time. They are open to the researchers' subjective evaluations and prejudices, and they contain question marks about reliability

(Tranfield et al. 2003). In addition, it has been stated that the scope of such studies is very narrow, they can include a limited number of studies in the analysis, and therefore they cannot be used to map a scientific field comprehensively (Caputo et al. 2019; Zupic and Čater 2015). Bibliometric methods "have the potential to introduce a systematic, transparent, and reproducible review process and thus improve the quality of reviews. Bibliometric methods are a useful aid in literature reviews even before the reading begins by guiding the researcher to the most influential works and mapping the research field without subjective bias" (Zupic and Čater 2015: 2). In addition, extensive data can be studied with bibliometric methods, and a more holistic picture of the field can be taken (Caputo et al. 2019).

Bibliometric analysis or scientific mapping classifies a particular scientific field in concordance with various criteria and visualizes it (Boyack and Klavans 2010). According to Zupic and Čater (2015), who made one of the most comprehensive studies on bibliometric methods, these methods enable literature review studies to be conducted with a different perspective by classification, visualization and mapping. Bibliometric analysis can be conducted without limiting the number of documents included in the analysis, without prejudices, through objective data and visual maps.

While traditional review methods provide the opportunity to examine a specific subject in depth, bibliometric methods are more suitable for review studies that require working with big data, aim to examine a field comprehensively and reveal its various structures (e.g., intellectual structure, conceptual structure, etc.) (Boyack and Klavans 2010; Zupic and Čater 2015). Bibliometric methods are not actually an alternative to traditional methods such as literature review and meta-analysis but are considered methods that complement them (Caputo et al. 2019; Zupic and Čater 2015).

Bibliometric analyzes are used to evaluate an institution or individual's research performance or reveal the intellectual structure, conceptual taxonomy and dynamics of a particular scientific discipline (Cobo et al. 2011). Various data such as authors, references, keywords, titles, abstracts, affiliated countries and institutions of the authors can be subject to bibliometric analysis, depending on the study's purpose. In bibliometric studies, analysis methods such as hierarchical cluster analysis, exploratory factor analysis or multidimensional scaling have been used to create clusters from the relevant data or to reveal subgroups, but criticisms have been brought about the suitability and sensitivity of the use of these analysis techniques (Börner et al. 2003).

On the other hand, network analysis methods and programs developed for this purpose (e.g., VOSviewer) have significant advantages such as (a) analysis and visual maps can be conducted in a single program, (b) the results are more reliable and accurate, (c) there is no need to normalize the values (Lee et al. 2014; Zupic and Čater 2015).

To summarize, bibliometric analyses are objective studies based on quantitative data and free from bias. Besides, since it is a summary and review of a scientific field, it helps new researchers to understand the field quickly and easily (Zupic and Čater 2015). Although there are many other bibliometric analysis methods such as citation analysis, co-citation analysis, bibliometric coupling (for a comprehensive review

see; Zupic and Čater 2015), co-authorship and co-word analysis are used in this study.

17.4.1 Co-authorship Analysis

Co-authorship analysis analyzes social networks created by co-authorship in scientific studies (Acedo et al. 2006). The fact that two or more people have names as co-authors in a publication indicates that these people cooperate somehow (Laudel 2002). According to Zupic and Čater (2015), co-authorship has stronger social connections than other types of relatedness.

Collaborations in scientific studies enable different academicians to contribute to their knowledge, expertise, skills, equipment, and resources, share their workload and transfer knowledge to each other (Lee and Bozeman 2005; Li et al. 2013; Sooryamoorthy 2009). Similarly, research collaboration increases the possibility of producing more effective and boost innovative solutions to a specific problem (Ponomariov and Boardman 2016). Because of these contributions, research collaborations can positively affect both researchers' academic productivity and the effects of publication in the field. Empirical studies also support these inferences. It has been demonstrated that working with multiple authors increases the acceptance of scientific studies by journals and has a positive effect on research productivity and publication quality (Acedo et al. 2006; Laband and Tollison 2000; Li et al. 2013; Ponomariov and Boardman 2016).

While some of the studies that conduct co-authorship analyses focus on the reasons and results of the motifs of the researchers to collaborate for scientific studies, the other part analyzes the social networks of researchers arising from this collaboration (Acedo et al. 2006). Reaching a certain maturity level of an emerging scientific discipline may require the collaboration of individuals from different disciplines. Based on this, the increase in cooperation between academics from two different disciplines may points to a new scientific field that will derive from these fields (Abramo et al. 2017). Li et al. (2013) stated that academics create a social network with scientific collaborations and that this network creates a structural (structural embeddedness such as network ties and intensity of inter-individual ties), relational (value created by collaborations) and cognitive (knowledge, skills and abilities) social capital.

Social network analysis aims to reveal the intellectual structure of the analyzed area (Zupic and Čater 2015). With this analysis technique, in addition to co-authorship, collaborations between countries and countries' positions in that scientific field (since the co-authors have country and institution information) can also be analyzed. In this study, the positions of countries in green HRM studies were examined in addition to the collaborations between the authors.

17.4.2 Co-word Analysis

Co-word analysis is a content analysis method used to reveal the dynamics and conceptual structure of that area based on the measure of similarity between the words of written texts in a specific field (Caputo et al. 2019). Title, keywords, abstract or the entire text can be analyzed. The basic logic in this analysis is "... when words frequently co-occur in documents; it means that the concepts behind those words are closely related" (Zupic and Čater 2015: 7). The cognitive structure of a particular scientific discipline in a certain period can be revealed by analyzing the relationships between the concepts and creating the map formed by them, and the development of the field can be followed with the help of these periods (Börner et al. 2003; Zupic and Čater 2015). Revealing the main themes, main streams, concepts and relationships in a scienctific discipline and following the evolution of the discipline by mapping new concepts, streams and themes emerging in that discipline are important for both researchers in the field and professionals who expect a benefit in the field (Caputo et al. 2019).

While other bibliometric methods use indirect measures such as citation or co-citation, co-word analysis directly measures the similarity between words and is therefore seen as a more powerful technique in revealing a field's conceptual structure (Caputo et al. 2019). In this study, author keywords have been analyzed. Keywords analysis is an effective method to reveal the conceptual structure and thematic developments in a field because it is chosen as the critical words of the relevant text by the authors. For this reason, it is widely used in the literature, especially in recent years (e.g., Herrera and de Las Heras-Rosas 2020).

17.5 Method

Although different databases are used in bibliometric studies, the Web of Science database is the most preferred database (Lee et al. 2014; Li et al. 2013; Zupic and Čater 2015). The data here are generally regarded as "certificated knowledge" and considered reliable (Ramos-Rodriguez and Ruiz-Navarro 2004). In this study, articles in the WOS database are considered. The following steps are taken to search for articles in the WOS database, using the WOS Core Collection database and locks those chemical indexes out. We searched the following terms in topic; "Green human resource management" or "green personnel*" or "green recruit*" or "corporate social responsibility" and "human resource *" or "csr" and "human resource*" or "green performance management" or "green performance appraisal" or "green performance evaluation" or "green training"or "employee* green behaviour". Article or early access or review is preferred as document types. The years between 1990 and 2020 are determined as the time range. The articles published in the years before 1990 are excluded in the study since the green HRM field is relatively new, and there

could exist some deficiencies in the bibliometric data of the articles prior to this date (Lee et al. 2014).

In the study, articles that deal with Corporate Social Responsibility (CSR) and human resource management together with Green HRM (using the apostrophe is to include these terms in the search field as they are) were also included in the analysis. This is because "environmental responsibility" is one of CSR's basic dimensions (Su et al. 2020). However, since it is a multidimensional structure, CSR articles were examined in detail. Articles that did not include the environmental dimension as at least a variable and those not related to HRM were excluded from the analysis. As a result of this search, 687 articles were found. This number is considered quite good when looking at the number of articles that conducted similar studies in the literature (e.g., Herrera and de Las Heras-Rosas 2020).

The titles, keywords and abstracts of these articles were read, and articles that were not related to green HRM and the environment or did not have author keywords were excluded from the analysis. Deletes are articles about customer service representatives (which is written as CSR) (e.g., van Jaarsveld and Yanadori 2011) and topcics such as gender (Kachouri et al. 2020) or disability groups (Marina et al. 2016) that are discussed under the title of Corporate Social Responsibility (hereafter CSR) but not related to the environment. After this preliminary analysis was completed, the remaining 446 articles were included in the analysis. In order to analyze the bibliographic data for articles, the VOSviewer software, which was developed by van Eck and Waltman (2011), and which has been used in many studies published in many prestigious academic journals in very different disciplines including management (e.g., Lee et al. 2014), marketing (e.g., Martínez-López et al. 2018), engineering (de Oliveira et al. 2018), and environmental science (Homrich et al. 2018), has been used in this study. It is stated that the VOSviewer software uses the most advanced, valid and reliable techniques at every step of the statistical processes in extracting and selecting the terms in bibliographic analyses, depicting the visual relationships and clustering the scientific objects (Lee et al. 2014).

Before starting the analyses, the data preparation (pre-cleaning) process was carried out and the data was proven to be uniform. Co-word Analysis is based on the keywords of the authors. Uniformity has been achieved in terms that have the same meaning before analyzing (e.g., employer attractiveness - organizational attractiveness; environmental HRM- environmental human resource management; green behaviour-green behaviour). After the pre-cleaning process, the default settings of the program were used. The threshold for the minimum number of occurrences of a keyword is 5, and 71 of 982 keywords met the threshold.

A similar data preparation process was followed for Co-authorship Analysis. The same author name can be expressed differently. For this reason, uniformity is provided in the names of the authors (e.g., luu trong tuan - luu, trong tuan; luu, tuan). In order to understand whether the authors expressed in different ways are the same persons, the country, university and department information as to the authors were examined. If they were the same, it was accepted that these differently expressed names were the same person. The author's minimum number of the document has been selected as two because only 129 out of 1071 authors have

two or more publications. However, 79 of the authors were not connected. The most extensive set of connected authors were 50. As a result of the analysis, 12 clusters emerged according to the network relationship between the authors.

The data were analyzed for country analysis, but there was no need for a pre-cleaning process because there was no confusion in the country names. 2 was selected as the minimum number of publications and countries with more than 2 publications were included in the analysis.

17.6 Results

In this study, the area's content analysis was first made using keywords and taxonomy of the main themes. In order to understand the main themes in more depth, the relevant articles are examined and discussed. In the second stage, an overlay analysis was made based on the articles' average publication dates in which the keywords were included to determine the development of the field and emerging trends and concepts, and the results were discussed. In the third stage, to examine the conclusions in more detail and reveal the field's intellectual structure, the network between the authors and countries and the weight of countries in the field were analyzed.

17.6.1 Taxonomy of the Field

The results of the Keywords Analysis are visualized in Fig. 17.1. There are items (words) and links that indicate the relationship between these items in the visual. Each word's size represents its number of repetitions, and the thickness of the link between items represents the number of times these two items are used together. Each colour on the visual represents a cluster. Clusters are formed in concordance with the frequency of the terms used in relation to each other. However, the terms in different clusters can also be used with each other. For example, although sustainable development and green HRM are in different clusters, there is a strong link between them; thus, they are often used together.

The visualization in Fig. 17.1 provides a descriptive perspective on the relationship between green HRM, CSR and the environment through the terms' clusters. In the analysis, the keywords that were analyzed were divided into six clusters. These clusters are titled *green HRM for a sustainable environment, individual outcomes of green HRM and CSR practices, green recruitment and environmental sustainability, organizational outcomes of HRM and CSR, CSR* and *corporate governance, sustainable applications for environmental sustainability*. With the analysis of these clusters, HRM and CSR's role in protecting and managing the environment, central issues, and mainstreams emphasized by the field researchers are defined. In order to

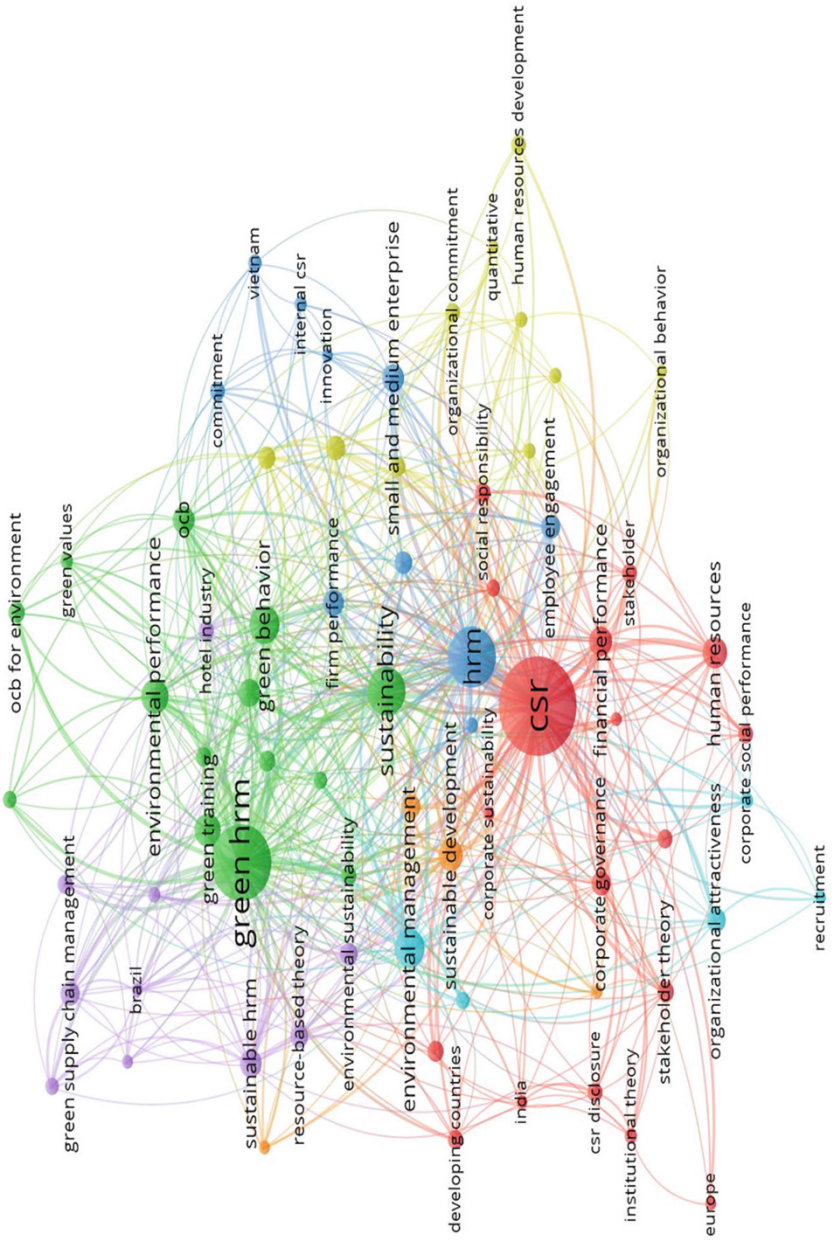

Fig. 17.1 Key-words map

examine each cluster in detail, articles containing keywords with high "links weight" in the cluster were also examined.

17.6.1.1 Green HRM for a Sustainable Environment

The terms related to Green HRM applications and their results are collected in this cluster. When the terms are evaluated in the cluster, the terms such as green HRM, sustainability, organizational citizenship behaviour, organizational citizenship behaviour for the environment (OCB-E), environmental performance, green training, green behaviour, pro-environmental behaviour, green innovation, green values and green management are frequently used together. It is understood. The term, Ability-Motivation-Opportunity (AMO) theory, which is included in this cluster, indicates that the mentioned term is often taken to explain the relationship between GHRM and outputs.

One of the GHRM applications' primary objectives is to increase businesses' environmental performance and contribute to environmental sustainability (Alvarez Jaramillo et al. 2019; Roscoe et al. 2019). Environmental performance is defined as the output of enterprises' activities to protect the natural environment (Paille et al. 2014). For these outputs, the enterprise should care about environmental protection, encourage activities related to this, and develop strategies in this direction and turn them into practice (Roscoe et al. 2019).

Ability-Motivation-Opportunity (AMO) theory is regarded as one of the most commonly used theories to explain the relationship between GHRM practices and organizations' sustainable environmental performance. When this theory is considered in the context of GHRM, organizations can improve their performance; (a) by increasing the environmental knowledge, skills and abilities of employees with green training, (b) by increasing the motivation of employees with performance management systems where environmental activities are taken into account, and (c) by creating opportunities with systems such as suggestion systems at both organizational and individual levels and by opening the way for environmental activities (Pham et al. 2020; Pinzone et al. 2016; Renwick et al. 2013).

The studies conducted support the assumptions of this theory. According to the literature, organizations' environmental protection performance is directly related to the strong interactions between environmental management policies and practices at the organizational level and HRM and high involvement in employees' green initiatives (Daily et al. 2012; Paille et al. 2014).

Accordingly, organizational understanding and practices (e.g., green organizational culture, green management approach and leadership) and the implementation of the GHRM system encourage employees to participate in green behaviours and initiatives (Kim et al. 2019; O'Donohue and Torugsa 2016; Paille et al. 2014), these attitudes and behaviours of employees increase the environmental performance of the organization, and as a result, environmental sustainability is achieved (Alvarez Jaramillo et al. 2019; Roscoe et al. 2019).

In addition, the GHRM practices such as green training, involvement and performance management give rise to individual positive results such as employees' perception about the work, organizational commitment, organizational citizenship behaviour and OCB-E, and these results lead to an increase in the environmental, social and economic performance of the organization (Jabbour 2013; Paille et al. 2014; Pham et al. 2020). To give a concrete example, OCB-E is generally used as a mediator variable between GHRM applications and organizational outputs. Accordingly, as GHRM practices positively affect their perceptions of the organization, they enable employees to take more responsibility for the environment and participate more in the organization's voluntary environmental activities and ultimately improve its environmental performance (Pham et al. 2020).

17.6.1.2 Individual Outcomes of Green HRM and CSR Practices

In this cluster, there are terms associated with the results of environmental HRM and CSR practices. Along with job satisfaction and organizational identification, which are the most significant terms in the cluster, organizational commitment, HRM performance, and organizational behaviour are among the results of environmentally sensitive practices. The organization's senior management's environmental sensitivity affects the development of environmentally sensitive practices as an antecedent. It is seen that the studies, including the terms in this cluster, are predominant in China.

When the terms in this cluster and the related literature are examined, it is seen that CSR and GHRM applications contribute to positive employee outcomes, which will ultimately add to organizational performance. Accordingly, the policies and activities of organizations regarding environmental and social responsibility, which are welcomed by employees, increase job satisfaction, OCB and organizational commitment and ultimately reflect positively on organizational performance (Jabbour 2013; Molina-Azorin et al. 2009; Ng et al. 2019). To give a concrete example, the job's meaningfulness has a strong mediating effect between GHRM and job satisfaction. In other words, GHRM practices strengthen employees' meaningful job feelings, and this increases their job satisfaction (Shafaei et al. 2020).

In terms of the outputs mentioned in this cluster, the organization's leaders' support and the systems' development are essential. Leaders have a significant influence on the formation of environmental culture and awareness within the organization and employees' participation in environmental initiatives (Pham et al. 2020; Renwick et al. 2013). This effect emerges positively when leaders have environmental sensitivity and negatively otherwise (Paille et al. 2014). Similarly, the organization's environmental performance is fostered by the fact that it operates by taking green standards into account. It has individualized goals and objectives regarding the environment, and that employees are involved in environmental initiatives (Berrone and Gomez-Mejia 2009). However, to sustain this situation and motivate employees about environmental initiatives, sustainable environmental activities should be awarded (Merriman and Sen 2012).

17.6.1.3 Green Recruitment and Environmental Sustainability

In this cluster, which is the smallest of the six clusters, it is seen that the words environmental management, sustainable development, green recruitment, green initiatives, organizational attractiveness and socially responsible HRM are frequently used together. Here, it can be concluded that environmental awareness and practices are supported by green recruitment, which is one of the green HRM applications. In addition, it is understood that environmental sensitivity practices have a positive impact on organizational attractiveness.

Organizations are trying to create a green employer image by adding various environmental duties and responsibilities to their job postings, thus increasing the organization's attractiveness and attracting talented people with environmental sensitivity (Chaudhary 2018; Mousa and Othman 2020). High-potential employees prefer to work in companies sensitive to the environment and society and consider whether their work includes social and environmentally responsible duties and activities (Kim and Kim 2020; Kim and Thapa 2018). Employees with environmentally sensitive attitudes contribute to the environmental performance of the organization by making more green initiatives, experience positive outputs such as job satisfaction and organizational commitment because they find their job meaningful, and this contributes to organizational performance via increasing their job performance (Renwick et al. 2013; Shafaei et al. 2020; Zibarras and Coan 2015). As seen here, there is mutual benefit in terms of the employer (image, talented HR and performance) and employee (meaningful job, satisfaction).

17.6.1.4 Organizational Outcomes of HRM and CSR

In this cluster, it is seen that such concepts as HRM, small and medium enterprise, firm performance, commitment, competitive advantage, employee engagement and innovation are those that are frequently used together. In this cluster, we come across the terms related to the relationship between activities as to the responsibility of and the environmental, social, economic, and overal performance.

When the results of the Keywords Analysis and related literature are examined, it is seen that the existence of a strong relationship between the sustainable performance of the organization, which includes environmental, economic and social performances, and HRM practices, is also highlighted (e.g., Dubey and Gupta 2018; Jabbour 2013; Mousa and Othman 2020; Stefan and Paul 2008). Accordingly, a large part of the society, which includes customers and regulatory organizations, expects green initiatives from organizations for a sustainable environment and takes this situation into account in their interactions with the organization. Thus, green practices reflect and positively affect organizations' environmental, economic and social performances (namely sustainable performance) (Stefan and Paul 2008). Mousa and Othman (2020), who conducted an empirical study on this subject, revealed that GHRM practices are powerful determinants of environmental

performance, economic performance and social performance, which are the components of sustainable performance. Therefore, activities carried out within the framework of responsibility contribute to the overall performance of the organization.

17.6.1.5 CSR and Corporate Governance

In this cluster, which emerged as the largest cluster in the analysis, concepts related to CSR, financial performance, corporate sustainability, business ethics, social responsibility, corporate governance and corporate governance stand out as the frequently encountered terms. The terms "developing countries," "India," and "banking" give the impression that such studies are often conducted in the banking sector and developing countries. These studies are generally based on stakeholder theory and institutional theory.

When the results of the Keywords Analysis and related literature are examined, it is seen that the activities within the scope of CSR produce results similar to the activities within the scope of GHRM and even work with similar mechanisms (e.g., mediation mechanism). Firstly, a significant part of the studies on the field reveals that CSR activities depend on HRM and employee participation (Herrera and de Las Heras-Rosas 2020; Kim and Kim 2020; Sarvaiya et al. 2019; Voegtlin and Greenwood 2016). Secondly, when we look at the organizational results of corporate responsibility applications, such variables as organizational economic, social and environmental performances (Meier et al. 2019), organizational reputation (Wang and Bansal 2012), sustainability and overall business performance (Brik et al. 2011) are the ones that are frequently used in the literature. Thirdly, establishing an organizational level culture and leaders' or managers' support are considered necessary for CSR activities' success (Reimer et al. 2018; Shen and Zhang 2019). Therefore, CSR's general mechanism can be summarized as "CSR support and applications at the organizational level support the development of positive outcomes of the employees and thus supporting the increase in the organizational performance."

17.6.1.6 Sustainable Applications for Environmental Sustainability

It is seen that sustainability stands out in this cluster. While the terms "sustainable HRM" and "environmental sustainability" come to the fore in the context of sustainability, sustainable supply chain management, organizational sustainability and sustainable operations management are the other terms included in this cluster. Again, it is understood that the terms such as hotel industry, hospitality, resource-based theory, Brazil and Malaysia take place in the cluster and also the studies on sustainability are conducted based on resource-based theory, mostly in the hospitality sector and in such countries as Brazil and Malaysia.

Sustainable HRM is often confused with GHRM, while the concept of GHRM is regarded as human resources practices focused on environmental problems. In

contrast, sustainable HRM deals with all human resources practices from CSR principles to create both organizational and social values (Diaz-Carrion et al. 2020). In other words, sustainable HRM is a more comprehensive concept as it focuses on human and social practices as well as environmental practices and policies (Kramar 2014; Macke and Genari 2019), and GHRM can be regarded as one of its sub-dimensions.

However, in recent times, sustainable HRM has been studied mostly within the framework of GHRM. Because, in recent years, both organizations and researchers have attached strategic importance to protecting the environment in terms of sustainability, and it has been observed that the environmental performance of the organization largely depends on HRM's environmental initiatives and activities (Kainzbauer and Rungruang 2019; Renwick et al. 2013). GHRM and other CSR practices, especially green training and employee involvement, have a determining effect on organizations' environmental sustainability (Pham et al. 2020). Along with other GHRM practices, the development of personnel in environmental-related areas positively affects their interest in environmental activities, their success in these activities, cleaner production, resource-saving and, consequently, the sustainable development of the organization (Jabbour 2013; Mousa and Othman 2020).

17.6.1.7 A General Distal-Proximal Antecedents and Outcomes Framework

By examining the clusters that emerged from the Keywords Analysis, the terms in the clusters and the relevant literature, a general framework model was created showing the variables used in the field and their relationships. The theoretical background of the framework in the literature. With this framework shown in Fig. 17.2, the purpose is not to determine the clear relationships between all the variables in question but to reveal a general distal-proximal antecedents and outcomes framework from a macro perspective. Of course, there may be different levels of interaction between these variables. To put it more clearly, each level's variables may have an independent-dependent variable relationship among themselves. For example, GHRM systems and applications can positively affect job satisfaction and meaning at work (Shafaei et al. 2020). Similarly, leaders' environmental and social responsibility approach can contribute to the formation of an environmentally oriented green culture (Reimer et al. 2018).

The formed distal-proximal antecedents and outcomes framework is naturally compatible with the studies in the literature, as it is a summary of the literature. In terms of the effectiveness of organizations' environmental and social responsibility activities, first of all, the awareness and support of decision-makers (e.g., shareholders, managers, etc.), environmental policies and strategies, and an appropriate green corporate culture (e.g., Beji et al. 2020; Lin and Liu 2017; Norton et al. 2017; Reimer et al. 2018; Ren et al. 2018; Shen and Zhang 2019) are initials requirements. These organizational-level factors related to environment and responsibility require the formation of the systems and procedural-level factors (e.g., GHRM, CSR,

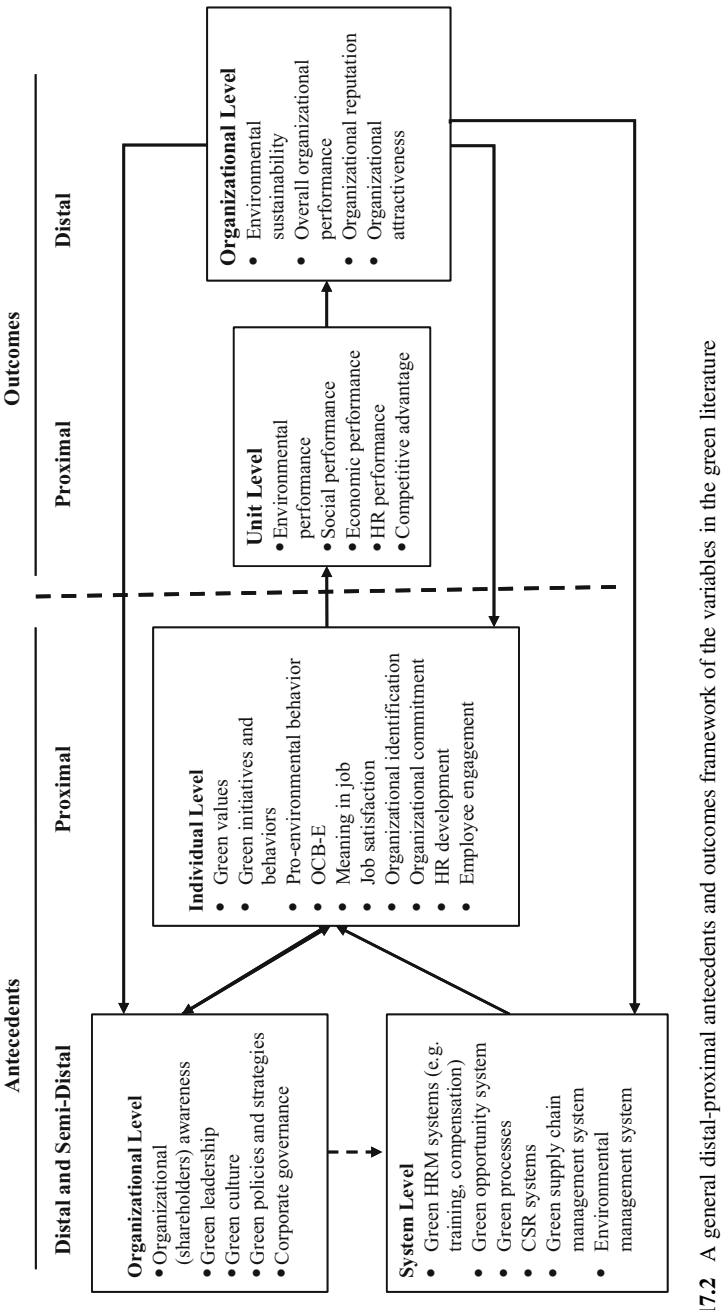

Fig. 17.2 A general distal-proximal antecedents and outcomes framework of the variables in the green literature

environmental management, green opportunity, green process) and ensure their development by encouraging them (Diaz-Carrion et al. 2018; Guerci and Pedrini 2014; Hilliard 2013; Kim and Kim 2020; Lin and Liu 2017; Nigri and Del Baldo 2018; Paille et al. 2014; Wagner 2015).

Practices made through organizational factors and green and responsible systems (e.g., green training, green recruitment, green compensation) feed the performance of employees, who are the key actors of success, both in their responsibility activities and their main jobs by affecting their perception, qualification, attitude, behaviour and motivation (Govindarajulu and Daily 2004; Kim et al. 2019; Ng et al. 2019; Pham et al. 2020; Renwick et al. 2013; Roy et al. 2013). Qualified, motivated, and high-performing employees contribute to higher outcomes in their field of activity (unit level), and therefore, to overall organizational outcomes (Alvarez Jaramillo et al. 2019; del Brio et al. 2007; Mousa and Othman 2020; Paille et al. 2014; Roy et al. 2013; Singh et al. 2019).

17.6.2 Emerging Concepts Analysis

In order to identify the new emerging and developing trends in the field of HRM and CSR in the context of environmental protection, the terms revealed by the Keywords Analysis were subjected to the overlay analysis. Average publication dates of the terms were used as analysis criteria. Accordingly, the resulting visual is shown in Fig. 17.3. The items, coloured in yellow in the chart, represent new emerging and interesting terms regardless of their clusters. The darker shade of the colour indicates that the terms are relatively outdated. In Table 17.1, the terms with an average publication date of 2018 and above, that is, newly emerging, developing or both terms, are given in more detail.

Emerging terms analysis revealed that green innovation (average publication year: 2019.7), bibliometric analysis (average publication year: 2019.4), green recruitment (average publication year: 2019.29), internal CSR (average publication year: 2019.17), and green values (average publication year: 2019.0) are the newest terms. Green behaviour, green training, pro-environmental behaviour, environmental awareness–, sustainable development, green performance management, OCB for the environment, environmental performance, HRM performance, green HRM, and socially responsible HRM are the other prominent new key-words, most of which are environment related terms.

When relatively old terms are examined, it is seen that a significant portion of these terms is related to CSR and corporate governance. Among these, recruitment (average publication year: 2013), Europe (average publication year: 2014), business ethics (average publication year: 2014.28), and green initiatives (average publication year: 2014.50) stand out as the oldest terms. Hospitality, human resources, CSR disclosure, organizational attractiveness, organizational behaviour, environmental sustainability and stakeholder are the other major terms. The old terms regarding

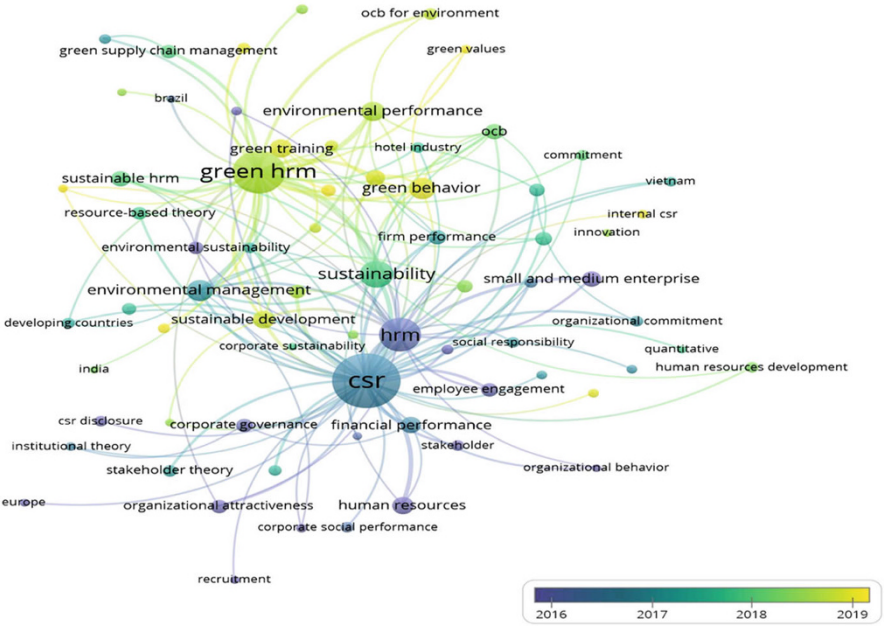

Fig. 17.3 Overlay analysis of keywords demonstrates new trends

environment here derive from the studies that deal with the environment in the context of CSR rather than GHRM studies.

17.6.3 Social Network Analysis

After the taxonomy of HRM and CSR literature on environmental protection was carried out, it was seen that China, Brazil, Malaysia, Vietnam and India were among "the keywords countries." In contrast, Western European and North American countries that performed the majority of science production were not included in the list.

Considering these countries, only the term "Europe" is included in the keywords list that exceeds the threshold. However, when the 71 words in the list are listed according to the total link strength criteria, it is in the last place (total link strength is 8). This data is striking because, in terms of the field's development, the interest of countries that are at the forefront of research productivity and with higher research budgets seems to be critical. In order to examine the data in more detail, a network analysis was separately carried out for authors and countries, and the intellectual structure of the field was aimed to be revealed.

With the VOSviewer software, co-authorship analysis can be done in accordance with the countries, organizations and authors. In this study, author and country

Table 17.1 Emerging concepts

Label	Cluster	Links	Total link strength	Occurrences	Average publication year
Green innovation	1	16	27	10	2019.70
Bibliometric analysis	3	10	18	5	2019.40
Green recruitment	3	12	16	7	2019.29
Internal CSR	4	9	12	6	2019.17
Green values	1	11	19	6	2019.00
Malaysia	6	9	18	8	2018.88
Green behavior	1	26	66	33	2018.85
HRM performance	2	10	14	6	2018.83
Green training	1	28	62	26	2018.81
Pro-environmental behavior	1	25	60	19	2018.79
Environmental awareness	1	13	21	8	2018.75
Sustainable development	3	28	67	23	2018.74
Green performance management	1	11	15	7	2018.71
OCB for environment (OCB-E)	1	11	23	11	2018.64
Environmental performance	1	31	81	29	2018.55
Green HRM	1	55	301	128	2018.53
Socially responsible HRM	3	16	34	14	2018.50
Ability motivation opportunity theory	1	10	19	7	2018.43
Innovation	4	10	12	5	2018.40
Organizational sustainability	6	10	13	5	2018.40
Stakeholder engagement	3	10	16	5	2018.40
Competitive advantage	4	15	22	6	2018.33
Structural equation model	4	14	31	12	2018.33
Human resources development	2	6	13	8	2018.25
India	5	10	14	5	2018.20
OCB	1	27	56	17	2018.12
Commitment	4	15	21	8	2018.00

analyses have been conducted. Each item here represents an author (country), and the link in between represents the relationship between authors (countries). The fact that the items representing the authors (countries) are close to each other and the links between them are intense, pointing to closer cooperation and a more robust network; otherwise, it indicates weaker cooperation (van Eck and Waltman 2011).

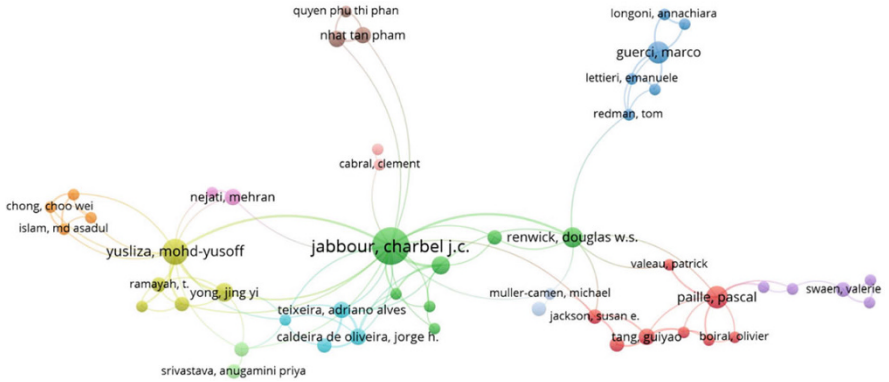

Fig. 17.4 Authors network

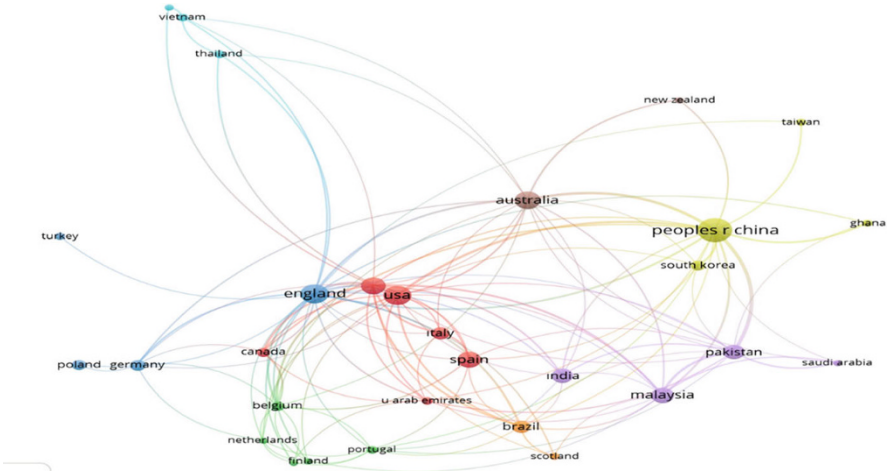

Fig. 17.5 Countries network

Figures 17.4 and 17.5 visualize co-authoring cooperation between the authors' network and the networks across countries. In the co-authorship analysis, the author with the highest total link strength was Charbel J.C. Jabbour. However, the largest cluster is the one in which Pascal Paille is at the pivotal place. In terms of countries, China is in the lead, both in terms of the total number of documents (77) and the link strength. In terms of the number of publications, the USA (51), England (50), Australia (43), France (40), Spain (35), Malaysia (31), India (30) and Pakistan (28) are the other countries in the top ten list.

In either way, except for a couple of countries and authors, it is generally seen that the distance between items is considerable, and the number of links is low. Therefore, it can be stated that strong and wide cooperation networks in the field are insufficient. Publication efficiency in co-authorship varies depending on whether the

authors publish as a continuous research team. While some authors temporarily collaborate on research, some teams are permanent. Continuous cooperation networks contribute more to the publication efficiency and scientific discipline for which they work. Such collaborations are essential for the advancement and widespread use of a scientific discipline (Glanzel and Schubert 2005).

17.7 Discussion

Using a bibliometric science mapping review approach, bibliometric data of GHRM and environmental CSR literature were analyzed in this study. As a result of the co-word analysis, co-authorship analysis and literature review, a holistic framework of the field's conceptual and intellectual structure and the transformation of environmental activities into effective positive organizational results have been presented. With this study based on objective data and empirically based complementary review of the classical review, studies have been made.

17.7.1 Conceptual Structure

As a result of the analysis of the keywords based on the author keywords to reveal the conceptual structure of the field, six headings/topics, which are green HRM for a sustainable environment, individual outcomes of green HRM and CSR practices, green recruitment and environmental sustainability, organizational outcomes of HRM and CSR, CSR and corporate governance, and sustainable applications for environmental sustainability have been defined. This conceptual classification shows prominent research topics in the field and critical concepts and variables within these topics systematically and holistically.

Field researchers can benefit from this classification in designing their studies by going through the emerging trends, concepts and topics around which the field studies are focused. Especially due to its interdisciplinary structure and the existence of independent studies from different scientific disciplines, a holistic conceptual framework of the green field can make a theoretical contribution to the field by providing an understanding of study subjects in different sub-fields and thus enabling researchers in other disciplines to look at the subject holistically. Because the fragmented structure in a discipline makes it difficult for researchers to see the subject with a holistic insight and share ideas, such holistic classifications make significant contributions to the field (Lee et al. 2014). This framework provides a systematic summary of the field and a tool that can be used by newcomers and practitioners in addition to field researchers, as it highlights major concepts and practices.

This study goes beyond the field's conceptual classification and offers another important tool that researchers and applications can benefit from. Because in this

study, based on the keywords analysis, conceptual clusters and literature given, a general distal-proximal antecedents and outcomes framework of the green literature variables is provided. This framework gives an idea about the working mechanism of the variables used in the literature.

To summarize, organizational awareness, leadership, culture, policy and strategies regarding environment and responsibility require systems to organize and promote environmental and social activities (e.g., GHRM system). Practices carried out through organizational variables and established systems (e.g., green training) increase the knowledge, ability, attitude, commitment and motivation of employees regarding responsibility activities, resulting in positive individual outcomes (e.g., OCB-E), thus an increase in individual performance. Employees' performance with these characteristics in their activities causes an increase in unit level performance (e.g., environmental performance, social performance) and, therefore, macro-level organizational results (e.g., organizational reputation, environmental sustainability). The macro-level positive results of the organization (e.g., organizational reputation) actually re-promote antecedents (e.g., attract high potential candidates, organizational green culture).

This distal-proximal antecedents and outcomes framework is an instrumental framework that researchers can use when designing their research (e.g., determining variables). For the practitioners, it is necessary primarily to allow them to see the area as a whole. Secondly, this is a guiding framework for practitioners to benefit from as it reveals (a) the positive outcomes of the activities of green practices and responsibility for the organization, (b) that the effective emergence of these outcomes depend on the interaction of several approaches, stereotypes, systems and practices at different levels (organizational, system and individual), and (c) the prominent approaches, strategies, systems and applications in the field.

However, studies show that there may be reciprocity relationships between variables at different levels. For example, as Ren et al. (2018) stated, leaders can improve employees' green values, attitudes and behaviours with GHRM practices. These values, attitudes, and behaviours spread among employees strengthen green culture. Similarly, organizational level results can have an impact on antecedents. For example, the organization's high environmental performance can positively affect the organization's image, contributing to green recruitment and strengthening of green culture (Ng et al. 2019).

17.7.2 Intellectual Structure

Research collaboration between authors and countries was examined to reveal the intellectual structure of the field. The analysis results show that the cooperation clusters between both authors and countries are small and dispersed, and links between items are sparse. This indicates that there are no large research teams with a strong network in the field. Although there may be different reasons for this, such disorganization can be seen in areas that have no theoretical consensus and that have studies from different disciplines (Gossart and Özman 2009). Therefore, this

network structure may depend on the fact that GHRM studies are multidisciplinary (e.g., management, environmental studies) and relatively new.

In the literature, it is emphasized that researchers in interdisciplinary fields such as sciences or econometrics, which require complex economic and mathematical models, expensive equipment and common laboratory, and green management, which require information from different techniques and different fields, need to work together (Acedo et al. 2006; Hudson 1996; Laband and Tollison 2000; Moody 2004). The fact that research collaborations are from different disciplines, institutions or countries facilitates a better understanding of the problems, more effective solutions to these problems, and the integration of different theories, concepts and techniques (Porter et al. 2006). Collaborations provide different capital contributions, such as financial capital, human capital, and social capital from various social and institutional segments (Ponomariov and Boardman 2016). The increase of collaboration between researchers (particularly from different disciplines) contributes considerably to the development of the relevant emerging diciplines (Abramo et al. 2017).

One of the issues that stand out in these analyzes is that studies on green HRM, environmental and CSR are carried out intensively in developing countries. In the literature, it is stated that the USA is far ahead in scientific production, North America and Western Europe produce more than 70% of scientific production in many fields (Diaz-Puente et al. 2007; Man et al. 2004; Muller et al. 2016; Tasli et al. 2012). In addition, more than 60% of the production in other countries is also based on the collaboration of writers in these countries and writers from the USA and Western European countries (Wagner et al. 2018).

However, it is seen that the USA and Western European countries do not provide the same efficiency in terms of green HRM. One possible reason for this is that studies in emerging and interdisciplinary fields are noticed and cited relatively slowly (Abramo et al. 2017). For this reason, a significant portion of the leading publications that produced as the result of collaborations of researchers from different disciplines is published in journals with lower impact factors (Wang et al. 2016). Another possible reason for this situation may arise from the countries' approaches towards the field. Publication productivity of countries in certain areas depends on that country's national scientific research system, resources and policies towards that field (Cimini et al. 2014). Finally, the fact that developing countries such as China have more problems with environmental protection than developed countries (Mousa and Othman 2020; Paille et al. 2014) may affect the researchers in these countries to focus more on the field.

17.8 Conclusion

Based on the bibliometric data of reliable studies in the literature, (a) the taxonomy of the green sustainability literature was made in this study (b) a general distal-proximal antecedents and outcomes framework was drawn that reflects the

relationship between the prominent variables in the literature, (c) the new emerging or developing term in the field and trends were identified, (d) the intellectual structure of the field was examined by analyzing the authors and research collaborations between countries. As a result of the analyses and evaluations made, the role of GHRM practices and responsibility activities in transforming the organization's activities towards positive organizational results has been revealed.

To make a general evaluation, there is mutual interaction and benefit in the enterprises' environmental activities' business-environment relationship. Businesses' development of environmentally sensitive culture, management understanding, strategy and HRM practices ensures the protection of the environment and the efficient use of natural resources. At the same time, environmentally sensitive business activities attract competent employees to the organization, thus positively affecting the perceptions, feelings, attitudes and behaviours of employees about the organization and their job and as a result, positive attitudes and behaviours (e.g., organizational commitment, organizational commitment) identification, job satisfaction, decreased turnover, motivation) might develop, too. Positive attitude and results are based on individual performance, and individual performances make it easier for organizations to achieve environmental and work-oriented goals and objectives. This contributes to establishing an image accepted by different social segments, gaining competitive advantage, increasing performance and obtaining higher financial and economic gains.

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