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Syed Nazim Ali
Zul Hakim Jumat *Editors*

Islamic Finance and Circular Economy

Connecting Impact and Value Creation

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Preface

Islamic finance has come a long way over the last four decades. In its current transformative decade, Islamic finance is facing the challenge of strategic sustainability, which requires the Islamic finance industry to revisit its operational paradigm.

The challenge can be seen in forms of the growing global landfills crisis, ecological and environmental degradation, climate change, and other environmental stressing factors, which are widely understood to be the by-products of the current linear approach of the world economy. While this approach of 'taking, making, using, disposing and wasting' the planet's resources is the dominant economic paradigm, the laws of ecology, like the water cycle, demonstrate that nature does not ever waste.

With the underlying principles of zero-waste and sustainable agenda, over the last few years, the circular economic system, which explores ways, processes and incentives that aim to minimize and ideally eliminate all types of waste, is gaining global attraction. That being so, what are the prospects of a handshake between Islamic finance and this emerging new paradigm?

The circular economy, if applied correctly, can first and foremost help countries like Qatar to fight the risks of climate change by becoming the first GCC country to implement sustainable economy and business model. It also allows companies to get much more value out of the energy resources, materials, and other primary sources they use. That additional value can then be deployed to optimize their services, contribute to their clients' return on investment, and promote transparent sustainable practices in the communities they operate.

This book presents studies and deliberations that are much needed to explore prospects for economy, finance, business, management, and other fields of humanities to learn from nature through the lens of Islamic values along with the multidimensional Sustainable Development Goals of the United Nations (UN SDGs).

All in all, this book would not have been possible without the hard work and dedicated efforts of several individuals. First and foremost, to the Dean of the College of Islamic Studies (CIS), Hamad Bin Khalifa University, Professor Emad El-Din Shahin for his constant trust and support that has provided me the confidence and motivation to continue my duties as the Director of CIS Research Division. In addition, without

the moral and financial support of the Qatar Financial Centre (QFC) Authority, especially Mr. Yousuf Al-Jaidah, CEO, and Mr. Henk Hoogendoorn, Managing Director, Financial Sector Office of QFC, we would not have been able to compile and edit this important monograph. We are truly thankful to the QFC team for their thoughtful support, as they continue to be a great source of strength and encouragement for all CIS research endeavors in Islamic finance.

I am also genuinely grateful to the CIS Islamic finance faculty members for their guidance and support to the Center for Islamic Economics and Finance (CIEF). It is with their support and encouragement that we have been rendering the services by organizing events of at a large scale and disseminating knowledge via our publications. Most notably among them are Prof. Dr. Nasim Shirazi, Prof. Dr. Ahmet Faruk Aysan, Dr. Abdulazeem Abozaid, Dr. Dalal Assouli, and Dr. Mustafa Disli. Also, my special thanks go to our former CIS Islamic finance faculty, Dr. Tariqullah Khan, for his inspirational motivations that initiated this research endeavor.

Likewise, I would like to express my deep appreciation to my CIEF staffs, Ms. Bahnaz Al-Qaradaghi, and Mr. Saqib Hafiz Khateeb, for their assistance in completing this book.

Last but not least, I am grateful to all my contributors in this book who have spent a great deal of time in preparing their chapters and following our guidelines, and to my co-editors, Mr. Zul Hakim, for always giving his best efforts into bringing out this book. I hope the readers will find this book an important addition to the growing body of literature on Islamic banking, finance, economy.

This book is product of the hard work done by academicians and processionals spread across several continents. I must appreciate their commitment and hard work in converting this book from a mere idea to a reality.

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Chapter 1
Islamic Finance and Circular Economy: An Introduction

Syed Nazim Ali and Zul Hakim Jumat

Abstract The world is facing unprecedented ecological, social, and economic imbalances and insecurities. Over the last few years, a circular economic system is emerging and introducing means and processes to learn from nature and minimize all types of wastes. It espouses a zero-waste economic system that calls for moderation in consumption and better treatment of natural resources, which mirrors Islamic finance and economy principles. On that note, the book, hence, provides a multidisciplinary approach in highlighting the common grounds of circular economy and Islamic finance in their efforts in providing a valuable and impactful alternative economic framework. The volume provides a critical overview and a comprehensive theoretical analysis of the circular economy from Shariah's perspective. In addition, it examines Islamic finance empirically in light of sustainability and value-creation while also highlighting several case studies on the circular economy application in the Islamic finance industry.

The world is facing unprecedented ecological, social, and economic imbalances and insecurities. The United Nations Secretary-General, Mr. António Guterres, reiterated this important issue in a lecture at the Hamad Bin Khalifa University, Qatar Foundation on December 16, 2018. In his lecture, he emphasized that climate change, which is the result of human actions, is the core cause of these uncertainties. He called for multilateralism and conscious efforts to reverse global warming, among other perennial challenges facing the world.

It is widely recognized that science and technology have made tremendous progress by discovering and learning from nature through different processes such as biomimicry. However, contrary to science and technology, economics, business management, and humanities have failed to learn any lessons from nature. The

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existing linear economic system is still largely based on extracting natural resources, producing, using, wasting, and dumping the waste into landfills, rivers, and seas or the atmosphere as incinerated smoke, causing an alarming signal to the earth's uncertain and adverse future. Over the last few years, a circular economic system is emerging and introducing means and processes to learn from nature and minimize all types of wastes. Moreover, it espouses a zero-waste economic system that calls for moderation in consumption and better treatment of natural resources.

Likewise, the teachings of Islamic finance and economy, which is the practical manifestation of Islamic values from the Quran and Sunnah, underline the significance of the universal scientific law of *Meezan* (balance) that juxtaposing care is needed to avoid ecological, social, and economic imbalances. In Chapter 55, verses 7 to 9 of the Quran states: "*And the heaven: He has raised it high, and He has set up the Balance. In order that you may not transgress (due) balance. And observe the weight with equity and do not make the balance deficient"*. Similarly, the *Maqasid al-Shari'ah* (the objectives of Shariah) and the UN Sustainable Development Goals, which will be discussed further in the chapters, are also in unison in highlighting the importance of preserving and promoting the ecological, social, and economic balance.

This challenge of uncertainty that the earth, humankind, and all other species are confronted with is truly unprecedented and more certain and real than commonly understood and realized. As the potential solutions are closely related to managing the earth's resources in a compassionate, judicious, and efficient manner with a long-term perspective, these solutions indeed must also be multidisciplinary in nature.

1.1 Book Outline

The principle of this book is to provide a multidisciplinary approach in highlighting the common grounds of circular economy and Islamic finance in their efforts in providing a valuable and impactful alternative economic framework. The volume provides a critical overview and a comprehensive theoretical analysis of the circular economy from Shariah's perspective. In addition, it examines Islamic finance empirically in light of sustainability and value-creation while also highlighting several case studies on the circular economy application in the Islamic finance industry.

Chapter "Islamic Perspective on Circular Economy" of this volume assesses the relevance of circular economy concepts in Shariah. The authors qualitatively suggest that circular economy concepts are in union with the Quran, Sunnah, and *Maqasid al-Shari'ah.* Furthermore, the chapter includes several suggestions of ways in which circular economy can be incorporated into *Shari'ah* models and contracts and be resonated adequately with *Maqasid al-Shari'ah* framework in promoting sustainable development.

Chapter "Environmental Protection and Sustainable Development: An Islamic Perspective" examines the provision of Islamic legislation on matters related to environmental care and sustainable development. Focusing on the Islamic jurisprudence

rulings and maxims, the authors summarize the *Maqasid* approach in addressing environmental issues that are designed to safeguard and promote all aspects of human well-being and obligate us to manage our usage of the natural resources as well as preserve it for the needs of future generations.

Part 2 of this book starts with Chapter "Circular Economy Financing: Islamic Finance Perspective" which highlights financing the circular economy concepts, especially "green financing" via Islamic finance products. The author analyzes the green financing trends and identifies the strengths, weaknesses, and some of the challenges that Islamic finance faces in financing circular economy projects.

Chapter "Circular Economy, Green Economy, and Sustainable Development: Establishing the Interconnections and Discoursing the Role of Islamic Finance" examines the connections of circular economy, green economy, and sustainable development goals in terms of their concepts, goals, and practical strategies. The authors shed light on a possible Shariah-compliant business model for Islamic banks, which offer Islamic banks an edge over conventional banks in terms of providing financing for all stages of circular economy and sustainable projects.

Chapter "The Circular Economy and its Possible Collaboration with Islamic Economics and Finance" focuses on the limitation of circular economy discourses and reservations that have been expressed on the social impacts of Islamic finance. The authors argue that, despite the limitation, the circular economy provides an opportunity to further strengthen the connection of Islamic banking discourse with the economic goal of social development.

Chapter "ESG Analysis and Shariah Screening: Mutual Learnings for a Better Investment Climate" discusses the performance of NIFTY100ESG, Nifty Shariah 50, and Nifty 50 indices in the Indian context over a period of time. The authors underscore the performance of the ESG index, and its value for the ESG strategies to be replicated in Shariah portfolios.

Chapter "Sustainable Investment and Transparency Recommendations in Segmented Markets: An Application to Islamic Investment Accounts" discusses the trust problem, which is critical in securing a sustainable long-term investment. Particularly in Islamic financial systems, trust problems are severe for private investors, where intransparent Islamic investment accounts are responsible for a majority of the funding of Islamic banks. The authors devise a sustainable investment recommendations model that rated 72 Islamic investment accounts across 13 countries.

Chapter "Sustainability, Trust and Blockchain Applications in Islamic Finance and Circular Economy: Best Practices and Fintech Prospects" explores the hype of blockchain-backed solutions to sustainability issues. The author highlights the need to filling up the current gaps of blockchain solutions through more innovative and applied research to expedite blockchain solutions in fulfilling its potential for circular economy and Islamic finance.

Chapter "Financial Development and Ecological Footprint in OIC Countries: Islamic Perspectives and Empirical Evidence" aims at analyzing the relationship between financial development and ecological footprint. The author demonstrates that financial development assists in both improving the quality of the environment

as well as its degradation depending on the priorities of the financial sector—and perhaps on the prosperity level of OIC countries.

Chapter "A Consumer Perspective of The Circular Economy: An Empirical Investigation Through Structural Equation Modelling" provides an empirical investigation through structural equation modeling and identifies inevitable factors of sustainable products and their impact on consumer purchase intention from a marketing perspective. By using the theory of planned behavior, the author discusses his findings that will assist policymakers in developing strategies that are both aligned to sustainable goals and circular economy principles.

Chapter "A Multi-Layer Analysis and Solution for Climate Crisis: From the Restructuring of Production to Restructuring of Knowledge" elucidates the root cause behind the inability of the current globalized economic system in preventing climate crisis by using the Hollingsworth framework of institutional analysis. The author discusses the foundation reconstruction of the society by adopting the Islamic—environmentally friendly—principles and paradigm template, which is essential in improving the climate crisis condition.

The third part of the book provides experiences from selected countries as case studies in terms of innovations in the area of circular economy. Chapter "Zero Waste Cities in the Developing World: A Comparative Study" discusses a detailed evaluation of waste management and zero waste attempts in Middle Eastern cities. The chapter highlights the perceptible significant gaps regarding waste management and therefore, calling for strategic waste management and an overly sustainable consumption model. With a backdrop understanding that the developing countries are quite vulnerable to the vagaries of climate change, the chapter studies the comparison of waste management and zero waste attempts in Middle Eastern cities, notably Qatar, and in some contexts in sub-Saharan Africa, where interesting case studies may be found. Furthermore, the author sheds light on the importance of the relationship between localization and zero waste strategies in playing an essential role in the circular economy.

Chapter "Solving the Problem of Water, Sanitation and Hygiene in Nigeria Using Blended Finance" studies the potential of Islamic blended finance in financing water and sanitation projects in Nigeria. The authors propose an innovative Islamic blended finance structure that could assist in bridging the financial gap in sustainable development goals project in Nigeria, specifically the WASH program project.

Chapter "The Role of Islamic Finance in Fostering Circular Business Investments in the Case of Qatar's Tire Industry" examines the role of Islamic finance in promoting circular economy investments. With the reference to Qatar's tire industry as an example of circular business, the authors suggest that Islamic finance profit and loss sharing financing, complemented with Islamic blended finance structure, can be used to promote circular businesses investments. In addition, the authors devised and drafted a circular economy law for the state of Qatar to foster the growth of circular businesses.

Chapter "Electronic and Electrical Waste Management: Malaysia and Sweden Experiences" studies the comparison of the implementation of SDGs in e-waste management between Malaysia and Sweden, especially the electronic and electrical

waste management systems. The authors highlight both countries' experience in e-waste management and attribute their success to the comprehensive regulatory support that fosters a conducive environment.

1.2 Future Directions: Key Takeaways

Targeting scholars and graduate students conducting research on various sustainable developments issues related to Islamic finance, this is the first practical handbook of its kind that helps readers to understand the circular economy framework and concepts under the lens of Islamic finance principles and applications. Some of the key takeaways are summarized below:

Need for a New Paradigm

The paradigm of multidimensional development leads to circular and impactful businesses. Blended finance, which advocates social subsidy for businesses, leads to the emergence of impactful SMEs. Social justice and social change are at the core of the circular economy. Sustainable development, green economy, and circular economy are considered common avenues to conciliate economic, social, and environmental goals.

Alignment with Shariah

Responsible investments are very closely linked to Shariah. *Maqasid al-Shariah* principles also attest to this alignment and linkage. According to the Islamic point of view, human beings are only vicegerents, so they should not think that they own this world. Rather they should consider the world as a responsibility that has been bestowed onto them. The convergence of ESG and Shariah criteria can help to rebrand Islamic finance and attract a wider spectrum of investors.

Tradeoffs

A balance between growth and sustainability needs to be achieved, and the solution may not be very straightforward as we take all the necessary parameters into consideration.

1.3 Proactive Efforts Using Technology, Regulations, and Increase of Awareness Required

Proactive efforts to finance technologies that help in achieving a circular economy need to be taken. Policymakers, practitioners, and regulators need to be aware of the perceptions and mentality of consumers, which affect their decision-making process when purchasing circular products. A collaborative effort is required among

central authorities, local governments, financial institutions, and enterprises toward the establishment of a sustainable financing mechanism. Innovations such as Green Sukuk can provide impetus to the circular economy efforts. Blockchain can serve as an effective tool as an SDG accelerator. A favorable approach, while less compelling, would be to gradually change the attitude as this avoids the indirect impact of disincentives on the business, economy, and employment. We need to develop the culture of serving the community and to know that we all are partners in the earth's resources and that this earth is for all of us.

1.4 Recommendations

Based on the chapters presented in the volume, the following recommendations can be summarized:

- Convergence between the principles as well as the objectives of circular economy and Islamic finance can bring positive change in the economy for the benefit of humankind.
- Aligning the objectives of sustainable financing circular economy, green economy within the framework of Islamic finance is essential in creating a valuable impact for the global economy.
- There is a need to revisit the concept of Islamic finance and align it with the goals of Islamic economics.
- Avoid focusing on conventional or western economic models, Islamic economics and finance should concentrate on developing their own code, model, and framework.

Syed Nazim Ali currently the director, Research Division and director of Center for Islamic Economics and Finance at the College of Islamic Studies, Hamad Bin Khalifa University (HBKU). Prior to joining HBKU, he was the Executive Director (Acting) of the Islamic Legal Studies Program (2010-2013) at Harvard Law School and Founding Director of the Islamic Finance Project at Harvard University since its establishment in 1995. During the last thirty years, he has spearheaded many research landmarks in the areas of Islamic finance and faith-based financial initiatives. He has paid special attention to lines of inquiry that seek to examine and interrogate the frontiers, facilitate research, and encourage dialogue among various stakeholders and external discussants. Dr Ali has played a lead role in organizing several conferences, workshops and symposia in the field during his nearly two decades association with Harvard, including the internationally renowned biennial Harvard University Forum on Islamic Finance; the proceedings of which are serially compiled and published under his supervision; and the annual workshop at the London School of Economics which brings together the sector's leading economists, shariah experts and practitioners in order to address key issues confronting the Islamic Finance sector. He is a member of the International Advisory Board of the Centre for Islamic Finance at the University of Bolton. His most recent publications include Fintech, Digital Currency and the Future of Islamic Finance (Springer, 2020), Fintech in Islamic Finance: Theory and Practice (Routledge, 2019), and Shari'a Compliant Microfinance (Routledge, 2012). He received his Ph.D. from the University of Strathclyde, Glasgow, U.K.

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Part I
Islamic Perspective on Circular Economy and Sustainability

Chapter 2
Islamic Perspective on Circular Economy

Saqib Hafiz Khateeb, Zul Hakim Jumat, and Munir Soud Khamis

Abstract Crises and disasters, man-made or natural, prove to be an opportunity from which mankind can benefit and take lesson to learn to be conscious of Allah's blessings and care for its rights. One of the lessons learnt is that capitalism is naturally driven by profit maximization actions that have adverse effects to our surroundings. This economic hegemony has led to environmental problems, which pose threats to humankind livelihood. In this light, the circular economy trend emerges to alleviate this adversity, preserve the rights of others, and protect the environment. Undoubtedly, the principles of circular economy coincide with Islamic economic theory. This chapter endeavors to study Circular economy in relation to Islamic economy and its principles, in two parts. The first part will be on "Defining Circular economy, concept, goals and benefits", and the second part will be discussing "Circular economy in Quran, Sunnah and *Maqasid al-Shariah*".

2.1 Introduction

From the dawn of the twentieth century, the global economy greeted a surge of ideologies that emphasized economic growth on the expense of resources that are abundant and low cost, without any prevailing concern of its impact on the environment. Hotelling model suggests that even when market prices fully reflect the value of a species, it will be efficient to exploit a species to extinction or totally degrade an ecosystem if the value of the species or the ecosystem over time is not increasing at least as fast as money deposited in an interest-bearing bank account (Hotelling

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1931). Hence, from a business perspective, the degree of natural resources exploitation is solely and highly correlated with profit maximization. Businesses increasingly extract raw materials either to minimize the costs or maximize the profits (Bakan, 2006). With the extracted raw materials, they manufacture desired products and sell them to as many consumers as possible. Households and consumers, on the other hand, have embraced a frightfully unsustainable lifestyle of acquiring, using, and discarding desired products after they have served their purpose without being conscious of the implications of their actions. In this manner, the economy has become a linear system of extracting, utilizing, discarding, and extracting more.

As much as the linear model seems to be economically compelling to businesses and consumers, the outcome of this model on the long run is likely to be shortage and depletion of natural resources, growing price volatility, climate change and continued ecological degradation. In fact, the growing concerns about environmental decimation in the present era are attributed to the linear economy. The emergence of newer challenges such as natural resource depletion, intensification of global warming, rise in new levels of air, water, and soil pollution, biodiversity loss, environmental degradation, and excessive land use are evident shortcomings of this model (Geissdoerfer et al. 2017). It is worth noting that these challenges are not confined to the ecological and social dimension. According to Sachs (2015) low productivity, inefficient and deregulated market structures, and disturbances in economic and financial markets can be regarded as symptomatic of the linear models (Sachs, 2015).

The sheer ineptitude of the linear economy undermines the need of an ultimate new model of industrial organization to disconnect the masses from a linear economy ideology, which carries no incremental efficiency gains. It is a call towards proper care for natural resources and products where it could be repaired, reused, or upgraded instead of being thrown away. Reasonable use of raw materials and the ability to reuse or recycle wastes are among the inherent and intuitive value in Circular Economy (CE). Furthermore, the concept of CE commensurates with the preservation of the environment and the United Nations Sustainable Development Goals (SDGs), particularly the twelfth SDG which calls for responsible production and consumption. The models of CE are characterized by less use of virgin nature's capital, more dependence on renewable energy, reductions in wastes and emissions, higher durability of products, focusing on recycling, refurbishing, and remanufacturing, and reductions in waste disposal. Circular business models remediate environment degradation by promoting the concept of eco-effectiveness (Braungart et al., 2007).

Judging by the objectives of circular economy and the values incorporated in its models, CE resonates adequately with the framework of *Maqasid al-Shari'ah* (the objectives of Shariah). In his book Al-Mustasfa, Al-Ghazali described *Maqasid* as: *"The very objective of the sharia is to promote the welfare of human beings, which lies in safeguarding their faith, their life, their intellect, their posterity, and their wealth. Whatever ensures the safeguard of these five fundamentals serves public interest and is desirable, and whatever hurts them is against public interest and its removal is desirable"* (Abu Hamid Al-Ghazali n.d.).

Islam forbids the waste of resources and considers it sinful. This materialistic behavior is labeled as *Israaf* (excess consumption/spending) in Quran. Since these

wasteful instincts drive the attitudes of entrepreneurs, individuals, households, and firms, it actually calls both the producer and the consumer as kins of the devil. It states: *"Those who squander are the brothers of Satan, and Satan is most ungrateful to his Lord"* (Quran, 17:27). Concurrently, Islam encourages the most efficient use of resources as Allah says in the description of true believers: *"And [they are] those who, when they spend, do so not excessively or sparingly but are ever, between that, [justly] moderate"* (Quran, 25:67).

The circular economy model is tandem with many elements of Islamic law such as social justice, better resource utilization, preservation of wealth, environmental care, and the notion of 'damage should be removed' which is a legal maxim. This paper adopts an analytical narrative approach to link the principles, objectives, and business models of CE to *Maqasid al-Shariʿah.* Furthermore, this study explores the concepts of CE and sustainability inherent in Shariah as an attempt to highlight potential opportunities that Shariah can offer to facilitate and promote CE models in a quest of achieving a comprehensive sustainable development.

2.2 Literature Review

Khan (2019) discussed a number of paradigmatic and regulatory reforms that will be required to enhance the actual effectiveness of Islamic finance in achieving the ideals of Comprehensive Human Development (CHD), and the SDGs at large. Khan stressed the need for a paradigmatic (one of which is the transformation of businesses from linear models to circular paradigm) and regulatory reform to address the objectives of *Shariʿah* to ensure that ecological environment is recognized as a resource (Khan 2019).

Abdul Jalil (Ibrahim & Shirazi 2020) explored ways in which Islamic finance can support circular businesses within OIC countries to achieve economic growth that is not at the expense of the environment. The study emphasized on the role of Islamic finance's compassionate contracts and financing modes such as equity-like, and risk-sharing financing modes to support circular businesses motivated by the holistic objective of *Maqasid*. The study also urged financial regulatory authorities and Islamic financial institutions to consider risks associated with climate change and linear economic activities in terms of asset valuation and pricing (Ibrahim & Shirazi 2020).

However, this chapter extends the literature on Islamic perspective of CE by demonstrating that nexus between the objectives of CE and *Maqasid al-Shariʿah.* Furthermore, it demonstrates the concept of CE from *Maqasid al-Shariʿah* perspective and explore methods of which *Shariʿah* promotes CE to achieve sustainable development.

2.3 Circular Economy

Arguably CE was initially conceptualized in view that economic growth leads to ecological degradation, over exploitation of natural resources and loss of biodiversity (Lieder & Rashid, 2016). Hence, CE was introduced to remediate the shortcomings of the linear models by promoting the concept of eco-effectiveness (Braungart et al., 2007). The pertinent literature negates existence of a prevailing consensus over the definition of CE (Rizos et al., 2017). Generally, CE is usually defined based on the core features of its objectives and models.

Perhaps the most popular definition of CE is that "CE is an industrial system that is restorative or regenerative by intention and design. It replaces the 'end-of-life' concept with restoration, shifts towards the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse, and aims for the elimination of waste through the superior design of materials, products, systems, and, within this, business models" (Ellen MacArthur Foundation, 2016; Geissdoerfer et al., 2017; Schut et al., 2015). This definition indicates that a holistic implementation of CE necessitates a systemic shift of economy. However, the findings of Kirchherr et al. (2017) analysis negates this allegation, as they suggest that CE is most frequently depicted as a combination of reduce, reuse and recycle activities, whereas implementing these activities is not necessarily correlated with a systemic shift. Overall, the concept of CE can be depicted in the 'R frameworks' or 'R strategies'. The most basic of these frameworks being the 3Rs: 'Reduce, Reuse and Recycle' which has been used in China's 2008 Law on Circular Economy Promotion. On the other hand, the 9Rs framework is known to be the most sophisticated R framework. The 9Rs framework stands; 'Refuse, Rethink, Reduce, Reuse, repair, Refurbish, Remanufacture, Repurpose, Recycle and Recover'.

In a nutshell, a circular economy is where the resources are produced based on requirement and then adequately used, then regenerate products and materials at the end of each service life. This promotes economic prosperity, enhances environmental quality and social equity, and leaves the resources for the better use for future generations.

2.3.1 History of CE

The roots of circular economy can be traced back to the late eighteenth century. In 1798, Thomas Malthus, concerned about the world's mushrooming population, published his famous work, "An Essay on the Principle of Population" where he argued that continued population increases would eventually diminish the world's ability to feed itself. Other influential figures in these early years included John Stuart Mill and Hans Carl von Carlowitz, who advanced theories around responsible management of natural resources (Lacy & Rutqvist, 2015). In the late nineteenth century, the Journal of American History recorded the first protests against pollution

which was the first efforts to conserve natural resources, and the first campaigns to save wilderness (Rome, 2003). However, it was the twentieth century when CE fully gained its momentum, starting with Boulding's (1966) study that portrayed earth as a circular dimension with finite capacity as an indicator that very limited natural resources are accessible for human activities. This claim of natural resources' finite nature and their risk of depletion was further attested by the book 'The limits to growth' which argued that delays in global decision-making would cause the human economy to overshoot planetary limits before the human ecological footprint slowed. As a result, human society would be forced to reduce its rate of resource use and its rate of emissions (Lacy & Rutqvist, 2015).

It is worth noting that CE as a concept is attributed to the study conducted by Pearce and Turner. The findings of this study portrayed the influence of natural resources to the economy by providing inputs for production and consumption as well as serving as a sink for outputs in the form of waste (Pearce & Turner, 1991). However, CE as a concept did not receive much attention and importance until the Chinese Government attempted to implement it in the wake of the twenty-first century, through an initiative called the "Circular Economy Promotion Law of the People's Republic of China".[1] The Sustainable Development Goals can be regarded as the most recent initiatives in promoting CE which enhances achieving comprehensive human development as well as sustainable development. According to the 73rd UN General assembly "the CE holds particular promise for achieving multiple SDGs, including SDGs 8 on economic growth, 6 on energy, 11 on sustainable cities, 12 on sustainable consumption and production, 13 on climate change, 14 on oceans, and 15 on life on land" (UN Economic & Social Council, 2018).

2.3.2 Advantages of CE

The current widely followed economic system is what is known as a linear economic system. Broadly based on 'take, make and dispose mechanism', it centers around extracting from natural resources—some of which are already scarce -, manufacture a product, sell it to the consumer, consumption by the consumer and lastly to dispose it off as waste. The linear paradigm is an optimum solution to satisfying the demands of ever-hungry consumers as well as the ever-greedy companies. Such a capitalistic and materialistic way-of-life fulfilled the desires of self-centric humans, but the environment and the 'other' population had to suffer. The polluted oceans, the vanishing forests, the endangered species and the rising global temperatures are all results of linear economy. We do not need to wait for a change until the diminishing scarce resources fail to meet the consumer demands in the future. The destruction of the value inherent in the linear economy has become clear and the potential for

[1] Lieder, M. and Rashid, A. (2016), Towards circular economy implementation: a comprehensive review in context of manufacturing industry. Journal of Cleaner Production, 115, 36–51.

an alternative circular approach, one that is regenerative and restorative by design, is increasingly appealing (Working Group finance2016).

The term Circular economy is associated with the evolution and transformation of businesses from an unsustainable model encompassed with major predicaments such as a loss of biodiversity, deforestation, pollution and natural resources depletion to a more viable model of which all stakeholders, society and the environment can benefit from. Circular economy (CE) originated from the inspiration of nature and its living system as the CE is restorative and regenerative by intention and design which enhance restoration of ecological balance, societal well-being and achieving economic growth. CE models use two types of materials: biological (renewable) materials which are reusable and degradable; and technical (nonrenewable) materials, designed to move back and forth between production and consumption with minimal loss in quality or value (Lacy & Rutqvist, 2015). What better defines the importance of CE could be its expected results. It helps reduce waste, campaigns for better resource efficiency, creates a more competitive economy, and helps reduce the environmental impacts of our production and consumption. Unlike the linear economy, value creation in a circular eco-system is tied to the ability of firms to manage resources in the markets which promotes zero-waste value chains powered by regenerative (renewable) energy. In this regard, the circular economy is a multidimensional compelling nature course of sustainability because it takes the financial, economic and environmental benefits and costs into consideration in an integrating way (ING, 2015).

The circular advantage is the competitive edge gained by companies embracing an ethical and responsible alternative to the waste intensive linear paradigm. The paradigm involves design, make, use, reuse/repair, recover/recycle. It is better to fix the problem before it is late when all resources are gone deplete. Rapidly growing consumption demands and diminishing scarce natural resources only indicate towards the inability of the market to meet consumer demands in the future (Lacy & Rutqvist, 2015).

2.3.3 CE Business Models

Circular economy is a compelling business case of sustainability of which integrated disclosure and waste management prove to be pivotal in ensuring safeguarding environment and promotes ecological economy paradigm. The potentiality of CE to increase economic growth by 1–4% over the course of a decade not only presents new business opportunities but also is sufficient to meet the needs of the growing world population. The rise of the middle class along with a considerable increase in its share of wealth pose a multi-dimensional threat made up of an increase in CO_2 emissions, waste production and resource depletion (ING, 2015).

CE strategies can be implemented in different stages of CE business models from designing, manufacturing and procurement to waste collection and management. The most notable CE business models are: (1) Circular supply-chain which

are renewable, recyclable or biodegradable; (2) Resource recovery through recycling and upcycling services; (3) Product life extension via repairing, upgrading, remanufacturing or remarketing; (4) Sharing platforms which promote value creation by forging new relationships and business opportunities for consumers, entrepreneurs and companies who rent, swap, lend their idle products; (5) Product as a service to enhance product longevity and reusability to cut production cost (Lacy & Rutqvist, 2015). The variation of CE business models necessitates multiplicity of forms of capital financing as different forms of CE business models involve different levels of risks and requires different forms of capitals as a result. Not to mention some models require punctuality on the timing of cashflows, which emphasizes the importance of creditworthiness. Finance ability of CE business models can be increased through value creation in secondhand markets and to account for the value of a product at the end of the life cycle. Overall, the major financial implications of the transition to CE may include balance sheet extension, increased working capital and increase credit risks in some CE business models (ING, 2015).

2.4 The Idea of Circularity from Islamic Perspective

According to Chapra (2008), a rise in income and wealth through development is necessary for the fulfilment of basic needs as well as the realization of equitable distribution of income and wealth. This is in line with *Shariʿah* but not sufficient to realize the comprehensive vision of human well-being. Fulfilling the spiritual and the non-material needs (such as environmental and social needs) is equally consequential as the economic needs are not only to ensure true well-being but also to sustain economic development over the longer term. If all these needs are not taken care of, there will be a lapse in well-being, leading ultimately to a decline of the society itself and its civilization. The satisfaction of all these needs is a basic human right and has been addressed in Islamic literature under the generic term '*Maqasid al-Shariʿah*'. Therefore, through *Maqasid al-Shariʿah approach*, Islam promotes social cohesiveness and growth in economy through ethical and rational expansion and safeguarding the nature (Umer Chapra, 2008). By espousing *Shariʿah* guidelines encompassed under the auspices of *Maqasid al-Shariʿah* we will be able to realize benefits to greater nature and all species and removing any harm which is known as public interest or *maslahah.* In Islam, *Maslahah* rather aims to protect humans, society and the fragile nature. Imam Ghazali, rightly classified that to protect the religion or belief, there are four worldly activities that are important, i.e. safeguarding of faith (*din*), life (*nafs*), lineage (*nasl*), intellect ('*aql*), and wealth (*maal*) (Abubakar, 2016). Among these five *maqasid*, two of them are directly related to conservation of resources, meaning that they call for circular economy model. The objective of preserving posterity ensures that the interests of next generations and their rights to utilize the sufficient resources and proper environmental conditions are preserved, which is the essence of sustainability. The OIC Fatwa on environmental protection declares that it is impermissible to undertake any activity that unleashes harm on

the environment or destructs the ecological balance (OIC Fiqh Academy resolution number 185).

Similar to the concept of CE, the Islamic notion goes beyond the conventional norm and is more sustainable, exceedingly demanding and profoundly applicable both in terms of theoretical and practical significance. Islamic paradigm encourages healthy business and economic activity in line with *Maqasid al-Shariʿah* element, and that is to sustain the societal benefit with minimum affliction to anyone. CE was established to promote alignment of financial system with sustainable development in a way that it ensures financial stability in the long run simultaneously with enhancing concepts and strategies of natural wealth, and green financing to enable a smooth transition to a low-carbon, green economy. With that in mind, arguably, three points can be drawn from CE, namely: the concept of long run growth rather than short-termism, understanding about inter-generational equity in the use of natural resources, and restricting as far as possible the pollution level for maintaining the quality of environment. These concerns are the hallmark of *Maqasid al-Shariʿah* and creation in a fine balance (*mizan*).

Shariʿah connotes that the world is created in a fine balance, where the humanity was selected as the stewardship of the Earth and its resources in trust from the Almighty creator: *"He has raised up the sky. He has set the balance so that you may not exceed in the balance: weigh with justice and do not fall short in the balance."* (Quran 55: 7–8).

With this trust in humanity's reason and moral responsibility comes a duty to act as guardians and protectors of the environment. Human beings are under the obligation of conservation and sustainable use of the earth's resources for the benefit of present and future generations. However, the current rate of climate change cannot be sustained, and the earth's fine equilibrium may soon be lost. Financial systems should not be influencing practices which result in environmental harm or financial loss to external stakeholders beyond those who have voluntarily put their capital at risk. Rather, a moderate and balanced approach should be adopted that does not breed inequality, depletes resources and destabilizes the ecological balance. As the result the natural setting of the *mizan* is compromised (Shogren & Toman, 2010).

The concept of *mizan* does not only relates to the alignment of the financial systems and business models with CE, but also with the Paris Agreement and the Sustainable Development Goals (SDGs). For instance, a number of SDGs are incorporated in the concept of natural equilibrium and balance of the eco-system. SDG 2 (zero hunger, food security, and sustainable agriculture) is manifested in maintaining equilibrium in the quality of agricultural lands, improving productivity, and avoiding food waste. Similarly, upholding natural harmony and preventing waste promotes healthy living and well-being (SDG 3) and access to clean water and sanitation (SDG 6), while encouraging responsible consumption and production (SDG 12), and protecting lives on land (SDG 15) and below water (SDG 14). Actions to reduce the effects of climate change (SDG 13) are also dependent on sustaining the natural equilibrium (AlMubarak, 2018) and can be enhanced by CE models.

The objective of preserving the wealth is also particularly relevant in the context of CE from an Islamic perspective. Environmental blessings being the source of most

wealth, if not all, and its sustenance should hence be protected and preserved. There are a number of verses and traditions, which direct the humanity towards care for environment, being the basis of this 'objective'. For instance, a total of 88 verses in 42 Quranic chapters were identified with a considerable emphasis placed on the importance of water resource management and water conservation, environmental justice, plant conservation, biodiversity, sustainability, and environmental stewardship (Aboul-Enein, 2018). Creating an economy that best suits preservation of nature and environment, is hence in turn a legal requirement of Islam. It is in the best interest of human being to be careful towards the abuse of earthly resources, for himself and for the generations to follow. It is in a hadith that the Prophet (peace be upon him) said:

"There is no Muslim who plants a plant or sows a seed and a bird, or a person, or an animal eats from it, but he has charity with it".[2] This hadith is generally understood as a call for preserving of nature, which is correct. Yet, it should also be seen in an economic perspective that the hadith calls for continuity of life and resources on earth in its natural life cycle. Today, in the linear economic model, the nature of usage is such that the resource is used for oneself only and that too for an excess desire. Rather planting a plant or sowing a seed, metaphorically the plants and seeds (resources) are over-extracted and utilized, leaving nothing for the mankind in the near future or for the other creatures.

The objectives of Shariah pertaining to wealth and life prescribe the consideration of the fiqhi maxim, which states that "the necessity must be assessed and responded proportionately". Thus, the response to the needs should be proportionate and holistic aiming at preserving the resources and keeping it available for the generations to follow and their needs. Another fiqhi maxim which censure linear economy is "there must be harm nor retaliation for harm".[3] The harmful side of linear economy model has only corrupted the mindsets of the materialist individuals by feeding whatever is their wants, by hook or crook. It has disrupted the environment, the people's mindsets, and the resources for the following generations. Quran reprimands saying: "*And cause not corruption upon the earth after its reformation"* (Quran: 07:56).

The Quranic recommendations of moderation and balance in worldly pursuits are intended to support the Islamic concept of sustainable development. Such a way of moderation and balance in production and as well as in consumption will show its benefits and will send a positive message to humanity that such a framework is imperative to produce an equitable economy, a better society and a world that is worth living for present and future generation (Hassan, 2006). In Chap. 25, verse 67, we have a Quranic definition of moderation as the "just mean", in between the extremes of prodigality and miserliness. In 26 and 27 of Chap. 17, Satan is described as "wasteful" and "ungrateful," and so, an implicit connection is made between his disbelief on one hand, and his ungratefulness and wastefulness on the other. Quran urges us to avoid the prodigal (who cause corruption upon the earth) (Quran 26:151–152), and the miserly (who enjoin people to be miserly) (Quran, 57:24). An implied

[2] Al-Bukhari, Sahih, No. (2320).

[3] Ibn Majah, Sunan, No. (2340).

connection is thus made between wastefulness and corruption, where extravagant consumption and luxury are believed to have a corrupting influence on our souls and the earth (Reda, 2018).

The insistence of Shariah on preservation of the progeny manifested in CE models is intended for ensuring inter-generational equity in the distribution of wealth and prosperity, conservation of resources, and sustenance of the environment, all links of one chain. For example, the Prophet (peace be upon him) prohibited cutting trees around Madinah and restricted Muslim army from bringing harm to the trees especially those which are fruitful. Umar, during his caliphate, refused distributing conquered lands in Iraq among the soldiers for the sake of future needs of the Ummah (Hasan, 2006).

Safeguarding of intellect is equally important to safeguarding of wealth and lineage from *Maqasid al-Shariʿah* perspective in the quest of shifting economy from linearity to circularity. Safeguarding the intellect enhances the ability of the society, as consumers and producers, to resist pollutive influence in business decision making. From a producer's perspective, Islam emphasizes on depriving and defying the conventional wisdom which focuses on short term returns at the cost of long-term value creation which results in marginalization of social and environmental effects and ultimately dampen economic growth on the long term. The Shariah has not set a ceiling for profits nor has it condemned profit maximization motive in businesses, however, it should not be on the expenses of the society or the environment. Moderation and balance are Shariah guidelines in businesses to support the Islamic concept of sustainable development which is also the mandate of CE.

As consumers, a balanced consumption of resources is in line with the circular economy model. Once the prophet saw one of his companions, Saa'd bin Abi Waqqas, using a little excess of water while performing ablution, which is an obligation for acceptance of prayers. He outrightly advised the companion against this mistake saying, "What is this extravagance, Saad?" Since it is an obligation and not one of his desires, Saad asked how can there be an extravagance in ablution? To it Prophet replied: "Yes, even if you are beside a flowing river"[4] This is a direct regulatory text that the resource even if it is abundantly present for use, should be used as per the need only.

The concept of CE encompassed in the Islamic paradigm has the potential of paving a way to the creation of a responsible system of production and consumption. The system would be concerned about the wellbeing of the producers, consumers, the quality of the environment and social welfare.

[4] Al-Nasa'I, Sunan, No. (425).

2.5 Promoting CE Models from Islamic Perspective

Clearly, *Maqasid al-Shariʿah* supports the quest of CE of shifting businesses from a linear destructive economy to a circular generative one. The current global financial systems have been created and maintained unjustly and are unstable. They are based on debt and compound interest which breeds inequality, depletes resources and destabilizes the ecological balance. CE presents an alternative to this destructive narrative which focuses on planning for a holistic comprehensive development that can help overcome the challenges of linear economy such as biodiversity loss and natural resources depletion. Furthermore, many social problems could be solved should producers de-emphasize profit maximization in favor of quality-of-life indicators. This profound change in focus would align CE with pathways set out by *Maqasid al-Shariʿah.*

One way of understanding how the concept of CE is encompassed in *Maqasid al-Shariʿah* is through Islamic social finance institutions and philanthropic activities like *zakat*, *sadaqah* and *waqf* that are circular in nature. *Zakat*, for instance, when a person possesses something (whether money, cattles, resources like gold and silver etc.) above a prescribed amount (*nisab*), he/she is obliged to donate a portion of that to those in need. *Sadaqah* has no prescribed amount, leaving it open to the donor for the benefit of the beneficent so that the donated subject (money or item) can be used and re-used by others after him. The *waqf* system also supports the sustainability and continuity feature of the resource. It continues for the beneficiaries from its proceeds, contributing to improving people's living conditions in a sustainable and uninterrupted manner. Undoubtedly, the circularity nature of the aforementioned philanthropic activities is a clear indication of the nexus between the objectives of CE and *Maqasid al-Shariʿah.*

In addition to Islamic social finance institutions, developing *Shariʿah* based guidelines on SRI funds, *Sukuk* and so on such as the 'Value Based Intermediation' (Bank Negara Malaysia, 2017), is a way forward to incorporate CE and enhance sustainable development to deliver the desired outcomes in line with *Maqasid al-Shariʿah* through practices that ensure a positive and sustainable impact for the economy, community and environment, without compromising financial returns. This is an exclusionary practices approach where *Maqasid al-Shariʿah* enhances a CE ecosystem through restricting businesses from engaging in unethical transactions and dealings that include interest, uncertainty or deceptive contracts, gambling, and the promotion of disorder and evil ends. One implication of practicing *riba, gharar* and *maysir* is that undue profit for one party at the expense of another is viewed as unjust and ultimately unsustainable. From a *Shariʿah* point of view, these prohibitions are devised on the proposition of establishing a sustainable financial system, devoid of transactions that lead to unfair exchange and inequitable distribution of wealth (AlMubarak, 2018) and ultimately impede a complete transition of economy to a circular paradigm. Khan (2019) attributes the ecological disasters to the linear economy. According to him, the interest-based financial system has become an engine for driving a linear economy. He stressed on the importance of circular economy to

remediate ecological problems and believes that Islamic economy can be neither linear nor circular (Khan, 2019). Thanks to the exclusionary measures which act as a catalyst to enhance the society's ability of fully grasping the desired outcomes of the CE, undoubtedly, *Shariʿah* has a broader perception of CE than that of a conventional.

2.6 Conclusion: Key Shariah Takeaways for CE Models

The Shariah has the capacity of promoting and financing CE business models through a number of contracts, which are in line with *Maqasid al-Shariʿah.* Risk sharing contracts such as *Musharakah* and *Mudarabah*, can play a significant role in implementing CE on businesses. These risk sharing contracts can facilitate the deployment of capital from impactful investors and financial institutions in partnership with entrepreneurs to undergo a CE business. Thus, Islamic banks can use credit allocation as a catalyst for adopting circular businesses within the achievement of *Maqasid al-Shariʿah.* The Maqasid objective provides a religious motivation for Islamic banks different from conventional banks (Campiglio, 2016). Green sukuk and its proceeds can also accelerate as smooth transition to a circular economy. For example the Malaysian green sukuk guidelines which cover a broad range of eligible projects—including CE projects—aim to: (i) preserve and protect the environment and natural resources; (ii) conserve the use of energy; (iii) promote the use of renewable energy; (iv) reduce greenhouse gas emission; or (v) improve the quality of life for the society (SCM, 2017). Green Sukuk is a catalyst of circular business-friendly projects, particularly the waste recycling and renewable energy production projects.

In addition to the risk sharing contracts, businesses can capitalize on *Ijarah* model in some CE models, particularly product as a service model. According to Aboul Naja (2015), the exploitation of natural resources is mostly attributed to the ownership of goods phenomenon. With the absence of producer's responsibilities in most countries, durability of products is a luxurious trait of most products. The owner produces goods to make a profit for himself, but he does not bother much about the durability of his product. If ownership is replaced with the utilization of the asset, then the durability of the goods can be enhanced which is the essence of the circular economy (Aboul-Naja, 2015). The utilization of the asset can be structured on the basis of *Ijarah* contract where the lesser will charge a fee from leasing the product to the lessee. The *Ijarah* model will promote the production of durable goods which in a way will reduce exploitation of natural resources and ultimately limit excess waste generation.

Finally, the application of blended finance can be effective in financing CE models by bringing Islamic social finance institutions and takaful to the equation. Islamic social finance institutions can mobilize adequate volume of finance to support the transition to a CE. *Waqf*-based products (perpetual endowments backed by tangible assets), *waqf*-based contracts and *takaful* can be powerful contributors in areas related to sustainable infrastructure, renewable energy, and water management.

These are three ways of which CE can be incorporated in *Shariʿah* models and contracts. The concept and objectives of the CE resonates adequately with *Maqasid al-Shariʿah* framework in promoting a sustainable development. Targeting economic development -as embodied in linear economy- with the neglect of other requisites (ecological and societal factors) may result in a relatively higher rate of growth in the short-term at the expenses of economic degradation and social inequality but ultimately deterioration of the financial system is inevitable as emphasized by Ibn Khaldun (Umer Chapra, 2008).

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Chapter 3
Environmental Protection and Sustainable Development: An Islamic Perspective

Mohammed El-Gammal and Abdulazeem Abozaid

Abstract Islam safeguards and protects all aspects of human's life and guides them with proper etiquette in dealing with their surroundings and environment. It also urges humans to preserve the natural resources for their needs as well as the needs of future generations. With this regard, Islamic legislations do not limit these virtuous actions to being merely recommended things to do, but rather Islam varies their relevant rulings between obligatory, prohibitory, recommended, and reprehensible, which indicate Islam's special care on the environment protection matter. This chapter, therefore, reviews the Shariah's perspective on environmental issues and attempts to relate them to Islamic jurisprudence rulings through induction methodology, especially those matters related to what is known today as "sustainable environment". This will show and prove Islam's precedence in environment protection-related matters, which has laid the foundations of today's sustainable development agenda. The study also adopts the *Maqasid* approach in addressing environmental issues, since the preservation of environment and its sustainability has been emphasized by Shariah, and negligence in return threatens environment sustainability or at least depletes its resources.

3.1 Introduction

The word environment (*Bei'a* in Arabic) refers to the natural place where a person lives and the factors and elements that affect his living and lifestyle.

In fact, Quran and Sunna include numerous texts that relate to the environment. Generally, those texts urge people to preserve the environment, and they prohibit acts that may harm it, which indicates that care for the environment is critical in Islam.

Moreover, the general objectives of Shariah, which are identifiable by the entirety of Shariah texts and provisions, intersect with the care for the environment to the extent that preserving the environment may be considered an independent Shariah objective. This is if we adopt the approach that Shariah objectives are not limited to

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a particular number but exceed the five essential values: preservation of the religion, life, intellect, lineage, and wealth.

This study attempts to determine the extent to which the Lawgiver takes care of the environment in light of the *Maqasid Al-Shar'iah.*

3.1.1 The High Objectives of the Shariah

The objectives of Shariah are the highest values that are nurtured and observed from the provisions of Islamic law. The objectives extend to include provisions related to human's servitude to their Lord, which is expressed in the high objective of preserving the religion, and provisions related to human's worldly interest through the remaining high objectives of preserving their life, mind, progeny/honor, and wealth. In this regard, the interactions observed between the Shariah objectives and the care for the environment are evident in Shariah provisions. Since caring for the environment is an essential factor in safeguarding and promoting human life, intellect, and wealth and the progeny after them.

From the Shariah perspective, the realization of these high objectives also contributes to fulfilling the function of *Khilafa* (vicegerency) and *Imran* (developer of the earth) as one of the purposes of creation decreed in Islam. For *Khilafa,* it is stated: "and (mention, O Muhammad), when your Lord said to the angels, Indeed, I will make upon the earth a successive authority (*Khalifa*)" (Quran: 2:30). In addition, the role of *Khalifa* (vicegerent) is to worship God Almighty, as stated in Quran 51:56, "and I did not create the jinn and mankind except to worship Me", which alludes that the purpose of creation is to achieve *Khilafa* of the earth for the sake of worshiping God Almighty.

Inevitably, the preservation of the universe (the environment) is necessary for the realization of the purpose of creation. That is because environmental corruption results in ceasing humankind's existence, and this would desist the very *Khilafa* of the earth. Nevertheless, nothing on earth happens against God's will, but Allah has established this universe on a very balanced system of causes and effects.

3.2 Preservation of the Environment is Complementary to the Five Essential Values

3.2.1 Preservation of the Environment as a Shariah Objective

Certainly, the five essential values can only be preserved if the environment in which man lives is preserved with all of its vital components, such as pure water and fresh air. This is in addition to the food resources that nurture the human body and maintain

its strength, away from the diseases that weaken the man and may pass on to his descents.

In fact, the preservation of the five essential values, namely, religion, life, intellect, lineage, and wealth, is only possible by preserving the environment and caring for it. This is explained in the following:

Preservation of the Religion

Among other things, the preservation of religion is achievable through pondering the cosmic wonders. This is in itself is doable by observing the environmental phenomena using the Quran approach to explaining the realities of existence. Hence, preserving the environment also involves preserving those divine signs. Besides, it is evident that living in an environment of arduous conditions and turbulent resources distracts one from discharging his duties toward his creator.

Since preserving the environment is a religious requirement, as in the Almighty's saying: "And cause not corruption upon the earth after its reformation" (Quran, 7:56), seeking to preserve the environment becomes a religious obligation such that its omission amounts to a transgression against the religion and the value of preserving it.

Preservation of Life

Life is the value that is most affected by the corruption of the environment, since tampering with the environment may threaten its survival and continuity. Hence, Shariah does care for the environment, that is, for the survival of the human race and its healthy life on the planet. Evidence from the Shariah for such care are numerous in its provisions and texts, such as by the request of Shariah for personal hygiene and cleanliness, as stated for example in the Quranic verse: "O you who have believed, when you rise to [perform] prayer, wash your faces and your forearms to the elbows and wipe over your heads and wash your feet to the ankles" (Quran, 5:6). Thus, Muslims are supposed to keep cleansing themselves, as they have to pray five times a day. Besides, other Sunna reports also call for cleanliness, as in the Hadith[1] "Whoever performs ablution on Friday has done a good thing and he who takes bath, taking bath is better (for him)".[2] Another Hadith reads: "Indeed Allah is *Tayyib* (good) and he loves *Tayyib* (what is good), and He is *Nazif* (clean) and He loves cleanliness, He is *Karim* (kind) and He loves kindness, He is *Jawad* (generous), and He loves generosity. So clean' your courtyards, and do not resemble the Jews".[3]

This care for life is also evident in the Hadith that teaches Muslims how to avoid epidemics that may claim people's lives. "If you get wind of the outbreak of plague in a land, do not enter it; and if it breaks out in a land in which you are, do not leave it".[4] The Prophet (peace be upon him) is also reported to have said in this regard: "Do not

[1] Hadith refers to a Sunna report, a statement that is attributable to the Prophet (peace be upon him).

[2] Abu Dawud, Sunan, No. (354), Al-Tirmidhi, No. (497).

[3] Al-Tirmidhi, Sunan, No. (2799).

[4] Reported by Al-Bukhari and Muslim. See: Riyad Al-Saliheen No. (1792).

put a patient with a healthy person as a precaution".[5] Obviously, these instructions are in order for new people not to become infected or pass the epidemic on to others.

Preservation of the Intellect

Preservation of the environment entails preserving the right thinking in a person in order to be able to appreciate the importance of caring for the environment. The absence of sound reasoning makes one fail to observe rightness in dealing with the environment and underestimate the dangers of tampering with it. One who covers his mind by choice no longer knows what is good for him and what may harm him. Indeed, the absence of reason causes a person to disregard all values and to harm his environment. There is also no doubt that neglecting to enrich the intellect with science makes a person unable to appreciate the consequences of his transgression on his environment. Hence, we find that Shariah has forbidden consuming intoxicants and urged people to seek all sorts of useful knowledge. The Almighty says: "O you who have believed, indeed, intoxicants, gambling, [sacrificing on] stone alters [to other than Allah], and divining arrows are but defilement from the work of Satan, so avoid it that you may be successful" (Quran, 5:90), and according to a Sunna report: "Seeking knowledge is a duty upon every Muslim".[6]

Preservation of Lineage

Crime against the environment threatens the survival of mankind and threatens future generations because it carries with it the seeds of destruction. This includes the depletion of resources, which are the right of all generations.

On the other hand, environmental education is necessary, especially the education about the importance of the environment and its role in preserving the human life and the life of other creatures. This also comes in fulfilling the duty of care referred to by the Hadith: "All of you are guardians and are responsible for your subject".[7]

Preservation of Wealth

Man benefits from the various environmental elements, such as animals, crops, grains, fruits, and other consumable resources. Those resources represent wealth, and wealth is requested by the Lawgiver to be well preserved and not wasted.

Nevertheless, among the environmental problems facing the world nowadays is the problem of depleting resources, which threatens the lives of future generations. Therefore, observing the value of preservation of wealth as demanded by the Lawgiver makes it an obligation for a person to preserve resources and not deplete them or overuse them.

[5] Al-Bukhari, Sahih, No. (5773).

[6] Ibn Majah, Sunan, No. (224).

[7] Al-Bukhari, Sahih, No. (7138).

3.2.2 Ranks of Maqasid

Maqasid al-Shari'ah are of different ranks: Necessities, Needs, and Desirables. Necessities come first in terms of importance, next is Needs, and then Desirables.

Because of the status of Necessities, the rulings related to them are in the rank of obligations or prohibitions, that is, what a Muslim is obligated to do or avoid. Prayer, for example, is a duty and its omission violates the *maqasid* pertaining to the preservation of the religion. Conversely, alcohol is forbidden, and drinking violates the value of preserving life and intellect, and so on.

In fact, many of the provisions related to the environment belong to either Shariah obligations or Shariah prohibitions, that is, they are among the necessities of the provisions of Shariah, which makes it imperative for a person to abide by them. Man's recent tampering with nature has elevated the need to care for the environment to the necessary level, given the disastrous effects that this absurdity has left. What cannot be ranked as obligatory in terms of caring for the environment remains in the sphere of the recommended acts, which is called *Mandoob* or *Masnoon* according to Fiqh terminology.

Moreover, the challenges facing Islamic countries make planning for sustainable development necessary. This is because sustainable development is a mean to tackle environmental problems and overcome the effects of human misuse of the environment.

3.2.3 Nature of the Shariah Provisions Relating to the Environment

The provisions for preserving the environment are of two types:

The Positive Provisions

These provisions involve the Shariah demands, which include what is obligatory and what is recommended. The obligatory (*wajib*) refers to what the Lawgiver has demanded in a strict way, such that if neglected, one is prone to punishment, but if discharged, one gets rewarded (*thawab*). Whereas the recommended (*mandoob*) refers to what the Lawgiver has demanded but not in a strict way, such that if neglected, the neglector is not prone to punishment, but if discharged, the doer gets a reward (*thawab*).

Those demanded acts include the revival of the environment and its various elements, such as afforestation and expansion of the green belts, agriculture, and plantation, in addition to taking care of forests and oceans, preserving the breeds of different animals and plants, developing the environmental scientific research and their various related experiments. Achieving sustainable development as well as moderation in all human consumptional behavior also falls under this category.

Among the texts concerning the above is the saying of the Prophet (peace be upon him), peace and blessings be upon him: "Indeed Allah is *Tayyib* (good) and he loves *Tayyib* (what is good), and He is *Nazif* (clean) and He loves cleanliness, He is *Karim* (kind) and He loves kindness, He is *Jawad* (generous) and He loves generosity. So clean' your courtyards, and do not resemble the Jews".[8]

The Prophet (peace be upon him) also said: "There is no Muslim who plants a plant or sows a seed and a bird, or a person, or an animal eats from it, but he has charity with it".[9]

In another Sunna report, "If the Final Hour comes while you have a shoot of a plant in your hands and it is possible to plant it before the Hour comes, you should plant it".[10] Indeed, this Hadith stresses the importance of caring for the environment.

Accordingly, preserving the environment in terms of demands starts from making new contribution and caring for what is existent. However, Shariah also cares for the environment by enacting certain prohibitions as discussed in the following.

The Negative Provisions

This type of Shariah provision relates to the demands of the Lawgiver to avoid things. These demands involve the prohibitions (*Haram*) and the disliked (*Makruh*). While *Haram* refers to a demand from the Lawgiver to avoid something in strictly prohibitory words, *Makruh* refers also to the demand to avoid something but not strictly. Avoiding the *Haram* for the sake of Allah is rewarding, and its commission is punishable. On the other hand, avoidance of the *Makruh* for Allah's sake is rewarding too, but its commission carries no punishment.

In Shariah, it is well known that prohibition is more dominant and important than what is demanded to do (the positive provisions) and that the greater the damage, the stronger the prohibition of committing what would cause the damage. Abu Huraira narrates that he heard the Messenger, peace be upon Him saying: "Refrain from what I forbid you, and do what I command you to the best of your ability and capacity".[11]

In fact, the prohibition of both types (*Haram* and *Markuh*) reverts in this regard to harm, and the Lawgiver has forbidden harm: "There must be harm nor retaliation for harm".[12] The prohibited harm also includes harming the environment, because it affects all people and future generations. The Almighty says: "And cause not corruption upon the earth after its reformation" (Quran, 7:56). The Almighty also says regarding the slander of the corrupting man: "And when he goes away, he strives throughout the land to cause corruption therein and destroy crops and animals. And Allah does not like corruption" (Quran, 2:205).

Among the applications of prohibitions in this context is the prohibition of contaminating vital resources in all its forms, such as water, and spoiling them for any reason.

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[8] Al-Tirmidhi, Sunan, No. (2799).

[9] Al-Bukhari, Sahih, No. (2320).

[10] Ahmad Iin Hanbal, Musnad, No (12,902).

[11] Muslim, Sahih, No. (130).

[12] Ibn Majah, Sunan, No. (2340).

One Hadith states: "Guard against the three things which produce cursing: relieving oneself in watering-places, in the middle of the road, and in the shade".[13]

In another Hadith: "You should not pass urine in stagnant water which is not flowing then (you may need to) wash in it".[14] Another application of prohibition in this regard is polluting the vital resources with chemical waste. The Quran says: "Corruption appeared on land and sea with what gained the hands of people" (Quran, 30:41). The examples of this type of provisions include:

- Prohibiting extravagance (overspending and overconsumption), which has led to other environmental problems whose impact is not limited to humans alone but extends to include the rest of the other creatures sharing the planet Earth with us—until some animal species have become extinct and or on the verge of extinction. The Prophet (peace be upon him) said to Sa'ad bin Abi Waqqas, who used to perform ablution (*Wudu'*): "What is this extravagance, Saad? So Saad said: Is there extravagance in ablution?" The Prophet (peace be upon him) replied: "Yes, even if you are beside a flowing river".[15] In another Hadith, the Prophet (peace be upon him) says: "If the morsel falls from one of you, let him pick it up, remove the dirt from it, and eat it, and not leave it to the Devil".[16]
- Not to cut down trees except for a genuine need. According to one report that is attributable to Abu Baker Al-Seddeeq: "Do not cut fruit trees, do not cut palm trees, do not burn them, do not destroy an inhabited building, and do not slaughter a sheep or a cow except for food".[17] Likewise, the Hadith: "Whoever cuts Sidra, God will set his head in the fire".[18]
- The prohibition on killing or torturing an animal and making anything in which the soul is an object, as in the Hadith: "Do not take any living creature as a target".[19] In fact, The *Hisbah* system is used to protect the public facilities as well as the animals. For example, Umar bin Abdul Aziz sent to his appointed governors to warn people not to load camels over six hundred pounds (Abdullah Bin Al-Hakam, 1984). In the same context, the Prophet (peace be upon him) is reported to have demanded Muslim to avoid unnecessary slaughtering of productive animals: "Avoid those that are lactating"[20] (i.e., those from which milk is received).
- Accordingly, preserving the environment from this side requires avoiding everything that harms the environment with its various elements, and at the forefront of that is the issue of climate change, radioactive pollution, and some methods of waste disposal, especially chemical, nuclear and atomic ones.

[13] Ibn Majah, Sunan, No. (328).
[14] Al-Bukhari, Sahih, No. (239).
[15] Al-Nasai', Sunan, No. (425).
[16] Muslim, Sahih, No. (134).
[17] Al-Baiyhaqi, Sunan, No. (18,612).
[18] Abu Dawud, Sunan, No. (467).
[19] Muslim, Sahih, No. (1752).
[20] Ibn Majah, Sunan, No. (3180).

3.3 The Precedent of Shariah in Sustainable Development

In addition to what has been previously stated regarding the Shariah observance of the environment and its keenness not to deplete its wealth but rather to preserve it, which is in the interest of achieving sustainable development, the Islamic law includes a few legislations that indicate that it considers the issue of sustainable development and seeks to achieve it.

3.3.1 Waqf (Endowment) System:

The endowment system is based on withholding the ownership of the endowed asset in favor of a party, so it is neither sold nor inherited, but the proceeds of that asset are disposed or donated. An example of waqf is when a person endows a land planted with fruits for the orphans so that its fruits are distributed among them, and no one has the right to sell this land. Another example is when a person builds a building, like a hospital for treating people such that it cannot be sold; or that a person digs a well and endows its water for passers-by (Kahf, 1998).

Throughout the ages, Islamic countries are known for many endowments that still exist to this day, including schools, universities, hospitals, care homes for orphans and the elderly, mosques, gardens, wells, bathrooms, and rest houses. It also includes places to care for stray or elderly animals (Al-Khassaf, 1904).

Waqf also works for the decedents of the endower, so that they benefit from its proceeds and have no right to sell it. Accordingly, the endowment is of two types: charitable (*khairi*) and familial (*Thurri*), and both of them contribute to achieving development and improving people's living conditions in a sustainable and uninterrupted manner.

3.3.2 Ihya' Al-Mawat (Land Revival and Reclamation)

Ihya' al-mawat literarily means bringing life to a dead land. Technically, it refers to reclamation of lands that were not previously built on or planted, so that they become suitable for construction or agriculture, and so on.

According to Shariah rules, the one who revives a dead land may own it. In fact, Islam encourages people to utilize and benefit from the unused lands so that they achieve prosperity and increase their wealth and power. Hence, Muslims should revive their dead land, i.e., reform their lands and make use of them. The Prophet (peace be upon him) is reported to have said: "Whoever revives a dead land, it belongs

to him".[21] He also said: "Whoever revives a dead land has a reward for it and for the animals eating from it".[22]

The implication of this legislation is that communal lands that are not owned by individuals become the property of those who invest in them for productive purposes such as agriculture and other businesses that contribute to the achievement of production and benefit for the public.

Revival of lands has its own detailed jurisprudential rulings, the most important of which is that the investor's ownership of the land is linked to his productive work in it. Consequently, there is no ownership before work, and there is no permanence for this property if the productive work stops, but ownership of the land reverts to the one who transforms it into a productive one again.

Therefore, granting lands by the State is meant to achieve a public interest. If this is not achieved by not reviving the land, then the land should be recovered. Amr bin Shuaib narrates from his father that the Messenger of God (peace be upon him) granted some people from *Mazina* or *Juhaynah* a piece of land, but they did not revive it and some other people did. Then, *Juhanis* or the *Muznites* complained to Umar ibn Al-Khattab and Umar replied: If it was from me or from Abu Bakr, I would have recovered it, but it was from the Messenger of God (peace be upon him). Then he said: "Whoever has a land (assigned to him as fief) but does not revive in three years, but others do, then it belongs to those who revive it" (Abu Yusuf, 2010).

In fact, this legislation encourages people to work in a productive and sustainable manner, because the land reviver knows that his right over it depends on the sustainability of production. If his production stops, he will lose his investment right over the land to the one who utilizes it. This ruling will achieve the survival and sustainability of production.

3.3.3 Validation of Productive Contracts, Such as Mugharasa (Planting Trees), Muzara'ah (Sharecropping), and Musaqat (Irrigation of Planted Trees).

The provisions of Shariah also include the validation of contracts that are of sustainable productive nature. For example, *Mugharasa* refers to an agreement where a landowner gives his land to someone to plant it with a known number of trees that produce fruit or wood. When the trees start producing, the planter will have an agreed-upon portion of the land. Such a contract transforms idle lands that the owner cannot physically or financially cultivate into lands with extended production and public benefit.

Musaqat, on the other hand, refers to putting already planted trees at the disposal of someone (the farmer) to water them and do whatever is necessary for them to produce fruit against a known common share of these fruits. Thus, it is a contract

[21] Abu Dawud, Al-Tirmidhi and Al-Nasai'. See: Ibn Hajar, Talkhees Al-Habeer 3/63.

[22] Ahmad, Al-Musnad (No. 13859); Ibn Hebban, Sahih (No. 5205).

between the owner of trees and the farmer to irrigate the trees and take care of them, so that they share the fruits between them in agreed proportions.[23] Thus, *Musaqat* helps produce fruit so that tree and lands continue their production.

Likewise, *Muzara'ah* increases production by turning idle lands into productive ones, for it is a contract between a landowner and a farmer who ploughs the land, fixes its soil and cultivates it, so that they divide the resulting crop according to a ratio they agreed upon (Al-Zuhaili, 1988).

3.3.4 Tolerating Uncertainty (Gharar) in Productive Contracts

It is notable that Islamic law has tolerated uncertainty (*gharar*) in some of the productive natures, such as *Salam*. This contract, in fact, is one of the most important productive contracts. Typically, *Salam* is applied to the sale of agricultural crops, as a farmer needs to spend on his land in order to be able to produce, by ploughing it and then fertilizing and irrigating it to finally cultivate it. In order to be able to do so, he sells the crop he is planning to grow in advance to a merchant who pays the price upfront. That is, the farmer benefits from the price received in spending on the land until it produces. After the harvest, the crop is delivered to the trader. The uncertainty in this contract is that the object of sale is not present at the time of the contract, or that it is not under the ownership of the seller. If its genus is present in the markets, and this is disallowed in principle as the seller, in general, has to sell only existing assets and assets that he personally owns. Nevertheless, Shariah had tolerated this *gharar* when it permitted the contract of *Salam* as in the Hadith: "Whoever pays in advance, then let him pay in advance for known measurements (of fruit) and known weights for a specified period of time".[24]

Hence, this tolerance toward *Salam* shows the expediency and importance of this contract, as it benefits both parties to the contract and brings public benefit to the society at large, because it facilitates production. Have it not for the farmer to sell the crop in advance, he would not be able to invest his land in achieving production.

3.4 Maqasid Maxims Relating to the Preservation of the Environment

The following can be considered *Maqasid* maxims as the literature of *Maqasid* comes in line with environmental preservation and advocates it. The *Maqasid* maxims

[23] Musaqat in Arabic language implies interaction between two parties, and it is derived from the word (*saqa*) which means to irrigate.

[24] Al-Bukhari, Sahih, No. (2239); Muslim, Sahih, No. (1604).

accommodate all the requirements for preserving and caring for the environment as well as the principle of achieving and seeking sustainable development.

Ordaining Laws by the Lawgiver is Meant to Achieve the Best Interests of People in this Life and the Hereafter (Al-Shatibi, n.d.**)**

The link between this maxim and the subject of the study is that the Shariah provisions have taken into account the interests of the people, so everything that genuinely achieves these interests is acceptable and validly attributable to the Shariah. This naturally includes the issue of caring for the environment and achieving sustainable development.

The Greater the Overall Interest, the Greater the Keenness of the Lawgiver to Adopt it and Ordain it

This maxim indicates that the extent of Shariah's keenness to take care of, or request, something depends on the importance and utility of that thing. Therefore, if caring for the environment is one of the pressing needs of our time, then the rank of this need is among the highest in the Shariah.

In fact, we can invest this maxim in the positive aspect of protecting the environment, such that what is *Mandoob* (recommended) can take precedence over what is obligatory if more beneficial. The *Usulis* (scholars of *Usul al-Fiqh*) proclaim that and justify it on the ground that the Shariah's ultimate objective is to achieve the best interest of human beings. On the other hand, what is permitted by part, such as fishing, for example, becomes forbidden if it is at the expense of the public interest. Here comes the issue of restricting permissibility and the extent to which the state interferes with its regulation, so if fishing, for example, harms the environment or disturbs the ecological balance, it can be restricted.[25]

The Greater the Harm, the More Severe the Prohibition

This maxim indicates that the degree of prohibition is related to the size of the harm that results from the prohibited act, so the greater the harm, the more severe the ruling. Accordingly, if the damage to the environment, such as the damage resulting from burying nuclear waste, is dangerous for people or future generations, then the actions leading to harm it amounts to the highest degree of prohibition.

Warding Off Evil Takes Precedence Over Bringing Interests

This rule indicates that the interests gained from doing something are not justified if there are equal evils resulting from it. Therefore, if excessive use of natural resources, for example, brings some good to people but brings equal harms, then it is prohibited. This also includes building laboratories that pollute the environment or produce emissions that significantly damage the environment. Even though these plants achieve benefit in terms of productivity, their significant harm cancels out their good and places them in the sphere of prohibition. This is when the benefits and harms are equal; but if the disadvantages prevail, then of course the Shariah would

[25] Murad Naoom, Legal Protection of the Enviroment, p. 403–404.

categorically reject the whole thing all together. The Holy Quran confirms this when saying: {They ask you about wine and gambling. Say: "In them is great sin and [yet, some] benefit for people. But their sin is greater than their benefit".} [Quran: 2/219]. This verse, if fact, defines the criterion for the right Shariah provision when harm and benefit meet in one thing; if the harm exceeds the benefit, it is necessary to consider the harm rather than the benefit, and that is why wine is forbidden despite the benefit it contains.

The Public Interest Takes Precedence Over the Private Interest

This rule indicates that the balance between the private interest and the public interest must be taken into consideration in the matter of realizing interests. If some of the environmental activities carried out by individuals achieve self-benefit for them, but they are incompatible with the overall good, then the consideration of the public good becomes the predominant one. Accordingly, the self-benefit that individuals gain at the expense of the public good, or even the self-benefit that a country reaps at the expense of other planet's inhabitants, shall be all rejected and prohibited by Islamic law.

Among the applications of this maxim are prohibiting the depletion of natural resources for the benefit of individuals if it is at the expense of the interest of society and prohibiting the environmental pollution that a country may do at the expense of the safety of the planet and the people living on it.

Implications of Acts are to be Considered

This maxim is an application of the *Usuli* principle *Sad al-Dharai'* (blocking the means to evil). It means that the outcomes of actions should be taken into consideration when judging things, and not to be concerned only with the formal validity of the action. If the outcome is evil or bad, then the act itself becomes unlawful.

In the context of caring for the environment, acts that seem to be acceptable from the point of Shariah on the ground of their apparent validity, such as building factories, chopping trees for wood and fishing, may be considered unlawful in view of their implications. If those acts may harm the environment, then despite being lawful in essence, they shall be ruled as unlawful in view of their implications (Al-Najjar, 2002).

3.5 Conclusion

It has become clear from the previous discussion that the principles and rules of Shariah not only accommodate all the requirements of caring for the environment and achieving sustainable development. Rather, these environmental considerations are surrounded by a set of regulatory provisions that guarantee implementation and do not leave the individual or society a choice between adopting and not adopting them. Those provisions vary between obligation, recommendation, and prohibition (including the acts that are abhorred but not to the degree of prohibition). Many of the

provisions related to the environment oscillate between obligation and prohibition, which does not leave people an option to neglect a positive act that remedies or preserves the environment, or to do and act that might harm it.

The Shariah also has its own means to ensure abidance by its rules. The state, for example, is basically responsible for the people's compliance with the Shariah laws so long as it is possible for the state to monitor such compliance. On the other hand, the state has the right to impose penalties and punishments upon its subjects in the event of contravention by abandoning duty or doing something forbidden.

On top of that, the Shariah, being part of the religion of Islam, has additional means to make people comply with its provisions. That is, the principle of the eschatological reward and punishment comes to fill the gap in the humanly imposed penalty system. Thus, if a person is able to evade the worldly penalty, then he knows by virtue of his belief that there is no escape for him from the punishment of the afterlife, if he does not remedy himself by repentance and ceasing to violate the Shariah. He also knows that by abiding by the ruling, he will obtain the pleasure of his Lord and be rewarded for that.

There is no doubt that this eschatological support may be more effective in achieving commitment than the worldly one, especially when the enforcement of the worldly laws is hindered by the corruption of those who are supposed to guard and enforce the laws, or the possible conflict between their own interests and the very enforcement of the laws.

Thus, the provisions of Shariah, along with their eschatological and worldly supportive provisions drive the individual, society, and states to achieve environmental balance and development in a way that achieves benefit and good for all, and curb harm and corruption for everyone.

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Part II
Convergence of Islamic Finance and Circular Economy

Chapter 4
Circular Economy Financing: An Islamic Finance Perspective

Nafis Alam

Abstract Achieving the goal of a circular economy depends on the creation of an economy where the "end-of-life" concept is replaced by the option of getting rid of waste through the superior design of materials, products, systems, and business models. To achieve the full benefits of a circular economy, the model is reliant upon co-operation within sectors and supply chains, and across countries. But there is over-reliance upon the backing of financing and investors who recognize the risks of the linear system and can spot new opportunities. To maintain the spirit of the circular economy, providing an effective and sustainable source of finance is key for the financial needs of circular economy industrialization. This chapter will shed light on the perspective of Islamic Finance in financing the circular economy concept, especially the "green financing".

4.1 Introduction

Achieving the goal of a circular economy depends on the creation of an economy where the "end-of-life" concept is replaced by the option of getting rid of waste through the superior design of materials, products, systems, and business models. Circular Economy (CE) is a term that first appeared in the last decade of the twentieth century (Pearce & Turner, 1990), as an alternative to the traditional economic model and it is based on the basic principles of the laws of thermodynamics. However, the term remained obscure until it was first implemented by the Chinese Government in the wake of the twenty-first century, through an initiative called the "Circular Economy Promotion Law of the People's Republic of China" (Lieder & Rashid, 2016).

Instinctively, recycling is increasingly being just common sense and advancements in materials and focus on environmental sustainability are making the process easier

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for complex products as well. But the solutions of the circular economy are not immediate and the shift toward it remains marginal. To achieve the full benefits of a circular economy, the model is reliant upon co-operation within sectors and supply chains, and across countries. But there is over-reliance upon the backing of financing and investors who recognize the risks of the linear system and can spot new opportunities. To maintain the spirit of the circular economy, providing an effective and sustainable source of finance is key for the financial needs of circular economy industrialization. In this perspective, governments globally have been launching their Green Finance Strategy to increase investment in sustainable projects and infrastructure.

To understand the role of financing and more specifically green financing, we first need to understand the concept of circular economy and its position in the new world. The concept of the circular economy is inspired by nature and its living systems. In nature waste does not exist, there is no landfill as materials flow constantly in circles. As humans, however, we have adopted a linear approach of production and consumption where we take, make, and dispose of materials. Circular economy is all about keeping resources as long as possible in the production and consumption cycle, and thus reducing waste and enabling better utilization of resources for less negative environmental impact. CE aims to provide an alternative approach to the traditional (linear) economy model that is based on the concept of take-make-use-dispose (Morlet et al., 2016).

A circular economy can be treated as a restorative and regenerative economic model intending to decouple economic growth from resource consumption. The transition to a circular economy requires a radical change in the way we produce and consume. In a circular economy, products are designed for durability, upgradeability, reparability, and reusability, to reuse the materials from which they are made after they reach the end of their life. In the use phase, products are managed to maximize their utilization capacity and extend their useful life, thus maintaining their value for as long as possible.

More and more companies across industries are adopting circular principles to reduce costs, increase revenues, and manage risks. Circular solutions accounted for 13% of Philips' revenues in 2019,[1] while Caterpillar offers more than 7,600 remanufactured products.[2] The circular economy has started transforming entire industries: in fashion, clothing resale is expected to be bigger than fast fashion by 2029; and in plastics and consumer packaged goods, profit pools along the value chain are being transformed by increasing regulation, public pressure, and innovation.

Governments across the globe are the key player in accelerating the scope of the circular economy framework by encouraging competitiveness, developing more resilient supply chains, and delivering on societal and environmental objectives. For example, circular economy is a key pillar of the European Green Deal and circular economy roadmaps and legislation in place in countries including China, Chile, and

[1] See Philip. (2019). Annual Report 2019. Retrieved 30 March 2021, from: https://www.results.philips.com/publications/ar19/downloads/pdf/en/PhilipsFullAnnualReport2019-English.pdf.

[2] Caterpillar. (2021). Cat Reman. Retrieved 30 March 2021, from: https://www.caterpillar.com/en/brands/cat-reman.html.

France. While megatrends such as shifting demographics, digitalization, and resource scarcity are also reinforcing the transition to a circular economy.

To achieve the goals of a circular economy, finance is going to be one of the key enablers especially "green financing". Green finance involves engaging traditional capital markets in creating and distributing a range of financial products and services that deliver both investable returns and environmentally positive outcomes. This involves internalizing environmental externalities and adjusting risk perceptions to boost environmentally-friendly investments and reduce environmentally harmful ones. Promoting green finance on a large and economically viable scale helps ensure that green investments are prioritized over business-as-usual investments that perpetuate unsustainable growth patterns.

4.2 Financing Circular Economy

Building effective circular economy infrastructure at a large scale is an unprecedented challenge, which will require large-scale financing from both public and private sectors. Green Financing can be used as a strategic approach to overcome existing shortcomings with financing and risk mitigation and will allow the financial sector to make a major contribution to the transformation of the circular economy and the context of sustainability.

All aspects of finance will play an important role in bringing forward the transition to a circular economy. Investors, banks, and other financial service firms using their scale, reach, and expertise can stimulate and support businesses to make the shift. This is not just about investing in perfectly circular companies or divesting from extractive ones, but about engaging with and encouraging companies in every industry to make the transition (Ellen MacArthur Foundation, 2020).

The main source of capital toward the circular economy can be divided into three major categories: public capital, private capital, and hybrid funds.

The existing financial products offered by public and private financiers can already open up a world of opportunities for entrepreneurs who would like to develop a circular business. While large businesses are often capable of financing the circular transition internally through retained earnings, young and fast-growing firms are often dependent on external financing for growth. Circular businesses or projects are considered more complex, thus resulting in higher risks compared with standard investment deals. This implies that investors would demand a higher premium on the capital they provide, a premium proportionate to the risk profile of the company or the project. To generate financing opportunities for the circular business, lenders and investors are expected to get used to the circular rationale as well. Only a few financial institutions especially banks are looking at it in a more structured way. ABN Amro, ING, and Rabobank have created circular economy guidelines that they hope others will use and which define terminology and the role that finance can play in supporting a transition toward the circular economy.

Goldman Sachs has made the circular economy one of the key pillars in its USD 750 billion sustainable finance target, while Morgan Stanley has made a Plastic Waste Resolution to prevent, reduce, and remove 50 million tons of plastic waste from entering the environment by 2030, through providing structured products, financing, and advisory for plastics innovation, among other initiatives.

To increase the availability of green financing for circular business, governments can support innovation on the supply side by increasing their direct budget allocations, which can provide flexibility for funding priority circular economy programs and mainstreaming green innovation with current development programs. Green business incubators and other similar venture support programs (including early-stage venture funding support) via government or multilateral agency interventions can also play a vital role in helping smaller firms scale up the objectives of a circular economy. The UK is taking a lead in such initiative by launching its Green Finance Strategy to increase investment in sustainable projects and infrastructure. The strategy is part of the UK's goal to meet its recently announced target of reaching net-zero carbon emissions by 2050.[3]

Following the strategy announcement, HSBC UK Commercial Bank has announced it is supporting British companies to meet their environmental and sustainability goals with the launch of a new green finance proposition. The new range—available for small to medium enterprises (SME) through to large corporates—includes a Green Loan, a UK industry first Green Revolving Credit Facility (RCF) and a Green Hire Purchase, Lease, and Asset loan.

In the capital market sphere, bonds also represent a large share of global financial flows with around US$100 trillion outstanding globally. The majority of these (around 75%) are issued in developed countries—mainly the United States (40%).[4] Green bonds offer an opportunity to provide much-needed finance to support circular businesses. Green bond proceeds can go specifically to low carbon climate-resilient projects as well as can be used to finance utility-scale renewables, energy-efficient buildings, and large-scale transport infrastructure.

The opportunities are abundant to support the cause of circular businesses, but many funding bodies and investors are not familiar with the circular economy, and in particular, with the correct assessment of risks (linear and circular) and opportunities, which hampers the bankability of the circular economy projects and businesses. It is essential that more knowledge is developed (assessment guidelines and methods, associated indicators/metrics, etc.) and disseminated, and more training is provided to understand the concept of Circular Economy.

The core of the problem lies in the techno-economic appraisal, the assessment of the financial impacts of circular economy projects, and the availability of associated key indicators. Among other things, this will allow stakeholders to better manage and assess circular projects and business plans, and as such increase their financing

[3] Government launches Green Finance Strategy. (2019). Retrieved 21 March 2021, from https://www.circularonline.co.uk/insight/government-launches-green-finance-strategy/

[4] OECD, *Mobilising Bond Markets for a Low-Carbon Transition*, Green Finance and Investment, 2017.

prospects (bankability). Further adding to the issue is a lack of clarity on the financial/industrial scope of "circular economy" projects and insufficiently developed risk assessment methodologies for circular projects and businesses. Funders are also unaware that how can a linear investment be made circular, by, for instance, changing an existing company's supply chain and production process to eliminate negative impacts on the environment and reach zero waste or by changing the eligibilities/requirements of new/existing financial instruments (Table 4.1).

In this context, Huifang (2018) has provided some relevant financing policy tools and acting mechanisms for promoting the circular economy:

4.3 Islamic Finance and Circular Economy

As the world economy is gradually moving toward adopting a circular business model and more sustainable development initiative, the Islamic finance industry has tremendous opportunities to develop Shariah-compliant financing facilities to meet the expanding liquidity requirements in this sector. Islamic finance has substantial synergies with the sustainable circular business concept and fits in well with the objectives of a circular economy.

One important accelerator in Islamic finance to drive a circular economy can be leveraged on the green Sukuk, which can act as a catalyst for the circular business financing needs. A green Sukuk is a Sukuk that complies with the green principles with which a green bond complies with (Alam et al., 2016). As the green principles are independent of the underlying financing structure, a green Sukuk is similar to a non-green Sukuk, with the addition of the Green Framework that dictates the usage of the issuance proceeds. A Second Opinion report or Green Certification by an independent reviewer, and a post-issuance Impact Report that covers how the funds raised have been used and the environmental impact that has been achieved. More recently, the impact is looking into reducing production waste and facilitates recycling and supporting an effective transition from linear to a circular economy.

Global green bond issuance reached USD 271 billion in 2019, from USD 182 billion in 2018[5] while green Sukuk issuances accounted for USD3.5 billion in 2019. The 2019 global green bond volume was primarily driven by the European market, which accounted for 45% of global issuance.[6] This was followed by the Asia-Pacific and North American markets, at 25% and 23%, respectively. Out of 1788 green bonds issued, 250 (14%) were from new issuers, totaling USD67.8bn (26% of the total green bond issuance). As of July 31, 2020, there have been USD 6.1 billion issuances of green Sukuk globally.

[5] Sustainable Debt Sees Record Issuance at $465Bn in 2019, Up 78% from 2018, BloombergNEF: https://about.bnef.com/blog/sustainable-debt-sees-record-issuance-at-465bn-in-2019-up-78-from-2018/

[6] See Green Bond Market Summary (2019). Climate Bonds Initiative: Retrieved 30 March 2021, from https://www.climatebonds.net/system/tdf/reports/2019_annual_highlights-final.pdf?file=1&type=node&id=46731&force=0.

Table 4.1 Financing policy tools

Financing Policy Tools		Main Benefits and Acting Mechanisms
Green Bank System	Discounted Green Loans	Reduce the costs of funding for green projects
	Lender Liability	Strengthen the social responsibilities of investors; impede the availability of funds for polluting projects by increasing their financing costs
	Green Banks	Increase the return on green investment and reduce the investment risk and cost of private capital for green projects by leveraging the economies of scale and specialized services and operations
Green Capital Market	Green IPO	Facilitate efforts by green companies to raise funds; indirectly reduce financing costs
	Green Bonds	Reduce the cost of funding for green projects
	Green Funds	Build up the economies of scale and specialized green services and operations; reduce the cost of green investment
	Green Equity Indices	Indirectly reduce the investment costs of green projects by channeling more funds into green industries
	Green Insurance	Expose environmental risks through insurance policies, which indirectly increases the costs of polluting projects and discourages investment in such projects
Green Capacity Building	Carbon Markets	Drive down the cost of emission reductions through market mechanisms
	Green Ratings	Reveal environmental risks; reduce the investments in polluting projects by increasing their costs; reduce the financing costs of green projects and foster more of these projects by showing their positive externalities
	Environmental Cost Database	Increase the accessibility of environmental information and reduce the cost of environmental impact studies

(continued)

Table 4.1 (continued)

Financing Policy Tools		Main Benefits and Acting Mechanisms
	Green Investor Network	Increase investor companies' preference for green projects through pressure from institutional investors; increase investors' preference for green projects through online educational programs
	Compulsory Disclosure	Encourage (discourage) companies to invest in green (polluting) projects by emphasizing greater corporate social responsibilities

Source Adapted from Huifang (2018)

Green Sukuk lies at the intersection of three investment trends: Islamic mutual funds, socially responsible investments (SRI), and Sukuk. Proceeds from green Sukuk can be used to finance construction or the payment of a government-granted green subsidy. The structure of green Sukuk involves securitizing future income cash flows from ring-fenced projects or assets with specific criteria.

Green Sukuk has several advantages over other private funding sources. First, they represent a tradable capital market instrument, which has the potential to allow for transferability and ease of exit. Second, green Sukuk can be based on a pool of portfolio projects, which generally entails risk diversification, resulting in a low required return threshold. This could be a way to address the current economic feasibility challenges in circular business positioning. Green Sukuk proceeds can be used to finance projects which are (a) contributing substantially at least one of the global environmental objectives namely (i) climate change mitigation, (ii) climate change adaptation, (iii) sustainable use and protection of water and marine resources, (iv) transition to a circular economy, waste prevention and recycling; (v) pollution prevention and control, and (vi) protection of healthy ecosystems.

Green Sukuk represents an untapped financing means for circular business initiatives in major Islamic finance countries such as MENA and SEA countries, which are at the forefront of Islamic finance. As green Sukuk signifies a good mix between the positive features of green bonds (with their ethical environment-friendly orientation) and the attractive features of Islamic finance (with its asset-backed attributes), they ought to have a growing demand in the near future. Green Sukuk is a great enabler to fund circular business-friendly projects, in particular in the field of renewable energy generation and waste recycling.

With the growing need to finance enormous circular business projects and do so with low-cost alternatives to traditional bank financing, Islamic financing such as green Sukuk can provide a very plausible investment solution. Moreover, as Sukuk is the preferred choice of investment among Islamic financing options, green Sukuk can be used as a preferred investment vehicle to finance the circular business's ambitious projects.

4.4 Way Forward

The issue of the unfavorable risk/revenues profile of circular economy projects dominate the financing need of the projects. In a circular economy paradigm, approach that preserves the economic value of materials and products faces the problem of revenue generation and uncertainties, resulting in a high financial risk which can be overcome by innovative financing instruments such as green Sukuk. Funding bodies such as banks and investors are aware that circular economy projects are not necessarily inherently riskier than linear projects, especially from the long-term perspective. But it is rather that the regulatory system, markets, and financial risk assessment are distorted and biased in favor of the financing of linear projects thus making it difficult for them to finance circular economy projects.

The circular economy financing market is slowly picking up with the support of both public and private sectors. Yet while the recent growth in financing is promising, far more capital and activity will be needed to scale the circular economy and fully seize the opportunity it presents. It is also important to make sure that the features and implications of circular economy are rightly incorporated in financial and accounting standards. The adaptation of accounting standards would enable a more representative valuation of circular business models and risks attached to it.

To further boost the popularity of circular economy among private sector, there need to be more open approaches to make it accounting and financial implications of circular economy participation. Potential adjustments can include adapting approaches to depreciation and residual value calculation for assets with multiple use cycles and ensuring tax treatment reflects the characteristics of circular business models. Mechanisms enabling effective pricing of positive and negative externalities, and a broader focus on nonfinancial capital in accounting standards and reporting, would further help reflect the true value of circular companies and the risks of extractive practices.

It should be a wholehearted effort from financiers, regulators, policymakers and to push for the long-term value creation and longevity of circular business projects, which will help the circular economy to become the main priority among the sustainability domains. All global stakeholders need to understand that the development of the circular economy is not only beneficial to the effective protection of the ecology and the sustainable exploitation of the resource but also to the long-term survival of the world and humanity.

To overcome the financing challenges of circular businesses, there should be a collaborative effort among central authorities, local governments, financial institutions, and enterprises toward the establishment of a sustainable financing mechanism. Enterprises toward the establishment of a sustainable financing mechanism can be overcome by financing raised via green Sukuk. To provide the needful financing for circular businesses, governments have a key role to play in strengthening domestic policy frameworks, better aligning and reforming policies across the regulatory spectrum to overcome barriers to circular economy investment and providing an enabling

environment such as green financing and green Sukuk options that can attract both domestic and international investments.

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Chapter 5
Circular Economy, Green Economy, and Sustainable Development: Establishing the Interconnections and Discoursing the Role of Islamic Finance

Abdul Rashid and M. Abubakar Siddique

Abstract Despite the large amount of hits on the concepts of Circular Economy (CE), Green Economy (GE), and Sustainable Development (SD), there is a dearth of coherent understanding of the interconnections between these concepts. Therefore, the aim of this chapter is to sketch out a broad and holistic framework to establish the interconnections between CE, GE, and SD. The second objective of the chapter is to link the principles, responsibilities, objectives, and business models of Islamic finance with social, economic, and environmental sustainability. The chapter suggests that both CE and GE are rooted in the ideas of eco-efficiency, resource efficiency, renewable energies, low carbon emissions, and improvement of nature capitals. On the other hand, both CE and SD mainly focus on intra and interrogational commitments, integration of non-economic aspects into development in order to achieve sustainable production and conception patterns. It has emerged that the conceptualization, implementations, and evolution of CE, GE, and SD highly assimilate the ingredients of resource efficiency and decoupling, sustained and inclusive economic growth, preservation of environment, and promotion of sustainable consumption and production patterns. The Shariah-compliant business models and products of Islamic finance provide an edge to Islamic banks over their conventional counterparts to provide financing at all stages to promote the CE, GE, and SD activities. Finally, the chapter proposes a business model based on *Musharkah* cum Ijarah for enhancing the transformation of linear economy toward CE.

5.1 Introduction

Although there are evidently different assumptions, operationalization strategies, theoretical approaches, and conceptual discussions, the concepts of sustainable development, green economy, and circular economy are considered a common avenue to conciliate economic environmental and social goals. All three concepts are currently

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being mainstreamed most vigorously at both the national and global levels among both scholars and policymakers as key development and sustainability avenues. The three concepts are trending among academia, researchers, practitioners, and policymakers. This is evident by the rapid growth of peer-reviewed studies on these concepts and the increasing number of journals covering these topics within the last two decades. The awareness of the opportunities and potential benefits associated with the circular economy is significantly increasing among companies and in fact, they have started to harvest advantages of the CE systems for themselves and their stakeholders. In recent years, these concepts have gained increased attention from academic scholars, international development practitioners, multinational firms, policymakers in developed countries, and some emerging economies such as China. Further, the governments of several other low- and middle-income countries have also started to implement the CE and GE systems for attaining sustainability at local, national, and international levels.

These concepts are of great interest to the academician and practitioners because they are viewed as operationalization for businesses to implement the concept of sustainability. The sustainability concept has been considered too vague to be implementable and thus, it has started to lose its momentum. This is partly due to heterogeneous interpretations and applications of sustainability. This is also partly because a wide variety of sustainability concepts and a large number of different practical strategies of its implementations and a range of suitable indicators to gauge its performance are proposed in investigations, policymaking, and private governance. Both the green economy and green growth concepts should be considered essential to operationalize sustainable development for businesses.

Undoubtedly, the sustainability concept has emerged as one of the most pressing challenges of our age. The concept has been mainstreamed in the global research and political agenda for the last couple of decades. However, it is extremely challenging in policymaking to the simultaneous achievement of economic, social, and ecological goals. For achieving local, national, and global corporate sustainability and social-ecological objectives, there is a need for greater identification and understanding of contemporaneous requirements in a holistic and inclusive manner. Linking visions and targets of policymakers, practitioners, and businesses to fundamental sustainability goals and issues is vital for attaining long-term social–ecological sustainability at different levels.

The main motivation behind our choice of these three concepts is the fact that they all are, highly considered to adapt to or currently transform the current linear economic system (take–make–waste) toward a more resilient and sustainable one. Some authors have emphasized the interconnected role of CE and GE in achieving sustainability (Loiseau et al., 2016). Some other investigations, such as Szekacs (2017) and D'Amato et al. (2017), have also pointed out the relationship among these concepts. Similarly, studies such as Kirchherr et al. (2017) have discussed the connections of CE with the goals of sustainable potential development. These studies have also related the social objectives of CE with the concept of sustainable development.

Despite several flexibility and abilities of the CE concept, there are several conceptual, theoretical, and practical issues concerning the importance of CE. For instance, the considerable disparities between theoretical approaches to the CE concept make difficult to define theoretical framework. Widely accepted theoretical framework will definitely provide basis for the development of strategies and the implementation of CE systems.

Knowing how the conceptual paradigms, theoretical frameworks, and practical strategies of CE, GE, and SD are interconnected will help adoption and transformation of the current linear economic system toward a circular economic system, which will not only result in long-term local, national, and global sustainability but enable us to achieve social–ecological goals in an effective manner. Therefore, the first objective of the chapter in hand is to sketch out a broad and holistic framework to establish the interconnections between CE, GE, and SD. To achieve this objective, the chapter first presents the existing views from academic research and the other stakeholders' viewpoints. Next, the chapter attempts to discourse the connections between the concepts, goals, and practical strategies.

Given the fact that Islamic banking business models are more resilient and protect Islamic banks from the negative impacts of economic and financial crises, Islamic banks perform better and contribute more effectively in the stability of financial sector (Rashid et al., 2017). It would be worth knowing the potential role of Islamic finance in promoting to and harvesting the benefits associated with CE, GE, and SD. This objective of the chapter is achieved by linking the principles, responsibilities, objectives, and business models of Islamic finance with social, economic, and environmental sustainability. Further, the chapter highlighted potential dimensions, scopes, and opportunities that Islamic finance has for facilitating the process of the achievements of the CE, GE, and SD objectives and targets.

The remainder of the chapter is organized as follows. Section 2 presents the definition, dimensions, and conceptualization of SD. Section 3 outlines the definitions, characteristics, and different aspects of GE. Section 4 is dedicated to CE. It discusses the origin, definition, and business models of CE. It also presents the flow chart of CE. Section 5 establishes the interconnection among the CE, GE, and SD concepts. Section 6 contains the discussion of the role of Islamic finance in achieving social, economic, and environmental objectives within the framework of CE, GE, and SD. Finally, Section 7 summaries the arguments developed in the chapter.

5.2 Sustainable Development

Even in these days, the world is facing several traditional development issues. Examples of these issues are economic stagnation, willing inequality, persistent poverty, high unemployment, hunger, and illness, etc. Further, the world is also facing several newer challenges such as natural resource depletion, intensification of global warming, rise in new levels, air, water, and soil pollution, biodiversity loss, environmental degradation, and excessive land use (Geissdoerfur et al., 2017).

Further, low productivity, inefficient and deregulated market structures, and disturbances in economic and financial markets currently are among the major and serious concerns of the world.

From the last several decades, governments, businesses, consultancy firms, NGOs, and various other stakeholders, such as the academicians and practitioners are seriously looking for new, cost-effective, permanent, and applicable solutions. The concept of sustainable development, which is also termed as "development which lasts" has considered one of the appropriate and key approaches for providing solutions to these issues.

The sustainable development concept was the first time presented in the chapter of the Brundtland Commission, our common future (Brundtland 1987). According to Brundtland report, sustainable development is defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." In the context of this definition, two fundamental questions arise. First, what exactly should be sustained within the framework of sustainable development? Second, how should it be sustained? The economic literature provides two far-reaching answers to the first question. First, the utility of future generations should be sustained. The sustainability of utility implies that the utility function of future generations has to be non-declining. Said differently, with regard to utility or happiness, the future generations should be as well off as we are now.

Second, according to Daly (2006), in order to get sustainable development, physical throughput should be sustained. This means that the flow of physical material from the sources of nature to the economic system and back from the economy to nature' sinks should be non-decreasing. This form of sustainability implies that the well-off of future generations in terms of having access to biophysical sources supplied by the ecosystem should not be less than the level we have in present.

The social system has objectives to enrich human relationships, enhance individual and group appreciations, and strength norms, values, and institutional setups. World leaders and policymakers have accepted the concept and goals of sustainable development, particularly, after the 1992 Earth Summit in Rio de Janeiro and the adoption of the United Nation's Agenda 21 (UN, 1993). Current production setups of different businesses are concerned with fossil fuels and mineral resources like metals, phosphates, fertilizers, and rare gases, etc. These natural resources are not considered renewable. Therefore, sustainable development is supposed to have an integrated growth concept.

Conceptually, a sustainable development framework is based on two questions. The first question is related to the intergenerational allocation of resources considered for sustainability. In this regard, Solow (1993) recommends that we maintain a generalized capacity to produce economic well-being. The second question is focused on the feasibility of sustainable development. This feasibility is highly associated with the sustainability of natural capital and man-made capital concerned with production.

5.3 Green Economy

Green economy is an emerging concept, and the "London Environmental Economics Centre (LEEC)" introduced this concept first time in 1989 (Pearce et al., 1989). The major attention was given to this concept after the occurrence of the global financial crisis of 2007–2008. World leaders, policymakers, academicians, business firms, consultants, practitioners, and other stakeholders have started to think and consider the concept of GE as one of the most suited, appropriate, and practical solutions to economic, social, and environmental issues of the current era.

Like the other two concepts: CE and SD, one of the major challenges and barriers in the practical implementation of the GE concept is substantial variations in the conceptualizations of the concept among the scholars, policymakers, and practitioners across the globe. Another major issue concerning the concept of GE is the lack of practical integrated frameworks. The main features of GE include sustainable development, conservation of nature's resources (e.g., water, land, forests), biodiversity, green growth, recycling, eco-efficiency, renewable energies, green technology, territorial resilience, green jobs, and the reduction in product lifecycle. Some of the selected principles of GE are given in Table 5.1.

According to the United National Environment Programme (UNEP, 2011), "[GE] results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities. In its simplest expression, a GE can be thought of as one [of the economic system] which is [yields] low carbon, resource-efficient, and socially inclusive." The concept of GE is fundamentally based on the concepts of resource efficiency and renewable. However, it primarily brings a higher green growth in the economy by providing solutions based on nature. Further,

Table 5.1 Green Economy Principles

Type	Principles
Economics	Identify natural capital and values Economic development and integration of this with growth models Internalization of externalities Promotion of practices concerned with resource and energy-efficient Generation of sophisticated work opportunities and green jobs
Environmental	Safety measures of maintaining biodiversity and ecosystems Invest in and sustain natural capital Identification of and give attention to the planetary boundaries and ecological limits Approaching higher global environmental sustainability goals
Social	Poverty alleviations, well-being, livelihoods, social equity, and access to basic and necessary services Socially inclusive, democratic, participatory, accountable, transparent, and stable Equitable, fair and just-between and within local boundaries and among different generation

Source Drawn from the literature

it enhances the economic and social well-being of the different segments of the society by stimulating the process of restoration, conservations of recourses, and sustainability of nature's assets, mainly through enhancing social inclusions. GE is more a holistic concept, which considers more aspects of social dimensions such as eco-tourism, education, and eco-enterprises mostly at regional levels. As in D'Amato et al. (2017), GE is one of the narratives that particularly related to the idea of social justice and public inclusivity, which are the two fundamental aspects of sustainable development.

5.4 Circular Economy

The term CE was coined by Pearce and Turner (1990) in which they highlighted the interconnection between the environment and economic activities and identified a closed-loop material flow in which the economic system takes place which stands on an assumption of "everything is an input to everything else." Yet, the CE principles trace back to the work of Boulding (1966). In his seminal work, he introduced the concept of a closed system to identify the very limited natural resources accessible for human activities.

The current understanding of the concept of circular economy, its theoretical framework, and practical strategies, and the associated business models has progressed various characteristics and influences from a wide range of ideas that are based on the concept of closed loops. Indeed, according to the existing literature, the definition of CE is not static and accommodates a wide range of principles and applications that have been devised in the last decades. Among several others, some of the most important and appropriate theoretical advancements are "regenerative design," "performance economy," "cradle-to-cradle," and "industrial ecology."

The most useful definition of circular economy is "[CE] an industrial system that is restorative or regenerative by intention and design. It replaces the "end-of-life" concept with restoration, shifts toward the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse, and aims for the elimination of waste through the superior design of materials, products, systems, and, within this, business models" (Ellen MacArthur Foundation, 2013).

The circular economy is based upon the principles of the spiral loop system (European Commission, 2015). The basic motive of CE is to keep utilizing products rather than waste them. Therefore, CE is also functionalized four R-strategies i.e., repair, reuse, recondition, and recycle. The proponents of CE are of the view that in order to optimize the natural resource usage one should keep materials available rather than disposing of them as a result closing the loop of materials within the lifecycle. Further, the growth in an economy with a circular logic cannot be realized with the production of more and more products, rather keep these existing resources available for an extended period, for example, by appropriate maintenance of natural resources instead of their replacement.

Table 5.2 Challenges of Circular Economy

1. Problematic ownership structure
2. Lack of understanding/awareness
3. Underestimation of associated benefits
4. Deregulated markets
5. Poor governance
6. Lack of political will
7. Existing technology and production methods
8. Financial constraints
9. Slow cash flow steams

Source Authors' own construction

As the literature suggests, the CE concept is based on the principle of the "spiral loop system." The philosophy behind the underlying principle is to maintain products in use and not disposing of them, which then involves the use of the famous four R-strategies, which are (i) repair, (ii) reuse, (iii) recondition, and (iv) recycle. A deliberate intention behind these strategies is that the product-producing firm would keep the responsibility for the product and apply these strategies during the operations. As a result, firms should have to consider how their business and methods are altered accordingly.

The literature has identified the huge number of barriers and they are typically connected to each other and undoubtedly demonstrate the complexity of CE and what is required for a transition, which is both multi-dimensional and multi-domain. Some overall challenges associated with the implementation of the CE concept are given in Table 5.2.

5.5 Interconnections between Circular Economy, Green Economy, and Sustainability

To achieve long-term economic, social, and environmental sustainability, it is necessary to understand commonalities and similarities between the concepts of CE, GE, and SD, on one hand, whereas, on the other hand, there is a need to highlight the theoretical, conceptual, and practical distinctions between the three concepts. Knowing the synergies between targets, objectives, and requirements for the practical implementations of CE, GE, SD is critical for world leaders, policymakers, practitioners, social and environmental activists, NGOs, consulting firms, businesses, international agencies and donors, and the academicians to harvest the maximum benefits associated with these concepts. Symmetry and synchronized approach, which is only possible when commonalities between these three concepts are identified, will help local communities, domestic firms, multinational companies, and countries across the globe to the simultaneous achievements of the goals of CE, GE, and SD. Table

Table 5.3 Potential Benefits of CE, GE, and SD

Economic Benefits	Social Benefits	Environmental Benefits
Cost reduction Increased productivity New jobs Higher profits Diffusion of technology Value addition Low inequality Internalizing externalities Less market disturbances Increased financial and economic stability Fast, persistent, and green growth	Inter and intra-generational equity Poverty alleviation Fair taxation Circularity of resources Social inclusivity Social linkages Social justice Socio-efficiency Better working condition Less social vulnerability Narrowing inequalities	Less resource depletion Less biodiversity loss Less water, air, and soil pollution Less land use Less waste and emissions Less use of material and energy input Less environmental degradation

Source Authors' own construction

5.3 presents some common potential economic, social, and environmental benefits associated with all three concepts.

Currently, corporations are focusing on "eco-innovations, eco-efficiency, and corporate social responsibility (CRS)" to achieve corporate sustainability targets (Bocken et al., 2014). However, there is a need to do much more by making the holistic changes in the vision, targets, production methods, and practical strategies to implement the concepts of CE, GE, and SD in a comprehensive manner. The governments, corporate companies, and private firms should be focused on eco- and socio-effectiveness to attain sufficiency and ecological balance in the framework of long-term sustainability. The reconciliation of the interlinkages between these concepts helps in understanding the economic, social, and environmental objectives and goals that are now the main item on the agenda of policymakers and businesses across the globe.

Both CE and SD highly emphasize on the economic and environmental aspects of sustainability. Unlike the conventional linear economic system, which is the model of production and exchange based on the take-make-waste mechanism, CE stands upon the closed-loop system, which is characterized by make, use, reuse, remake, and recycle. These characteristics of CE will result in economic activities and the increased efficiencies by reducing externalities. Further, CE will result in higher sustainability of production and consumption patterns by encouraging all the governments and businesses to focus on eco-innovations, long-lasting design, and refurbishing and recycling of resources. It also stresses on value addition and cost-effectiveness, which, in turn, result in higher profits, by advocating the reduction in the use of virgin materials and energy inputs in the production processes. The third

concept, GE, is also highly integrated with the concept of long-term sustainable production–consumption patterns. It promotes the growth of the economy taking into account the people-plants-profit concept. GE is mainly rooted in the concepts of resource efficiency and renewable (Franceschini & Pansera, 2015). It brings a higher green growth in the economy by providing solutions based on nature. Further, it enhances the economic development of the different segments of the society by stimulating the process of restoration, conservations of recourses, and sustainability of nature's assets, mainly through enhancing social inclusions.

The SD framework emphasizes on maintaining the stock of assets for future generations while optimizing the flow of production, distribution, income, and consumption. From the SD viewpoint, eco-efficiency plays a vital role in achieving the efficient allocation of recourses in production and ensuring optimal and efficient consumption decisions that are necessary conditions for maximization of utility. In this context, SD ensures sustainable production–consumption patterns by focusing on efficiency, stability, and growth aspects of the economy. Thus, in terms of high economic growth and sustainability, both CE and SD supplement each other.

Another important zone in which both CE and SD combat is the preservation of the environment. The idea of SD is highly linked with climate change intensity, system vulnerability, and system resilience. Changes in temperature, levels of sea, rainfall intensity, duration and frequency, and precipitation may adversely affect ecological, biological, and social and cultural systems. The proponents of SD propagate the three possible solutions for reducing environmental changes vulnerability, namely adaptive capacity, mitigative capacity, and resilience. Within the framework of SD, natural resources preservation, less air, water, soil pollution, and less biodiversity are essential for attaining higher and persistent economic growth by taking into account environmental sustainability.

Likewise, the concept of CE is highly aligned with the preservation of the environment. The models of CE are characterized by less use of virgin nature's capital, more dependence on renewable energy, reductions in wastes and emissions, higher durability of products, focusing on recycling, refurbishing, and remanufacturing, and reductions in waste disposal. Circular economic activities help product environment degradation by promoting the concept of eco-effectiveness. Under the framework of CE, eco-effectiveness, natural systemic, and economic systems are coupled into a single economic system, which entirely depends on renewable energy sources and recycling of all the raw materials used in the productions. The concept of CE stresses on new business models, market models, and product designs based on non-waste technology, limited waste, produce less harmful emissions and rely more on renewable energies. Similarly, the CE concept encourages and motivates private and corporate firms to invest in eco-design of the products and to adopt clean production methods, which will result in less greenhouse gasses. Thus, from the environmental point of view, both CE and SD concepts give great attention to environmental preservation while focusing on fast and sustainable growth of the economy, are highly interlinked with each other, and can be considered as complements. Like both SD and CE, GE is more confined to environmental preservations, specifically land and other nature's assets. In the context of environmental protections, GE primarily

emphasizes safety measures for maintaining biodiversity and ecosystems, investing in sustain natural capital, and achieving higher global environmental sustainability goals. Further, it gives an unusual type of attention to the planetary boundaries and ecological limits.

Concerning the well-being of the society, social security and sustainability are considered an integral part of the SD concept. In particular, the SD framework emphasizes strategies and policies for higher sustainable growth by focusing on empowerment, public inclusion, and good governance. It suggests the need for strengthened values and institutions for economic growth. Further, it also highlights the need for a holistic integration between the achievements achieved within the framework of individualism and collectivism. The SD concept triggers improving human prosperity, well-being, and welfare by increasing the consumption of goods and services. The idea of SD is deep-rooted on the concepts of equitable growth, poverty alleviation, and providing equal opportunity to all the segments of the society.

The CE concept is mainly indirectly linked to the social dimensions. The CE concept is originally grounded on holistic changes in industrial systems. Therefore, it does not accommodate sufficiently both social and regional dynamics. It is mainly based on reuse, remake, recycling, eco-innovations, durable product designs, reduce required material, and renewable energy without giving must weight to long-term social sustainability in terms of equal distribution of resources, poverty eradication, and welfare of the society. Business firms are mainly initiated CE because of legislations instead of political and academic movements. Furthermore, the CE concept more directly focused on minimizing the costs of productions, increasing profits, enhancing eco-efficiency, and improving existing production methods. Therefore, the visions, objectives, and actions of corporate businesses are not very tightly linked with the social well-being aspects of the society within the frame of CE. On the other hand, GE is, even more, a holistic concept, which considers more aspects of social dimensions such as eco-tourism, education, and eco-enterprises mostly at regional levels.

Based on the discourse analysis of the interconnection between all the three concepts, the visualization of the integrated aspects of the concepts is presented in Fig. 5.1. Both CE and GE are rooted in the ideas of eco-efficiency, resource efficiency, renewable energies, low carbon emissions, and the improvement of nature capitals. On the other hand, both CE and SD mainly focus on intra and interrogational commitments, integration of non-economic aspects into development in order to achieve sustainable production and conception patterns. Finally, both GE and SD have more common grounds with respect to social well-being and environment preservations. For instance, both of these concepts take into account intra-generational equity, economic, social and environmental resilience while suggesting practical paradigms for attaining sustainability. It has emerged that the conceptualization, implementations, and evolution of CE, GE, and SD highly assimilate the ingredients of resource efficiency and decoupling, sustained and inclusive economic growth, preservation of environment, and promotion of sustainable consumption and production patterns.

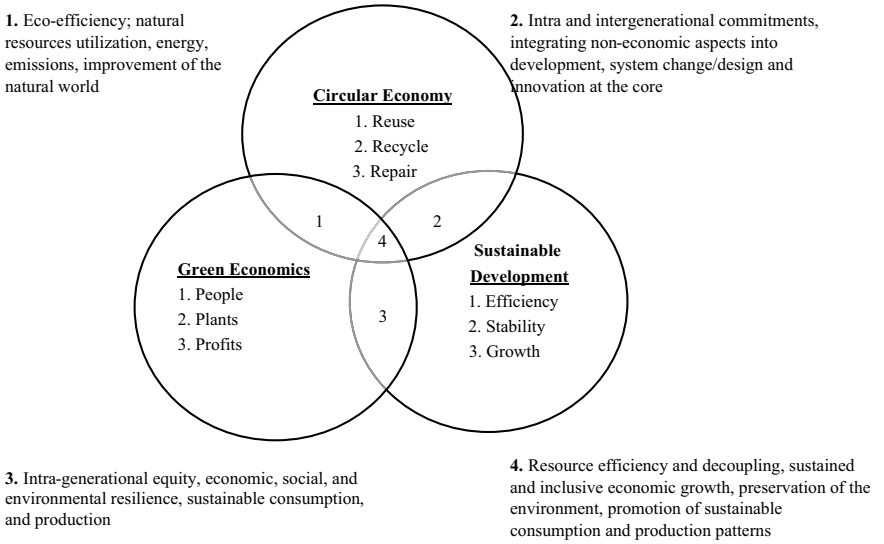

Fig. 5.1 Interconnections between circular economy, sustainable development, and green economy. *Source* Authors' own construction

5.6 The Role of Islamic Finance in Operationalizing Circular Economic, Green Economic, and Sustainability Models

The proponents of Islamic interest-free banking suggest that due to the inherent structural advantages attached to Islamic banking transactions over traditional banking practices, Islamic banking is a viable option to promote economic growth and is better suited to absorb macro-financial shocks. Islamic banking products and contracts are designed based on Shariah principles, which help reduce uncertainty in the financial system.

The 2007–08 global financial collapse (hereafter GFC) and subsequent disturbances in financial markets have increased the importance of financial sector stability for financial development and economic growth. An efficient, sound, and stable financial system is essential for improving financial and economic performance of an economy. No doubt, the stability of the overall financial environment significantly depends on the stability of banks. Indeed, banking sector stability not only affects the economy by enhancing its capability to absorb internal and external financial shocks but also positively contributes to domestic financial system stability and ultimately leads to achieving global financial stability.

Islamic banking due to linkages with the real economy helps reduce the uncertainty in the financial system. Apart from its popularity among Muslims because of the consistency of Islamic banking products with their religious beliefs, Islamic banking

is also adopted by non-Muslims. Undoubtedly, it is currently the fastest-growing banking industry.

5.6.1 Financial Sector Stability and Resilience

The stability of the financial sector is a prerequisite for achieving economic growth. During the current decade, the global financial crisis of 2007–08 has adversely affected the real output of economies and their welfare for a long time that economies could not yet come out of those adverse effects (BIS, 2008). Out of several reasons, a high level of public (Mian and Sufi, 2015), private, and household debt was the main causes of lower economic growth (Arcand et al., 2012).

Islamic banking industry (IBI) is distinguished from conventional banking by the fact that IBI is associated with real assets (Ayub, 2007). Islam has blocked all possible trails of illegal transactions by announcing the prohibition of interest, gambling, and *gharar* (uncertainty) (Khan, 2009) such as speculation, which is equally referred to as *gambling* (Aziz & Gintzburger, 2009). These are the Shariah principles, which connect the Islamic financial sector to the real economy and interdict the debt-based financing. Consequently, they reduce the probability of financial crisis and enhance the surety of the financial system. Therefore, most of the IFIs remained unaffected during the 2007–08 financial crisis (Hasan & Dridi, 2011).

Islamic banks and IFIs contribute to the stability of the financial system through their equity-based financing which lessens the exposure to systemic risks and paves the way toward overall stability (Taleb & Mark, 2009). Equity-based financing gradually expanded and brought non-banking financial institutions under its umbrella like *mudarbah* companies through *Modaraba* Companies and *Modaraba* (Floatation and Control) Ordinance, 1980 (Khan, 1996). Equity-based financing is a vast area with several opportunities, but the association of professionals who truly understand both the financial risk and business risk involved in equity financing is limited (Sadiq & Mushtaq, 2015).

5.6.2 Inclusive Finance

Shariah-compliant microfinancing would be the best form of inclusive finance at both geographical and religious levels. The involvement of higher risks is an impediment to conventional financial organizations from inclusive financing. On the contrary, IFIs can play their role in establishing sustainable opportunities for inclusive finance (Karim et al., 2008). Researchers have submitted that effective inclusive finance is subject to the microfinance facility at different levels, for maximum outreach. Available market data already establishes that IFIs are a better vehicle for inclusive finance as compared to its conventional counterpart (Ahmed, 2009).

To raise their funds, Islamic microfinance institutions (IMFIs) by regulatory restrictions cannot accept deposits. This would narrow down their operational scales. Zakah, Waqf, and other charitable funds are a potential source of funding for IMFIs to finance their operations. IMFIs can rapidly achieve the objective of outreach and sustainability if Zakah, Waqf, and other charitable sources are integrated with them.

5.6.3 Reducing Vulnerability of the Poor and Mitigating Risk

On the contrary to conventional finance, Islamic finance possesses a unique quality of having risk-sharing rather than only risk transferring. Moreover, the concept of takaful, a risk-mitigating tool, increases the level of investor's satisfaction. They provide micro-takaful to the poor segment of the society. Another approach of strengthening the poor is Zakah and Waqf, which would be very influential sources for IMFIs in reducing the weakness and upgrading the adaptability of the poor. In classical times of Islam, Zakah and Waqf remained effective and efficient institutions in taking care of the poor segment of the Muslim world. Researchers also suggested the interest-free credit approach, which is also named as *Qard Hassan* approach to the weak part of the society. Its practical implementation in the agriculture sector, named *Diwan al-Zakah*, remained successful in Sudan. Scholars also suggested that the problem of the miserability of the poor could be addressed through another persuasive approach, which is the utilization of Zakah and Waqf assets to pay their monthly takaful premium to secure them against some characterized risks (Sadiq & Mushtaq, 2015).

5.6.4 Contribution to Environmental and Social Issues

Cleanliness is considered 50 percent of the *iman* (faith) (Muslim, 261H) in Islam. This shows how environmental and social protection is an important matter in the eye of Shariah. All earth's resources available to humans are in the capacity of the vicegerent of Almighty Allah (Al-Quran, 2: 30). Consequently, they are not allowed to waste or misuse of the resources, which guarantees the protection of life in all aspects.

A bunch of studies described that the role of Islamic finance intending to environmental and social objectives is either little and negligible or nonexistent. Haniffa and Hudaib (2007) found that the Islamic bank's dedication toward social betterment got a low score. Kamla and Rammal (2013) reviewed the social reporting of nineteen Islamic banks and found that there was no role of Islamic banks in social improvement. They neither found any policy regarding the destitute part of the society nor in the fair redistribution of wealth. While explaining the reasons for such findings, they said that Islamic banks failed to make social equity a priority in their operations. Consequently, Islamic banks remained fail to achieve their ideological objectives.

5.6.5 Islamic Finance and Circular Economy

From contemporary scholarly discussion on financial sustainability, a new course of sustainability is discovered known as the circular economy. It is the concept that adopts the productive mentality of "reducing wastage, reusing, and recycling the resources" rather than focusing on the linear notion of "taking, making, and wasting" (ING, 2015). Consequently, it flows the resources toward their best, possible, efficient use along with economic development. The circular economy is a multidimensional compelling nature course of sustainability because it takes the financial, economic, and environmental benefits and costs into consideration in integrating way. Therefore, it takes care of all stakeholders: the public and the environment.

As per Quranic revelation, mankind is the earthly representative of Almighty Allah (Al-Quran, 2:30). Therefore, it is his responsibility to take care of all His creatures along with his interest. In this way, it becomes his first duty to use the resources in the best efficient way. Looking at the goals of circular economy, it seems to be a model paving the way toward the achievement of higher Shariah objectives of protection of life, the future generation, and wealth in broader terms. Islamic economy adopts both preventive as well as promotive strategies. Islamic forbids the waste of resources and considers it a sinful offense in one hand (Al-Quran, 7: 85) and encourages the best efficient use of them on the other hand (Bukhari, 256H). Subsequently, it would not be wrong to say that the basic theme of circular economy has its roots in Islamic law.

The circular economy suggests selling the utilization rather than ownership. Aboul-Naja (2015) integrated this concept with Islamic finance employing the Ijarah model. He says that the ownership of goods increases the volume of wastage of resources. The owner produces goods to make a profit for himself, but he does not bother much about the durability of his product. If ownership is replaced with the utilization of the asset, then the durability of the goods can be increased which is the basic objective of the circular economy. Therefore, he presents the idea that the Islamic financial model of Ijarah (lease) is the best approach where the consumer will get the usufruct of the asset against specific rental rather than ownership on it. The asset will be returned to the owner after the utilization. This approach will motivate the producing unit of the economy to produce durable goods of high quality. Finally, it will serve the objective.

Two possible models can be suggested using the idea of a circular economy. The first model is encouraging the primary producer to make durable goods to sell the utilization of the products rather than ownership. After the economic life of the product, they will recycle it to make the raw material useful. It is quite possible that they may not obtain economies of scale but employing the 4-R strategy of circular economy will give them benefit along with increasing the durability of national resources. The second model needs new companies creating new markets for used recycled products and materials. Innovative strategies will be required for the effective use of recycled products in the new cycle so that they may attract the people. Both models will enhance the residual value of the products. Otherwise, it will be

equal to zero in some cases and will be less than zero because of additional disposal costs.

5.6.6 *Musharkah Cum Ijarah Model*

Regarding the diversification of financial modes, the lap of Islam is very fertile. Both above mentioned models of circular economy could be integrated with Islamic finance through the Musharkah cum Ijarah (MCI) model. MCI model works on three levels. In the first model, Islamic banks, IMFIs and primary producers of a specific product will jointly own a product under the *Shirkat ul aqd* contract. Later, they will lease it out to the end-user of it against pre-agreed rentals that will be shared between them as per the principles of *Shirkat ul aqd*. In this way, the risk will be shared between IBs/IMFI and producers. By using the provision of takaful, they can hedge their associated risk. Such risk and cost-sharing model will encourage producers to produce durable products on one side and it will be more efficient to the end-users on the other hand, because the same benefit of an asset will be accessible to them now in a small amount of rental money. The corpus of the product will return to the owners at the end of the lease period, which can be the end of the economic life of the product. The primary producer, in the capacity of the partner, will recycle the used product or renew the product for another cycle and the cost of the procedure will be shared between the partners. The earnings of the recycled products from the new cycle will again be distributed between partners according to their pre-agreed shares. See Fig. 5.2. If the government pays attention to this model, this model can lead to exponential growth in the economy.

The second model is an extension of the first model where Musharkah will be terminated at the end of the economic life of the product. This model requires the creation of another company to adopt the approach of reduce, reuse, recycle, and renew the product with some new upgraded qualities and specifications. There are again two possibilities. One is that the producing unit of MCI model may create a new business subsidiary to achieve the objectives of the circular economy. For this purpose, it will buy the financier's share in the product at its residual value at the maturity of Musharkah (Fig. 5.3a). Another possible way is that the government may play its role to install new companies to get benefits of the circular economy (Fig. 5.3b) and the government can do it at the macro level. Consequently, it will instigate national economic growth by introducing new innovative industries, employment opportunities, and the efficient use of resources.

5.7 Concluding Remarks and the Way Forward

Despite the large number of hits on the concepts of CE, GE, and SD, there is a dearth of coherent understanding of the interconnections between these concepts. Although

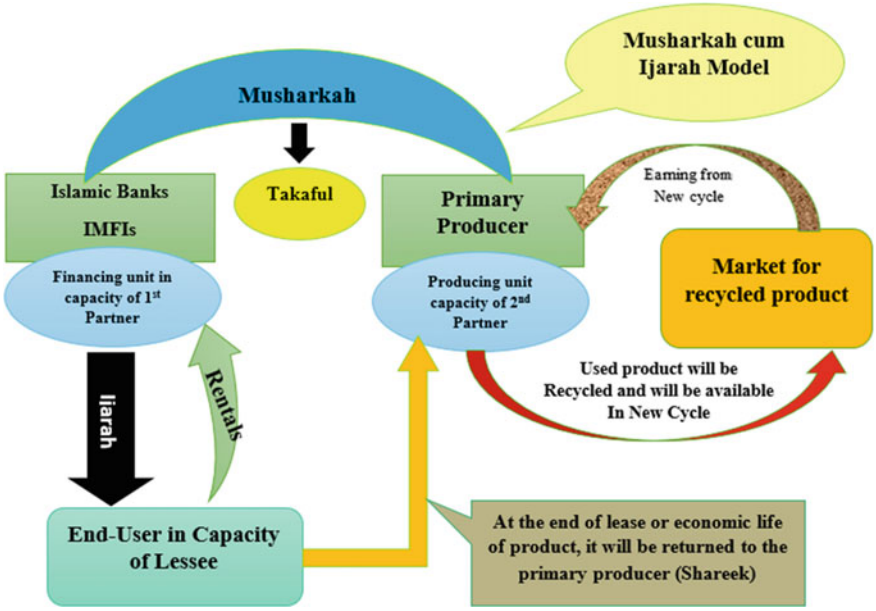

Fig. 5.2 Musharkah cum Ijarah Model A

the academicians, practitioners, and policymakers at both national and global levels as key sustainability avenues are currently considering the three concepts, there is a dire need to understand the interconnections between them. Knowing and identifying the integral role of Islamic finance in promoting and enabling the operationalization of the concepts is also indispensable for policymakers, businesses, and financial institutions.

Keeping in view the gaps in the existing literature, the aim of this chapter is to establish the interconnections between the three concepts. The second objective of the chapter is to link the principles, responsibilities, objectives, and business models of Islamic finance with social, economic, and environmental sustainability. Further, the chapter aimed at pointing out potential dimensions, scopes and in-built characteristics of Islamic finance that may facilitate the process of the realization of the CE, GE, and SD targets and objectives. The chapter also suggests a business model for Islamic banks to actively participate in the process of transformation of the conventional linear economic system toward a circular economic system, which has recently gained a great attention from policymakers, practitioners, and academia for attaining long-term economic, social, and environmental sustainability.

The research suggests that both CE and GE concepts are rooted in the ideas of eco-efficiency, resource efficiency, renewable energies, low carbon emissions, and improvement of nature capitals. On the other hand, the ideas of CE and SD mainly focus on intra and interrogational commitments, integration of non-economic aspects into development in order to achieve sustainable production and conception

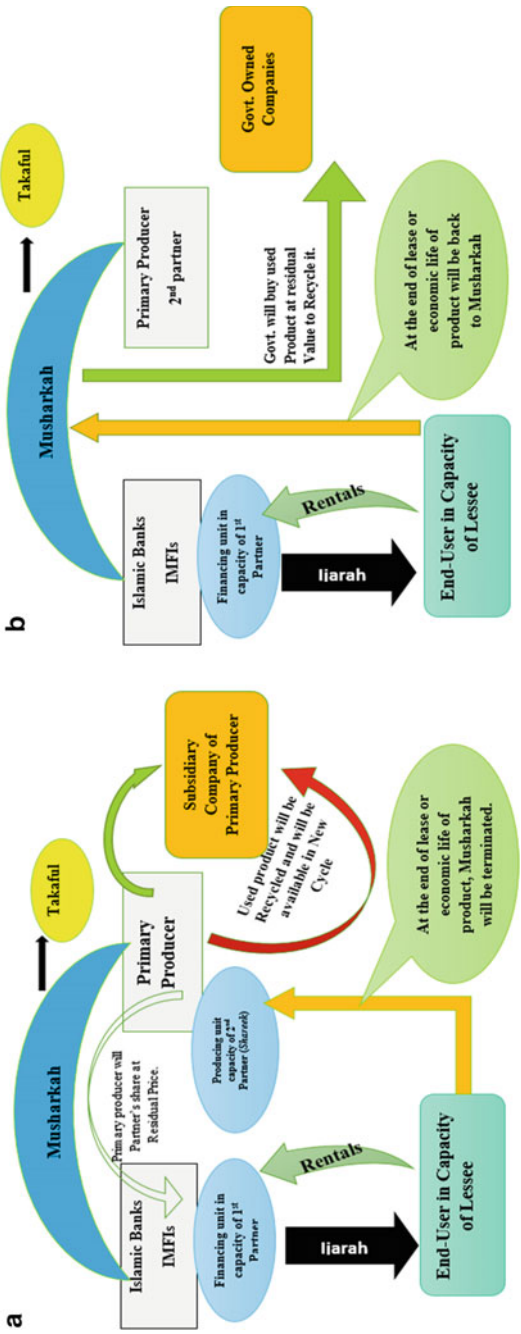

Fig. 5.3 **a** Musharkah cum Ijarah Model B **b** Musharkah cum Ijarah Model C

patterns. It has emerged that the conceptualization, implementations, and evolution of CE, GE, and SD highly assimilate the ingredients of resource efficiency and decoupling, sustained and inclusive economic growth, preservation of environment, and promotion of sustainable consumption and production patterns.

The research indicates that the role of Islamic finance is essential in harvesting the benefits associated with all the three concepts. The Shariah-compliant business models and products of Islamic finance provide an edge to Islamic banks over their conventional counterparts to provide financing at all stages to promote the CE, GE, and SD activities. Finally, the chapter proposes a business model based on Musharkah cum Ijarah for enhancing the transformation of linear economy toward CE.

From a policy viewpoint, more coordinated actions are needed at all levels of the implementations of CE, GE, and SD. The harmonization of the conceptual paradigms, theoretical frameworks, and practical strategies of CE, GE, and SD help adoption and transformation of the current linear economic system toward a circular economic system, which will not only result in long-term local, national, and global sustainability but enable us to achieve social–ecological goals in an effective manner. It is also recommended that there is a need to refine, clarify, and systemically nest all the three concepts in a more holistic single framework without compromising on their own recognition and intrinsic diversity, promoting the more interlinked descriptions and applications of CE, GE, and SD. There is also a dire need to identify common challenges and barriers in practical implementations of these concepts in true letter and spirit. The provision of funds is essential for the implementation, growth, and sustainability of any business models. Islamic financial Institutions have in-built characteristics to provide multidimensional compelling nature course to sustainability in terms of economic welfare, social well-being, environment preservation, and financial inclusion. Further, the inherent features of Islamic finance, such as equity-based instruments, asset-based banking, profit and loss sharing mechanism that focuses on social welfare and responsible investments (Nosheen & Rashid, 2019), will definitely help attain long-term economic, social, and environmental sustainability. Governments, private firms, corporate businesses, and financial institutions should design their business models based on the concept of sell utilizations rather than ownerships to gear up the transition process of the existing economy to the one characterized by ecological, biological, and sociological aspects.

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Chapter 6
The Circular Economy and Its Possible Collaboration with Islamic Economics and Finance

Mohamed Aslam Haneef and Husna Jamaludin

Abstract This chapter examines the possible relationship between the Circular Economy and Islamic (economics and finance). The fundamental idea at the base of this article is that the circular economy, with all its limitations, does present a different model of decision-making, i.e., one that sees decisions being made not based on a narrow individual self-interest. The circular economy promotes the view that economics and finance must incorporate "others" into one's decision-making. Islamic Banking/Finance has developed over the last three decades and while it has served the needs of providing a Shariah (read legal) compliant financing, reservations have been voiced as to its social impact and its contribution to the real economy that seems to have also contributed to the positive shift in the direction taken in IBF in the last decade. The chapter then presents the main highlights of the circular economy discourse and takes a critical look at some of its limitations. The authors argue that, despite its limitations, the circular economy provides an opportunity to further strengthen the preliminary re-alignment that has taken place in current Islamic Banking/Finance discourse, especially the development of social finance. The goals and overall approach of IBF must be reformulated to serve the needs of achieving socio-economic justice. Since Islamic finance is still dominated by Islamic banking, reforms made by Islamic banking authorities and IF educators will have a significant impact on developing the direction of the discipline. Instead of narrow focus on maximizing shareholder returns, these reforms will allow for promoting a genuine stakeholder model where decisions made by individual agents must include a concern for others, including the environment. The chapter generally uses secondary data and discourse/content analysis involving literature written over the last three decades.

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6.1 Introduction

Circular economy (CE) is a regenerative system in which resources either as input of production or waste from consumption are minimized through lifespan extension, repairing, maintaining, reusing, remanufacturing, refurbishing, and recycling (Geissddoerfer et al., 2016). In other words, the designed products need to be of high quality, durable, and long-lasting so that it can reduce new consumptions. Since the products sold are high quality, they can be reused to preserve and prevent resources from being injected into the market. When the reused period has passed, the products can be remanufactured to improve their performance. The last part is recycling the products so that they can be reused for other purposes.

CE promotes a sustainable solution to use and manage scarce natural resources in an efficient way where the product wastes are reused as inputs of new production to ensure the resources can keep circulating in the market system (see Fig. 6.1). Circular economy aims to achieve balance and systematic integration in three aspects: economic, environment, and social (Korhonen et al., 2018; Purvis, Mao & Robinson 2018; Murray et al., 2017; Homrich, 2017; Stahel, 2016). Circular economy is not only minimizing the waste and cost of production,[1] it also intends to build long-term resilience, generates business and economic opportunities, and provides environmental and societal benefits[2] (Ellen MacArthur Foundation, 2017). Due to its promising benefits, many recent studies have been conducted to discuss the concept of CE (Geisdoerfer et al., 2017; Berg et al., 2018; Korhonen, Honkasalo and Seppala 2018; Murray et al., 2017), its possible implementation (Genovese et al., 2017; Mrowiec, 2018; Murray et al., 2017; Zhu et al., 2010), assessment methods (Elia et al., 2017; Geng et al., 2011; Su et al., 2013), and ways on how to promote it (Nunes et al., 2018; Buil et al., 2017).

6.2 Limitations of Circular Economy

Despite its various potential benefits, sustainability of circular economy is questionable. Four arguments are given below to justify its limitations.

Implicit Costs—Cost of Maintaining, Recovering, Recycling, and Extending Products' Lifetime

The implicit costs of CE are not taken into account. First, the cost of maintaining the goods to be used for a longer period may not be justifiable. After certain period of time, the quality of the products will be diminished, and maintaining this kind of product in the system requires new resource inflow and may incur some costs

[1] It reduces resource inflow and energy costs of production.

[2] Its societal benefits are promoting sharing economy where the waste of one firm is the input of another firm, creating cooperation between firms and consumers in managing the products lifecycle, and offering job opportunity for new cleaner market.

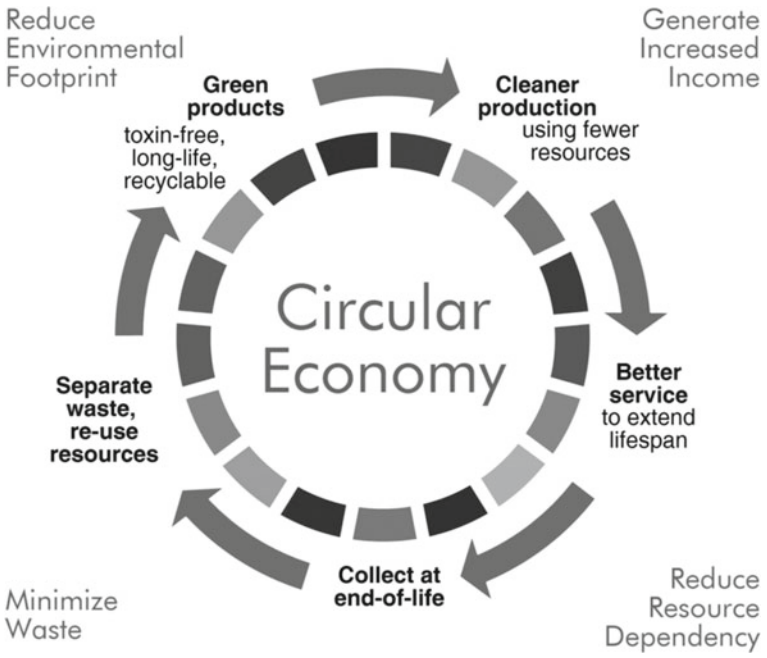

Fig. 6.1 Circular Economy process *Source* United Nations Industrial Development Organization (n.d)

to repair and improve it. Maintaining goods might be difficult due to the stigma of owning outdated goods (Cooper, 2005) and also not efficient if the new products can be produced at a cheaper price with a better quality.

Second, recovering materials from the used products may not be economically efficient. Although for the case of rare earth elements, expensive and vital ingredients in modern and green technologies, recovering the elements from the used products is less likely to occur. Most of the time, the cost of recovering is not worth of the metals extracted from the end products (Schüler et al., 2011).

Third, CE cannot provide recycling in perpetuity (Andersen, 2007) because some goods especially electronic, chemical, and medical products are difficult or may not be able to be recycled. Although some can be recycled, it is difficult to ensure the quality of the products over time (Winans and Deng 2017), and low-quality products will be less demanded. In addition, treatment of lower quality products will give lower benefits regardless of how they are valorized (Huysman et al., 2017). Furthermore, it cannot be denied that at certain point of time, recycling will become difficult to yield a net benefit (Anderson 2007).

Last, when products are designed to be long-lasting, the chemical used to ensure the longevity of the products may result in pollution, both in production process and after the end-of-lifecycle of the products. The life extension products are hardly to breakdown, energy expensive, and consume more energy in manufacturing process

and release more entropy than those designed with shorter life (Murray et al., 2017). A wooden chair, for example, is easy to perish and more environmental friendly than the finely manufactured office chair. Everything on earth such as molecules and atoms have their own lifecycle. For instance, evaporated water from the ocean forms rain clouds, and the rain falls on the land goes back to the oceans through river flow (Murray et al., 2017). A viable concept of circular economy should respect and not alter the biogeochemical cycle of the earth. However, prolonging the lifecycle of products may affect the environmental assimilative capacity due to its durability characteristic.

Invalid Assumptions

CE assumes that when the lifecycle of products is extended and the products are designed to be of high quality, consumption will decrease due to low rate of displacement, and thus reduce resource used (Murray et al., 2017). This assumption is not applicable to those who have/have no purchasing power. It is very common for the rich people to purchase more of high-quality and expensive shoes/watches to satisfy their utility. It is also less likely for the low-income group to purchase high-quality goods, associated with high price, with the intention to reduce their consumption. Rational behavior theory suggests that consumers will opt for expensive and durable good if the goods can reduce his/her costs and maximize utility. However, consumers are not always rational (Planing, 2015), especially for fashionable (i.e., clothing) and electronic goods (i.e., phone).

It is also assumed that prolonging products lifespan could reduce the need of raw materials and waste creation (Elia et al., 2017) because it allows resources to grow naturally before extracting the new resources, and the earth can tolerate the limited/minimum amount of waste generated. However, durability of the products will affect the capacity of earth to absorb the waste, and these products might be more polluted, for example, electronic waste, than the short-life goods. Also, the demand is higher than what the resources can sustainably produce, and hence will affect the resource reproductive rate.

Rebound Effects

CE aims to preserve natural resource and reduce environmental footprint caused by linear economy (make, use, dispose) through efficient use of raw materials, water, and energy (Elia et al., 2017; Geng et al. 2013). When products' efficiency is improved, it leads to cheaper cost of production and the price of goods (Zink & Geyer, 2017). As a result, it boosts up production and consumption which partially or fully offset the environmental gain created from improved efficiency. Consequently, overall production and consumption are increased and lead to high demand for resource extraction and increase waste generation.

Zink and Geyer (2017) argued that nothing is "green" about transferring waste of one firm as an input of another firm if it does not reduce the environmental impact in both during production and consumption stages. They further emphasized that the merit of circular economy is that whether the used products can reduce or prevent production of new products so that the resources can be preserved for future

use and low demand for landfills. Substitutability of goods depends on consumers' perceptions of using the used goods (Thomas, 2003), and the type of products. Daily used products such as clothing, toiletries, or stationaries may not be feasible because the prices are affordable. However, durable goods like cars, furniture, or expensive items (i.e., branded clothes, handbags, or shoes) may work due to their high costs or the need of having them.

According to Zink and Geyer (2017), low quality of inferior goods will not make them a good substitute for new products. For example, used clothes/items hardly compete with the new clothes. There is a possibility that the used or inferior goods reduces demand for new products due to their price advantage. When the reused goods enter the market, the low-income group might demand for the products due to their lower prices compared to the newly designed products. Thus, the presence of these good is likely to increase the overall production and consumption (Thomas, 2003), and hence contributes to waste generation. Increased supply of both new and old goods will reduce the overall price and encourage more consumption. Therefore, 3Rs (reduce, reuse, recycle) may lead to resource depletion, pollution, and waste generation if the growth of its physical scale is unchecked (Korhonen et al., 2018).

Silent on Social Aspect

There is a clear impact of circular economy in achieving environmental and economic objectives. However, the social aspect seems to be missing in the system (Homrich et al., 2017) especially its role in promoting greater social equality in terms of inter- and intra-generational equity (Murray et al., 2017). Although job creation in the green sector is highlighted as a result of circular economy, there is no clear justification of the extent of how circular economy could improve social well-being (Geissdoerfer et al., 2016). Circular economy emphasizes on redesigning of waste (Ellen MacArthur Foundation 2013) to be cycled and reused in the system which require engineers to design and manufacture the products (Winans and Deng 2017).

In addition, the concept stresses on efficiency improvement in production process, indicating the use of high technological machines and skillful workers. Although low-skilled workers could also benefit from circular economy through waste collection and sorting activities (Ellen MacArthur Foundation 2013), circular economy offers more professional job opportunities to the society which in turn widens the intra-generational inequality. However, from a different angle, creating more skilled workers is desirable for economic growth which can be achieved by upskilling as many people as possible to reduce the earning gaps.

Given the above limitations, we propose the following concepts to complement the CE.

6.3 Interdependent Utility Function and Social Finance

6.3.1 Interdependent Utility Function

Many may not realize that one's utility/profit depends on not only one's own consumption/production, but on the consumption/production of others. For instance, during the Covid-19 period, one's utility increases (in terms of lower risk of infection) when people around him wear masks. If we look at it from a wider perspective, preservation of scare resources by planting more trees in Bhutan, for example, will positively affect the well-being of other countries as a whole by slowing down the impact of climate change. Conventional economics discusses these under the topic "externalities,"[3] which is seen as a distortion to the market function.

Interdependence of utility is not a new concept. If one was to just search for references on interdependent utility functions, one would be amazed that much theoretical work has been written. My utility depends on the utilities of others.[4] Drakopoulos (2012) carries out a historical study that states:

> "*The notion of interdependent preferences has a long history in economic thought. In its general form, it can be found in the works of authors such as Hume, Rae, Genovesi, Smith, Marx, and Mill, among others. In the twentieth century, the idea became more widespread mainly through the works of Veblen and Duesenberry……However, such preferences were never part of the corpus of orthodox theory. For instance, although Pareto and Marshall were aware of their existence, they did not advocate their incorporation into orthodox economic theory.*"

A possible reason for its exclusion from the orthodox economic theories might probably because interdependent utility contradicts with the very basic economic concept of utility advocated by Strigler (1950) and other well-accepted concepts such as Zero-sum game[5] and Pareto optimality.[6] Ironically, on the other side of the argument, interdependent utility function is recognized when we talk about interdependence in oligopoly behavior. Two distinct characteristics of interdependent utility outlined by Dave and Dodds (2012) are (i) a purely altruistic concern for the others' well-being—termed as benevolence and (ii) concern with the action taken by others—termed as nosiness. Oligopoly refers to the latter because actions taken by one company will have an impact on the utility/profit function of other companies. The former is supported by Bergstorm (1999). He extended the utility function of a person beyond one generation—not only depending on the intra, but also intergenerational utility—because parents gain pleasure by observing the happiness of

[3] In these cases, we say positive externalities. Conversely, if we were talking about some polluting examples that would be termed a "negative externality."

[4] See Oxford Reference (2021). Retrieved 28 March 2021, from https://www.oxfordreference.com/view/10.1093/oi/authority.20110803100006606.

[5] A situation in a game theory in which one's gain is equivalent to another person's loss so that the net change in wealth is equal to zero.

[6] A similar situation to zero-sum game in which no person will be better off without making at least one person worse off.

their children (and grandchildren), while the children feel the same way when they could make their parents proud of their achievements.

Benevolence utility is acknowledged in the teachings of Islam—the willingness to trade one's happiness for the happiness of others for mutual/overall satisfaction. For instance, when we help the needy, our utility will increase although our money has reduced because we are happy when we could help the less fortunate and we believe that the reward from Allah will be greater. This condition is called as altruistic value, satisfaction gain when other humans benefit from it. If altruism is a linear function, as the degrees of altruism increase, altruistic utility functions of different persons will converge to a single function (Hori 2006). Ignoring the fact that everyone's utility is dependent on each other will lead to market failure, and its extreme example is the tragedy of the commons—maximizing my own utility by ignoring others' best interest led to overuse/depletion of resources. Elinor Ostrom won the Nobel Prize in Economics detailing the solution to address this issue, indicating the problem is real and needs fundamental changes in economic concepts. Similarly with the current practice of IBF, maximizing their profit by imposing high "profit" with the intention to replace "interest" and providing loans only to a certain group of people will not only defeat its purpose to serve the *ummah*, but will limit the money flow into their system. Tragedy of the commons teaches us when our decision-makings have a significant impact on public utility, altruistic/benevolence behavior should be adopted to sustain the system.

6.3.2 Social Finance

What is social finance? In the finance paradigm, social finance is seen as "investment decisions that not only give a financial return, but also have positive social and/or environmental impact."[7] Hence, social finance still makes a financial return (could be less than return under pure business criteria), but also does greater good to others in the process. It can include schemes and programs that make economic resources (including funds/financing) available to those segments of society who otherwise may not have access to these resources. It could also involve a social/environmental goal that requires funding due to lack of public funds per se. It seeks to balance between material profits and social good. This is where social finance can serve/complement the circular economy paradigm. It works by taking the individual, society, and the environment into account when making decisions. Put in another way, it requires a "multi-objective profit function" that also incorporates "interdependent utility functions" as discussed above.

[7] The four broad areas covered under this include socially responsible investing/finance, environment finance, development finance (including microfinance), and impact investing. See Tim Rourke, *From ESG to SRI,* Knowledge Leadership, CIBC Mellon a Canadian Company that specializes in social finance.

In recent years, there has been interest in talking about Islamic Social Finance (ISF). While welcome, the effort has been limited to discussing zakat, waqf, and Islamic microfinance. While these three institutions are important areas/institutions of ISF, it is still a very narrow approach to the social finance discourse mentioned above. It is very important that ISF discourse be widened to include all areas of finance—including Islamic banking—since what is crucial is to see a new model of decision-making being developed. Hence, ISF should also argue for a banking, capital market (for example, sukuk) as well as all other investment funds that have a "social impact." The circular economy paradigm is an ideal project to combine with social finance discourse since the central idea is about a new decision-making model.

Many may not be aware, but this is not new to Islamic economics. In the late 1970s and early 1980s, pioneers of Islamic economics asked this question "is the goal of the firm only to maximize their financial profit"? While the answer was a firm "no" (no pun intended), the details of how you would do this and show this theoretically did not get sufficient attention. This discourse slowly waned over the years. Faced with the available calculus tools of analysis used in standard economics, it was counter-argued that we should continue to use the "maximization" hypothesis but change the function/goal that was to be maximized.[8] This argument may have been a good "solution" to the debate, but unfortunately not enough theoretical work followed to build on these ideas. How one would actually modify the profit function, what were the components and "Islamic values" to be added, how these would be formulated, etc. and developed. Hence, the standard maximization rule just modified in "intention" without detailing out the components that had to be included in the profit/objective function and the constraints or limitations that represented Islamic considerations. This is quite puzzling since many young Islamic economists are actually well trained in the mathematics and quantitative techniques of modern economics. Hence, the renewed discourse on interdependent utility functions must be brought back into the research agenda.

As time went on, the stated standard view was that Islamic economics utilized a modified maximization rule. If the details were not developed in Islamic economic theory debates and discourse—an area that has not really been given sufficient attention—what more when we go to the discourse in Islamic banking and finance. In the world of Islamic banking, the "modified" maximization rule was taken as "given"—the goal of the Islamic bank is to maximize profit or to maximize shareholder income/wealth—but following *Shari'ah* (read as fiqh or law) requirements.[9] It is always re-iterated by proponents of current IBF industry that IBs are "*tijari*" entities and not welfare organizations. Without the capital of the shareholders, there would be no business, hence we should be fair to the shareholders. While this was

[8] Mahmoud Saud in the 1970s and later Zubair Hasan put forward this view and generally made the theoretical argument.

[9] It may also be the case that this question was never really a concern. Islamic banking and finance never really based its development on Islamic Economics Foundations (which in themselves were also not very well developed). Most research in IBF was focused on instrument development.

the discourse 30 years ago, things have changes drastically. From Corporate Social Responsibility (CSR) discussions in the later part of the 1990s, this question of "role of corporate entities" and especially banks have come under scrutiny. With the advent of social business discussions and more recently the circular economy discourse, the idea of greedy, self-interested maximizers has come under scrutiny again. While no one sees commercial enterprises as having to be welfare entities, the issue of interdependent utility functions would allow us to re-evaluate our decision-making. Social impact that is at the core of social finance can certainly make IBF a more relevant approach to human well-being.

6.4 Current Performance and the Need for New Directions

In this section, we begin with a brief mention of the evolution of contemporary IBF with some examples, particularly focusing on Malaysia. The second part of this section describes the current agenda put forward by the Central Bank of Malaysia that emphasize on the Value-Based Intermediation (VBI), and the last part discusses the possible application of circular economy in environmental policy. Some lessons can be learnt from the current practice of Malaysia's waste management. Both IBF and environmental issues attract a lot of attention especially in the last decade or so with the Sustainable Development Framework and the United Nation's Sustainable Development Goals discourse. Given these developments, it is worth to note that the new direction of IBF (social finance) could be used as a tool to finance green technologies for a better environmental quality.

6.4.1 The Evolution of Islamic Banking and Finance (IBF):

From Commercial IBF to Social Finance (SF)

According to the Global Islamic Economy Report 2020/21, Islamic financial assets were estimated to have grown by 13.9% to approximately USD 2.88 trillion at the end of 2019 (from USD 2.52 trillion in 2018). From this figure, approximately USD 2.2 trillion is in the banking sector, USD 536 billion in sukuk while USD 237 in Islamic funds. In addition, there were 1462 financial institutions globally.[10] This means that other sub-sectors of finance are yet to challenge the dominance of banks in the IF space. This is quite different in the conventional scene, where banks face stiff pressures from other sub-areas of finance, especially with the rise of the *financialization* process. Hence, many of the arguments made for IF can actually still refer to the example of IB. However, IB has also evolved over the last four decades.

[10] COVID-19 and its impact have been widespread. There is no growth expected in Islamic Finance in 2020, but expectations are for a 5% annual growth from 2021 to 2024 to reach USD 3.69 trillion by 2024.

Notwithstanding the growth of Islamic banking and finance from the various data and reports produced by so many parties, there has also been criticism targeting both the conceptual and practical levels of IB. The following paragraphs summarize some of these tensions.[11] Firstly, one finds the "questioning of Islamicity" of Islamic banking. In the 1980s, the debate was between the types of contracts used and the legalities of contracts. Fast forward almost three decades later—the discussion is no longer about mere contracts. There is also a questioning about the efficacy of debt-based instruments. Today, with the greater concern for the environment, proliferation of writings on CSR and the whole Sustainable Development Goals (SDG) agenda, people now ask what is IBF doing to promote the well-being of the *ummah* and humanity as a whole. With COVID-19 and its tremendous impact on the lives of people, this question is even more fundamental. No more should the goal of the bank be just to maximize profits or shareholders' wealth. Shareholders are one stakeholder of the bank. These developments provide a renewed opportunity to adopt a much more inclusive view of "Islamicity." Rather than just being financial intermediaries that were divorced from the pain and suffering of the less advantaged, Islamic banks must be proponents of economic development.

Secondly, there is also a need to clearly reduce the "theory–practice gap of the debt-based IB." Even if we accept debt-based instruments (like BBA, *tawarruq* and *bayᶜ al-inah*-based contracts in Malaysia), the theory—practice divide is further aggravated when the practice of debt-based IBF does not necessarily follow the requirements of the theory of debt-based IBF. A 2008 High Court judgement in Malaysia[12] gave a verdict that stated explicitly that the "BBA as practiced in Malaysia was not a bona-fide sale" and for all practical purposes was more like a loan contract. Of course, this was opposed by the industry. On appeal, the presiding appeal court judgement found that the High Court judge above had erred in his judgement, since *the BBA is a sale contract and not a loan.* Both judgements seem to be talking about different things: the appeal court was referring to the *theory of BBA*, while the High Court was referring to the *practice of BBA* in Malaysia. Why is there a departure between theory and practice? Why and how were the practices justified by the Shariah boards? This has brought into question the whole process of Shariah advisement and the qualifications of members of these boards, our third tension.

In the case of Malaysia, while there is no explicit requirement for Islamic law/*fiqh* qualifications, the convention is that Shariah advisors should be trained in Islamic law. While not questioning the sincerity of these scholars, the issue may be more about the qualifications and understanding of these scholars of contemporary banking and finance, and one can add, to the economic framework that banks function in. While attempts have been made to improve the knowledge of these Shariah advisors, such continuing education/training programs, there is still much to improve. Is it possible to serve the well-being of society as a whole without also knowing the economic and social implications of those instruments and how development as a whole is

[11] For a more detailed discussion of these tensions, please see Haneef (2009).

[12] See Datuk Abdul Wahab Patail, High Court Malaysia, Commercial Division, 18 July 2008. Judgement on various suits brought by a few Islamic banks against clients.

served?[13] Can we truly claim that the instruments that are being put forward are genuinely serving public interest if we do not see the bigger picture of the economic and social goals of society? Should we not also give the required attention to ethical (and not just legal) issues in the decisions that we make? Why are we satisfied to just have the "minimum legal requirement" as the standard that we want to follow?

6.4.2 *Moving Beyond Profit: The Value-Based Intermediation (VBI) Agenda*

In this regard, *Bank Negara Malaysia* or the Central Bank of Malaysia has put forward its Value-Based Intermediation (VBI) agenda. Basically, VBI argues that finance—in this case Islamic banking/finance—must look beyond the individual profit motive. No longer can the legal issues be the dominant focus, but ethical dimensions and implications of the decisions made must also be taken into consideration. The VBI initiative needs much more discussion and debate to ensure that it is a transparent, all-inclusive discourse. A recent thesis by Amin (2018) argues that the entire conventional banking system is being replicated by the Islamic banking system and calls for a "systems" approach to developing IBF. The last 10–15 years have seen efforts to establish *other types of Islamic banks*, modeled after what are called social banks that are part of social banking/finance. The last few years have also witnessed increasing discussion of the role of IBF in helping attain the United Nations' SDGs. Positive steps have also been taken to move away from just focusing on banks to *non-bank alternatives*. In addition, the numerous crises originating usually in the financial sector over the last 20 years have provided a new opportunity to re-look at the approach taken. In recent times, the circular economy discourse also provides another platform to re-consider the role of IB.

Finally, has IBF made a difference in facing the negative effects of the financialization process mentioned earlier? In terms of a definition, financialization refers to "the increasing importance of financial markets, financial motives, financial institutions, and financial elites in the operation of the economy and its governing institutions, both at the national and international levels" (Epstein 2001, p.1). It has transferred income from the real sector to the financial sector, shown by the increase in the share of return to owners of money capital vis-à-vis worker or labor,[14] and has caused a general increase in income inequality and wage stagnation. Intra-country studies have shown there is a growing inequality between the rich and poor in all countries,

[13] In this issue, M. N. Siddiqi (2007) pointed out the importance of understanding the 'macro-*fiqh*' dimensions of IBF on the economy and society as a whole as opposed to the 'micro-*fiqh*' qualifications of most legal scholars.

[14] As an example, the average trading in foreign exchange for WTO countries in April 2013 was USD 53.9 trillion whereas average total trade in goods and services for WTO countries in 2012 was USD 58.9 billion, meaning that what is traded in foreign exchange in less than a week is more than the total trade in goods and services for one year!

if not income, certainly wealth inequality.[15] Financialization may also render the economy prone to risk in financial markets that are more volatile. This is supported by the fact that many corporations even create independent financial companies and carry out credit operations. *Simply put, the financial sector no longer serves the real economy, but rather permeates and dominates the real economy.*

If we agree with even some of the arguments above, what has been the performance of leading IBF countries vis-à-vis these features of financialization? Has the introduction and development of IBF made a difference to the issue of inequality, dominance of the financial sector, the rise of debt as well as environmental degradation? Further serious research is needed. The financial sector has gained stature and importance over the trade/ manufacturing sectors. Many Muslim countries are rushing to become "Islamic finance" hubs. Huge numbers of people seek employment in the Islamic banking/ finance industry rather than become entrepreneurs or work in manufacturing. The question of inequality is still a major concern: deceasing relative inequality but rising absolute inequality.[16]

While IBF has been acknowledged in various studies to have been safer /more stable during the 2008 financial crisis, it is too early to celebrate. Islamic banks have been involved in various activities that seem to be features of financialization, but in a very cautious way. In tandem, studies need to be conducted to determine how much Islamic banks/finance have either contributed to raising inequalities, or has contributed to reduce it, or at least slow down its pace? It is also very important to conduct social impact studies of IB in various communities. Issues of basic needs as well as general well-being of society cannot be left to the government or the voluntary sector. IBs must play their role in providing for society, not just for those with money. However, we need to change the present trend and direction of development. The circular economy discourse provides an opportunity to re-look at how IE and IF can change its approach.

6.4.3 Application of Circular Economy in the Environmental Policy: Lessons Learnt from Malaysia's Waste Management

CE was initially introduced due to the environmental concern of increasing consumption of single-used products from a scarce resource. Therefore, a brief introduction of Malaysia's environmental conditions and policies is given. Prior to 1990s, traditional methods such as open dumping and waste burning were commonly practiced

[15] Thomson and Dutta (2015) quote an UNCTAD study that shows that USD 800 billions of capital flows have actually moved from developing countries to developed countries in 2008, thus showing the domination of the rich over the poor.

[16] Institutions like the United Nations University have undertaken research on poverty measurement and published a special issue of Review of Income and Wealth entitled Inequality: Measurement, trends, impacts and policies, edited by Tony Addison, Jukka Pirttilä and Finn Tarp (2017).

in Malaysia. After 1990s, landfills gradually became the most preferred solution for waste management (Al Ansari, 2012). This practice, unfortunately, is still being implemented after 3 decades of operation due to its simplicity and cost-effectiveness compared to another alternative incinerator. Currently, about 90% of waste generated are collected by concessionaires and of this number, 90% will be dumped in the landfills (Yong et al., 2019). The remaining 10% that was not collected by concessionaires (illegal dumping) will be managed traditionally (Tang et al., 2019). The waste generation is increasing due to the rise in consumption and population (about 4% per year), leading to high dependency on landfills that have approached their threshold or exceeded their maximum capacity (Moh and Manaf 2014). Also, the landfills have been poorly managed and created various types of environmental pollution (Hoe et al., 2002).

Many environmental policies and programs had been implemented since 1990s to convert valuable resources in the waste stream from being disposed in the landfills by promoting waste reduction strategy through waste management hierarchy (reduce, reuse, recovery, and recycle), setting up of buy-back centers and placement of drop off containers for recyclables at strategic locations such as schools and shopping malls, and creating awareness among Malaysian. However, the efforts made were deemed to be a failure because less than 5% of the total waste is recycled (Tahar 2017; Hassan et al., 2000) due to lack of supporting regulations and poor public participation (Ogiri 2019) as their mentality toward cleanliness, and the sense of responsibility in managing waste is lacking (Moh 2017).

Waste management hierarchy or 3Rs is a central component of circular economy, although circular economy covers a broader aspect. Nevertheless, its implementation did not achieve the expected outcome. Some people do not care about what comes out of the waste, where and how those wastes are disposed as long as they are collected from their house (Otitoju & Seng, 2014). They are not aware that their utility is also dependent on how the waste is being managed. When more land is being allocated for landfills, the opportunity cost of land will be high due to its increase in demand for other purposes such as residential areas, agriculture, manufacturing and wildlife, and therefore will affect human's life. The current situation indicates that Malaysia is not ready to move away from the traditional linear economy unless they realize that they are living in a shrinking ecosystem that requires everyone to look after one another.

6.5 Circular Economy and Social Finance Discourse (CESF): Opportunity for a New Decision-Making Model

As mentioned above, when we talk of Islamic social finance, one does not see the discussion of social finance as given in the West. Rather than discussing modifications to the business sector (as found in the conventional discourse of social finance)

as well as the potential to bring the "theory of the firm" back in focus—in Islamic discourse circles—to some extent, discourse seems to have been rather limited to our three institutions that "represent Islamic social finance": zakat, waqf, and microfinance/micro investment.[17] Hence, financing was made available to society as a whole and not just to the already well-to-do. In addition to these three institutions separately, some works have even tried to combine zakat and waqf with Islamic microfinance in order to be able to serve the *ummah* even better. However, the division of the Islamic economy into the *tijari* sector (private), *siyasi* sector (public), and *ijtima'i* sector (social/voluntary) has led to less discussion about the hybrid model as in the West. As mentioned earlier, until very recently, many "Islamic bank experts" still insisted that the role of IBF is to maximize returns for their shareholders. It is as if the three sectors cannot be integrated.

If we widen the discussion of Islamic social finance to include "overall decision-making" of all forms (banks included), we then have a new model of the firm. The 3Ps (people, planet, and profits) model is what the circular economy paradigm brings to Islamic economics and finance. Stemming from the Islamic worldview and Islamic economic philosophy discussions about the nature of resources, the nature and role of man as *'abd* and *khalifah*, the ethical principles that this brings in economics and finance plus the call for socio-economic justice and equity, naturally makes the circular economy and social finance discourse relevant. In making our personal decisions, we have to think of its impacts on others because their utility depend on ours and vice versa. Although much has been written on interdependent utility function, it has not been able to become mainstream. Bergstrom (1999) put forward a highly mathematical presentation of "benevolent utility functions" but these alternative theories of decision-making of economic agents must be developed by Islamic economists and be included in the analyses made from Islamic perspectives.

In Islamic economics, Zaman (2005) tried to present his alternative to consumer behavior that tried to separate the demand function into two so that the consumption pattern for the poor will be acknowledged clearly. Choudhury and Tageldin gave their own critique to this article. While one can find some work in this area, the reality of the matter is that these writings are just insufficient and in no comparison to the levels written by alternative economics in the West. Much more attention is needed to attract our young scholars to do research in these areas and to build theoretical models that reflect the Islamic perspectives on individual decision-making. Interdependent utility functions and putting others' welfare into our own welfare is the way to go. The CESF discourse affords a golden opportunity to revive the interest in this.

However, while CESF provides the necessary intellectual motivation to re-energize the Islamic economics and finance discourse, one must also be critical of the CESF discourse. A thorough evaluation of CE and SF from an Islamic perspective

[17] As for microfinance, Muhammad Yunus and Grameen Bank did something that many others could not. He managed to develop a system whereby the unbankable poor were the targets of microfinance schemes where group dynamics made collection and repayment an almost 100% success. There have also been criticisms, but as a whole, breaking the existing paradigm of "collateral" and credit worthiness has been achieved.

is needed, just as we would call for the critical evaluation of our *turath* and modern knowledge in the Islamization and Integration of Knowledge agenda.[18]

6.6 The Way Forward and Conclusion

Besides the overall need to situate IBF within the Islamic economic framework, other positive developments have taken place over the last 10 to 15 years or so. The CESF discourse allows a re-look at the economic and financial decision-making process of the agent—be it the consumer or producer. The rise of social/community banking has given alternative banking models other than the Anglo-Saxon commercial model. In addition, there must also be emphasis given to non-banking financial institutions such as Development Financial Institutions (DFIs) and other community-based alternatives. One could argue that companies such as Malaysia's e-hailing GRAB transport service and Air BNB's accommodation service are all examples of a democratization of asset ownership that could actually bypass established institutions such as banks.

As far as microfinance is concerned, a new area of Islamic social finance has developed rather extensively over the last 10 years. Zakat and awqaf are also part of this Islamic social finance where commercial interests are balanced with societal interests. However, everyone must be vigilant to not "overcommercialize" the institutions of zakat and waqf. Already there are writings by more commercially minded entities that are calling for a greater role of Islamic banking in zakat and waqf management. Caution needs to be taken so that the noble aims of zakat and awqaf are not corrupted by crass material intentions.

The Islamic economic system is quite unique in that it is a three-sector system: private, public, and voluntary or not for profit sectors. Each plays its own complementary role to achieve well-being for all. The private sectors, in this case, commercial Islamic banks have to work together with other institutions to achieve the wider goals of society. This can only be effectively done if IB re-aligns with its Islamic economic roots. With some of the developments post-2008 crisis, the environment has become more conducive to receive alternative approaches to develop contemporary IB. The circular economy paradigm also allows us to seriously question the narrow approach taken in developing IBF of the last 40 years. Alternative banks, non-banking alternatives as well as more holistic solutions that call for structural reforms, including those in distribution and redistribution, are now being discussed even in mainstream conferences.

Islamic economics and finance should take the opportunity to participate in this movement for reform. After all, the Islamic concepts of *tajdid, islah,* and *ijtihad* are

[18] For details on this, please see Haneef, M.A (2009) A Critical Survey of Islamization of Knowledge (2nd, Revised Edition) IIUM Press. The main argument in Islamization of Knowledge is that in order to develop contemporary Islamic perspectives in various aspects of knowledge and in the disciplines that we teach and use to understand human behavior, one has to integrate knowledge obtained from our Islamic heritage and their methodologies, with modern knowledge that has developed mainly in the West after critical evaluation of both bodies of knowledge.

all central to achieving the well-being of the *ummah*. Islamic economics, banking and finance must genuinely solve problems of the *ummah* and not just provide legally compliant instruments that do not necessarily establish justice and well-being for all, and something that is central to the objectives of the Shariah. In addition, just providing longer repayment periods to allow people to afford an already overpriced house does not genuinely solve the provision of the basic human right of shelter, which is a crucial goal of the objectives of Shariah. Solutions must be sought in a framework where finance is unified with economics and the socio-economic goals of society. Islamic banks and banking authorities must take the lead.

There is an oft-repeated and one of my favorites saying in the Malay language "*Kalau sesat, balik ke pangkal jalan*" (if you are lost, return to the beginning of the journey). In Islamic banking, there is soul-searching required and the way forward is to re-visit its Islamic economic foundations. Maybe the current discourse on circular economy and social finance will provide the incentive and impetus to re-connect IB to its roots. It is the responsibility of all to assist in bringing Islamic banking and finance home.

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Chapter 7
ESG Analysis and Shariah Screening: Mutual Learnings for a Better Investment Climate

Valeed Ahmad Ansari and Shariq Nisar

Abstract The chapter presents a study that investigates the performance of NIFTY100ESG, Nifty Shariah 50, and Nifty 50 indices in the Indian context over the period 2011–2019 employing CAPM, Fama and French, and Carhart benchmark models along with other measures such as Sharpe and Treynor Ratios. The results indicate a superior performance of ESG index based on Sharpe and Treynor measures. However, the results produced by benchmark models do not suggest a statistically superior performance of ESG index as alphas are positive and insignificant. The regression results on differential excess returns between ESG and Shariah index also yield identical result. Overall, we can conclude that the performance of ESG index is better than other indices. It implies that the integration of ESG criteria on Shariah portfolios may be valuable for investors and Islamic finance, both. It may provide a higher return to investors and can infuse social tenets in Islamic finance. It may also enable Islamic Finance to re-brand itself.

7.1 Introduction

The growing concerns towards environmental stability, socio-economic development, ethical standards, and governance issues have brought about a consensus towards the importance of responsible investments. One such investment strategy which addresses these issues and has gained currency among investors is known as a socially responsible investment (SRI). It is measured through environmental, social, and governance (ESG) scores and has roots in the stakeholder approach to corporate governance. The journey of ESG investing can be traced back to 2004 when former UN Secretary-General Kofi Annan invited over 50 CEOs of major

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financial institutions under the auspices of the UN Global Compact in collaboration with the International Finance Corporation (IFC) and the Swiss Government to participate in an initiative on the implementation of universal principles in business (originally launched in 2000). It resulted in a landmark study labelled as "Who Cares Wins: Connecting Financial Markets to a Changing World." It provided "recommendations by the financial industry to better integrate environmental, social, and governance issues in analysis, asset management and securities brokerage" (United Nations, 2004).

7.2 Socially Responsible Investment (SRI)

SRI is an investment process that involves identification of companies with high corporate social responsibility (CSR) profiles evaluated based on environmental, social, and corporate governance (ESG) criteria (Renneboog et al., 2008). The ESG criteria act as a screening device for the exclusion or inclusion of stocks in a portfolio. Unlike conventional investments that focus on risk and return of the portfolio, SRI focuses more on non-monetary objectives. It connotes that investors are not primarily interested in deriving financial utility from their investment decisions but also aim for a non-financial utility that is in tune with personal and societal values (Vo et al., 2019).

7.2.1 Islamic Investment

Islamic investment refers to an investment practice that is in consonance with Shariah (Girard & Hassan, 2008). Like SRI investment, Islamic investment also uses screening to exclude activities regarded as prohibited (Haram) such as *Riba*, *Gharar, Maysir*, etc. (Miglietta & Forte, 2007). The Proponents of Islamic finance contend that the ethical principles underlined by Islamic finance can forge a stronger link between the financial sector and the real economy, bring about the efficient mobilization of savings, lead to more equitable distribution of resources, mitigate gyrations in business cycles, and provide resilience and stability to the financial system (Choudhury, 2010; Warde, 2010). Furthermore, it is observed that the Islamic financial system is naturally inclined to promote sustainable economic development (Al-Damkhi, 2008).

Equity shares are closer to Islamic norms of profit and loss sharing. The equity shareholders are the owners of the company and share the risk of the business. They may lose their entire capital in the event of huge losses suffered by a company. Equity share investment is free from uncertainty and gambling. The rights and obligations of the parties are clearly defined and do not involve exploitation or injustice. Equity shares represent a viable non-interest-based investment avenue for investors. Further, in modern times, stocks of listed companies and mutual funds are closely monitored

and regulated by the authorities to obviate accounting manipulation and financial malfeasance. Thereby assuring the ordinary small investors of reasonable protection against fraud and deception. Considering the above factors, Shariah scholars have permitted investments in equity shares, but with certain conditions.

The main concern while investing in equity shares of a company is the nature of business. The holder of equity is responsible for any violation of Shariah principles. However, as a minority shareholder, which is usually the case, an investor cannot realistically expect to influence the policy of the company regarding nature and conduct of business. Hence, Shariah scholars have permitted investment in equity, provided Shariah violation about the nature and conduct of the business is within a limit.

7.2.2 Shariah Screening of Equity Stocks

To ensure compliance with Shariah principles, fund managers and investors conduct two levels of screening: Business and financial:

Business Screening

Shariah categorizes certain commercial activities as impermissible or haram. Hence the investment in the shares of any company engaged in such haram activities as its main business is impermissible under Shariah. There would be instances of business firms, which are not primarily engaged in haram activities. As part of their operations, however, they may indulge in activities that are not permissible according to Shariah. Alternatively, a firm involved in a permissible activity may have a subsidiary or have an investment in another company, which may be involved in non-Shariah-compliant businesses.

The most conservative Shariah scholars do not permit investments in the equity shares of a company which is invested in a haram business to any extent. Others allow investment in equities of companies, which derive a minor part of their income from haram activities, provided such activities are not their main area of business. In some cases, Shariah scholars agree to such relaxation only if the compromise can be justified on grounds of *maslahah* (public interest). Yet others make some exception on the ground that certain haram activities are so pervasive in the society that it is almost impossible to avoid them.

Financial Screening

While carrying out the financial screening of a company, the three aspects that need to be considered are:

- Shariah non-compliant funding (such as interest-based debt) availed by the company.
- Shariah non-compliant earnings by the company (such as income from interest-based investments and from non-halal activities).

Table 7.1 Shariah Screening Methodology

Index	Debt/ Average Market Cap	Debt/Total Assets	Cash + Interest based sources	Account Receivables	Interest Income	Revenue from Non-Shariah-Compliant Account
DJMI	33%	X	33%	33%	X	X
S&P	33%	X	33%	49%	X	5%
FTSE	X	33%	33%	50%	5%	X
MSCI	X	33%	33%	30%	X	5%
SC—Malaysia	X	33%	33%	X	X	X
AAOIFI	30%	X	33%	X	5%	X

Source Authors' compilation

- The extent of cash and receivables with the company.

Islamic finance is under scrutiny as it is argued that it has failed to meet expectations, as highlighted by the debate over "form-over-substance" among Islamic finance scholars (Hayat, 2013). One source of this concern stems from the screening methodology (Table 7.1). The different screening methodologies adopted by purveyors of Islamic indices lead to differences in identification of Shariah-compliant stocks. One firm may be certified as Shariah-compliant for one index and non-Shariah-compliant based on another methodology (Derigs & Marzban, 2008).

Further, it is pointed out that a strategy of exclusive focus on negative screening is inadequate to bring it in accordance with all the positive ethics and social prescriptions of Islam. In the words of El-Gamal (2006): "*Very little effort has been undertaken to apply positive screens as well, such as ones that would favour investment in pollution abatement or community development.*"

Given these concerns, the integration of two different approaches to ethical investing: Shariah and ESG may address some of the issues. It may enable Islamic finance to re-brand itself and bring it more in consonance with the objectives of Shariah. The integration may offer several benefits. The characteristics of Islamic and SRI investments differ in terms of asset allocations, and sectoral exposure. It is reported that Islamic funds are more skewed towards growth and small-cap stocks while SRI funds are value and large-cap oriented (Bauer et al., 2005). The integration of SRI criteria with Shariah-compliant portfolios can generate diversification benefits to fund managers, as it will mitigate portfolios' idiosyncratic risk arising from different risk profiles of Islamic and SRI stocks. Another justification in the integration of these two approaches is that SRI may aid in promoting transparency and social accountability for Islamic finance regulatory institutions (Chung et al., 2010).

The literature review brings out that there is empirical void regarding studies on the integration of these two approaches. The pioneering study on the integration of these two investment styles: Shariah and ESG are that of Erragragui and Revelli (2016). They investigate the effect of positive SRI strategy (companies with the most virtuous

or high-rated in terms of ESG scores) applied to an Islamic stock universe during 2007–2011. For this purpose, they construct Islamic portfolios based on ESG scores to test the difference in the performance of socially responsible Islamic portfolios from their counterparts. The results of their study suggest no adverse effects on returns because of application of ESG screens on Shariah-compliant stocks.

The present study aims to evaluate the performance of ESG index (Nifty 100 ESG), Shariah index (Nifty 50 Shariah), and conventional index (Nifty 50) in the Indian context. The findings of the study will contribute towards an argument for the integration of two approaches. The study also assumes significance as India is one of the fastest-growing economies of the world comprising second-largest Muslim population in the world. There exists a largely untapped market, as Islamic finance in India is yet to take root in real sense. Furthermore, there is a paucity of studies on performance evaluation of Islamic funds or indexes vis-a-vis conventional funds Dharani and Natarajan (2011), Natarajan and Dharani (2012), Dharani et al. (2019). The above-mentioned studies in Indian setting yield mixed evidence therefore offer justification to re-examine the issue.

7.3 Data and Methods

7.3.1 Data Set

The data for the study was obtained from the National Stock Exchange (NSE) of India website.[1] It consisted of monthly closing values of Nifty 100 ESG and Nifty 50 Shariah and broad-based Nifty 50 indices. The period of the study is from April 2011–December 2019. The starting period was selected keeping in view the availability of data of NIFTY100ESG. The data for SMB, HML, and WML factors was collected from Data library of Indian market[2] (Agarwalla et al., 2013).

7.3.2 NIFTY100 ESG Index

The NIFTY100 ESG index is constructed to reflect the performance of companies that are part of the NIFTY 100 index based on Environmental, Social, and Governance score. The index excludes companies engaged in the business of tobacco, alcohol, weapons, and gambling operations (NSE working paper, 2018). The companies mired

[1] See National Stock Exchange of India. (2021). Retrieved 28 March 2021, from https://www1.nseindia.com/products/content/derivatives/equities/historical_fo.htm.

[2] See Fama French and Momentum Factors: Data Library for Indian Market. (2021). Retrieved 30 March 2021, from https://faculty.iima.ac.in/~iffm/Indian-Fama-French-Momentum.

in any major environmental, social, or governance controversy are excluded. Sustainalytics, one of the global leaders in ESG research, conducts the research. The three pillars of ESG matrices are:

Environmental

It assesses the impact of the firm's activity on the environment on 52 indicators which includes carbon intensity trend, recycling and waste management process, and development of renewable energy among others.

Social

It measures the policies and impact of a firm's activity on working conditions, human rights, health and safety norms, financial inclusion, etc. This comprises of 52 Indicators.

Governance

This dimension measures the effectiveness of processes and policies related to corporate governance, business ethics, fraud, anti-corruption measures, etc. This pillar encompasses of 34 indicators. A company is rated on a score of 0 to 100 on each of these criteria. The assessment of a company's ESG performance is based on a review of the company reporting (annual reports, CSR reports, etc.), external sources (newspapers, etc.), analysis by experts, peer review, and company feedback. The company is assessed annually and in case of any controversy/incident pertaining to ESG on an ad-hoc basis.

7.3.3 Method

The study employs five risk-adjusted measures to analyze fund performance: Sharpe ratio, Treynor Index, Capital Asset Pricing Model (CAPM), Fama–French (1993) three-factor model, and Carhart's four-factor model (Carhart, 1997). The return of the indices is computed by subtracting the preceding month's index value from the present month and dividing it by the previous month's index closing value.

$$R_t = (P_t - P_{t-1}) / Pt - 1 \tag{7.1}$$

where Rt is the return of the index at time t, Pt is the current month index value, Pt-1 is the previous month's index value, respectively.

We calculate the Sharpe ratio by dividing each index excess return (Ri—Rf) to its overall risk, measured by the standard deviation.

$$SR = (R_i - Rf)/\sigma_i \tag{7.2}$$

The Treynor ratio is calculated by dividing each index excess return by its beta (systematic risk). Unlike the Sharpe ratio, the Treynor ratio considers only systematic risk, instead of total risk.

$$\text{Treynor Ratio} = (\text{R}i - \text{Rf})/\beta i \tag{7.3}$$

The first equilibrium asset-pricing model used in regression analysis is the Capital Asset Pricing Model (CAPM) measured by the following equation:

$$\text{R}i, t - \text{Rf, t} = \alpha i + \beta i(\text{Rm, t} - \text{Rf, t}) + \varepsilon i \tag{7.4}$$

where Ri, t is the return on the index as previously explained. Rm, t is the return in month t on a value-weighted market proxy, and Rf, t is the return in month t of a 1-month Treasury bill, αi is the alpha estimate, βi is systematic risk of the fund, and εi is the random error in regression.

The Fama and French model is estimated by Eq. (7.5)

$$\text{Rit} - \text{Rf}_\text{t} = \alpha_i + \beta_1\text{MKT} + \beta_2\text{SMBt} + \beta_3\text{HMLt} + \varepsilon\text{i} \tag{7.5}$$

SMBt is the difference in monthly returns between small and large-cap portfolios; HMLt is the difference in returns between value and growth portfolios.

The Carhart model added the momentum factor (Jegadeesh & Titman, 1993) to Fama and French model resulting in a four-factor model denoted as WMLt (Carhart, 1997). It is the monthly return on a portfolio long on past 1-year winners and short on past 1-year losers.

$$\text{R}_\text{it} - \text{Rf}_\text{t} = \alpha\text{i} + \beta_1\text{MKT} + \beta_2\text{SMBt} + \beta_3\text{HMLt} + \beta 4\text{WMLt} + \varepsilon\text{i} \tag{7.6}$$

In addition to this, in spirit of (Erragragui and Christophe 2016), we conduct regression to measure the relative difference in performance of Nifty 100 ESG and Nifty Shariah 50. The equation utilized is stated below:

$$\text{R}_{\text{it,esg}} - \text{R}_\text{its} = \alpha\text{i} + \beta_1\text{MKT} + \beta_2\text{SMBt} + \beta_3\text{HMLt} + \beta 4\text{WMLt} + \varepsilon\text{i} \tag{7.7}$$

where; $\text{R}_{i,t,esg}$ represents the returns of Nifty ESG 100 index and $\text{R}_{\text{i t,s}}$ is the return on Nifty50 Shariah. The independent variables are akin to as contained in Eq. (7.6).

A positive and significant αi denotes superior performance as it shows that the portfolio is yielding higher risk-adjusted return than prescribed by benchmark models of CAPM, Fama–French (1993), and Carhart (1997). αi in Eq. (7.7) shows the differential excess performance between Nifty ESG 100 index and Nifty50 Shariah.

7.4 Results and Discussions

Table 7.2 presents summary statistics of the average monthly return, maximum and minimum return (in percentage), median, standard deviation, skewness, and kurtosis.

Table 7.2 shows that Nifty 100 ESG provided the highest mean monthly return (= 0.87) and Nifty Shariah yielded the lowest return (= 0.6927). The average returns on market, SMB, HML, WML were 0.824, 0.158, −0.415, and 1,853, respectively. The magnitude of monthly momentum returns 1.853 is striking. The volatility of Nifty 100 ESG is highest and that of Nifty Shariah lowest. Among the factors, WML exhibited the highest volatility. The JB tests show that data for all the variables except HML and WML is normally distributed.

Table 7.3 contains the correlation between the three indices. It can be observed that these indices are significantly highly correlated. The correlation between Nifty 100 ESG and Nifty is 0.986. Table 7.4 reports the Sharpe and Treynor ratios. Nifty 100 ESG generated the highest Sharpe ratio followed by Nifty Shariah and Nifty50. In terms of Treynor ratio, Nifty 100 ESG generated the highest ratio (=0.3028) and Nifty Shariah lowest (=0.1521). Based on these two ratios, Nifty 100 ESG has outperformed other indices whereas the performance of Shariah index is lowest.

Table 7.5 reports regression results for the indices using the CAPM, Fama–French three-factor, and the Carhart's four-factor model. Panel A contains the results of CAPM. Panels B and C display estimates on Fama–French and the Carhart's model, respectively. Panel A demonstrates that the alpha coefficients are negative insignificant for Nifty Shariah and Nifty50. The coefficient is positive but statistically insignificant for NIFTY100ESG. The market coefficient is positive and highly significant for all the indices. The coefficient (0.691) is lowest for Nifty Shariah, specifying less volatility of Shariah index to market risk.

The regression estimates of the three-factor model provide similar results in terms of alpha and market coefficients. Among the indices, the alpha coefficient of NIFTY100ESG is insignificant positive. Shariah index exhibits the lowest market risk. The SMB factor is negative and significant for NIFTY100ESG and Nifty 50 whereas it is negative insignificant for Nifty Shariah. The magnitude of the SMB coefficient is highest for Nifty. It indicates that none of these indices are tilted towards small-capitalization firms. The HML coefficients are negative significant in all cases, emphasizing exposure towards growth rather than value stocks. Our findings conform with the results of Hoepner et al. (2011).

The Carhart four-factor model produces a similar result in terms of alpha and market coefficients as obtained using CAPM and Fama–French models. Again, only the alpha coefficient of NIFTY100ESG is insignificant positive and Shariah indices display lowest market risk. The results are similar in respect to SMB and HML as the coefficients are negative significant for all indices. WML slope is significantly positive for Shariah index, negative insignificant for Nifty ESG, and positive insignificant for Nifty. The positive and significant momentum strategy is difficult to explain as the Shariah index is a passive investment. The industry allocation of funds can account for this finding (Walkshausl and Lobe, 2012).

Table 7.2 Descriptive Statistics

	Nifty 100 ESG	Nifty50 Shariah	Nifty50	RM	SMB	HML	WML	RF
Mean	0.8783	0.6927	0.793	0.824	0.158	−0.415	1.853	0.588
Median	0.6243	1.1283	0.564	0.637	−0.040	−1.105	2.290	0.580
Maximum	15.463	9.638	12.433	13.268	9.665	16.643	18.126	0.856
Minimum	−10.489	−7.690	−9.284	−9.315	−10.132	−10.872	−20.239	0.393
Std. Dev	4.501	3.666	4.260	4.446	3.508	5.252	5.714	0.101
Skewness	0.2377	−0.029	0.095	0.085	0.0131	0.566	−0.610	0.153
Kurtosis	3.522	2.513	2.920	3.145	3.295	3.589	5.068	2.312
Jarque–Bera	2.185	1.051	0.187	0.220	0.386	7.143	25.230	2.475
Probability	0.335	0.591	0.910	0.895548	0.824	0.028	0.000	0.290
Observations	105	105	105	105	105	105	105	105

Table 7.3 Correlation

	Nifty100 ESG	Nifty50 Shariah	Nifty50
ESG	1		
Shariah	0.8588 (17.0)	1	
Nifty	0.9861 (60.39)	0.8559 (16.80)	1

Table 7.4 Sharpe and Treynor ratios

	Nifty50 Shariah	Nifty100 ESG	Nifty50
Sharpe	0.3212	0.3317	0.3164
Treynor ratio	0.1521	0.3028	0.2248

Table 7.6 reports the coefficient estimates from regressions based on CAPM, Fama and French, and Carhart four-factor models. T-statistics shown (in parenthesis) is computed using Newey–West heteroscedasticity and autocorrelation-consistent standard errors. The sample period is from January 2008 to December 2011.

The foregoing discussions bring out that performance of Nifty 100 ESG has edge over other indices. To address the issue whether this differential return is significant or not, T-test was performed. Table 7.7 reports the results. It shows the difference in return between indices is positive insignificant for all indices. The magnitude of the difference in returns is highest between ESG and Shariah index. Since our primary focus is to gauge the differential excess return between ESG and Shariah, we conducted regression using all the three models. The results are shown in Table 7.6. The alpha coefficient is positive but insignificant. The magnitude of the alpha coefficient increased substantially when more sophisticated model Carhart (1997) is used. The market coefficient is positive significant, and the momentum coefficient is negative insignificant.

7.5 Conclusions

The performance evaluation of SRI investing based on the ESG framework is an emerging area of research. The study investigated the performance of ESG funds, Shariah, and conventional indices over the period spanning from April 2011–December 2019. The study reveals that the ESG index produced maximum return and performed better than other indices based on risk-adjusted performance measures: Sharpe and Treynor ratios. However, performance measured utilizing CAPM, Fama–French, and Carhart models show the absence of statistically significant superior performance of ESG index over the other two indices. However, it may be noted that only the ESG index produces consistent insignificant positive alphas. The regression results on excess differential return between ESG and Shariah index also yield insignificant positive alpha. Another noteworthy finding is the lowest market risk of

Table 7.5 Results of regression models

	Nifty50 Shariah	Nifty100 ESG	Nifty50
Panel A—CAPM			
A	−0.058(−0.34)	0.063(0.47)	−0.011(−0.09)
Market	**0.691 (14.4)**	**0.964(19.8)**	**0.917(25.4)**
R^2	69	89	90
Panel B—Fama–French			
A	−0.102(−0.56)	0.010 (0.09)	−0.049 (−0.69)
Market	**0.761(13.24)**	**1.06(23.7)**	**1.00 (35.2)**
SMB	−0.092(−1.90)	**−0.172(−5.85)**	**−0.201(−7.67)**
HML	**−0.102(2.28)**	**−0.139(−6.17)**	**−0.119(−5.93)**
R^2	72	93	94
Panel C—Carhart			
α	−0.305(1.74)	0.020 (0.16)	−0.105(−1.28)
Market	**0.819(16.49)**	**1.058(28.07)**	**1.02 (37.0)**
SMB	**−0.095(−2.25)**	**−0.172(−5.82)**	**−0.202(−8.12)**
HML	**−0.085(−1.94)**	**−0.139(−5.69)**	**−0.115(−5.31)**
WML	**0.106(2.51)**	−0.005(−0.18)	0.029(1.654)
R^2	74	93	94

The figures in bold denote significance at 5% or better

Table 7.6 Regression results: Differential performance

	CAPM	FF	Carhart
A	*0.121(0.62)*	*0.112(0.57)*	*0.325(1.61)*
Market	***0.272(6.18)***	***0.300(5.76)***	***0.238(4.36)***
SMB	-	*−0.079(−1.43)*	*−0.077(−1.43)*
HML	-	*−0.037(−0.84)*	*−0.055(−1.28)*
WML	-	-	***−0.111(−2.89)***
R^2	27	29	34

The figures in bold denote significance at 5% or better

Table 7.7 The difference in Return between indices

	Difference (t-stat)
ESG-Shariah	0.186 (0.94)
ESG-Nifty	0.085 (1.39)
Nifty Shariah	0.100 (0.55)

Shariah index and its tilt towards the momentum portfolio. Further, all indices are exposed to growth stocks. Taken together, the evidence suggests no clear indication of outperformance of ESG index over other indices. However, we can safely conclude that ESG provides the best performance among all indices.

The findings have implications for investment decisions. An investment strategy that integrates twin criteria: Shariah and ESG may yield higher return and can offer diversification benefits. Further, integrating the twin screening criteria may move Islamic finance beyond the tick-box approach and closer to its substance. The convergence of ESG and Shariah criteria may enable Islamic finance to re-brand itself. Furthermore, the adoption of ESG framework may increase transparency, reduce information asymmetry, and bring accountability of Islamic financial institutions.

However, the results should be interpreted with the following caveats. The findings are based on a small sample, short period, and are drawn from one setting. The non-exclusive nature of stocks among the indices may cast an influence on findings. Moreover, the application of the industry-adjusted model may generate different results. The index is based on the aggregate ESG score. This may have confounded the results. The analysis of different dimensions of ESG issues on performance would have provided more insightful results.

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Chapter 8
Sustainable Investment and Transparency Recommendations in Segmented Markets: An Application to Islamic Investment Accounts

Ahmed M. Badreldin and Bernhard Nietert

Abstract Sustainable investment projects, such as those envisioned within the United Nations's Sustainable Development Goals, are impossible without sustainable financing, which in turn can only be secured if investors have long-term trust in these projects. Trust problems are severe for private investors, in particular in Islamic financial systems where intransparent Islamic investment accounts are responsible for 63% of the funding of Islamic banks. In this chapter, we develop sustainable investment recommendations to facilitate long-term trust in investments and apply these sustainable investment recommendations to 72 Islamic investment accounts across 13 countries. Moreover, we propose simple five-star rating transparency recommendations based on these sustainable investment recommendations.

8.1 The Problem of Trust for Climate Finance

The UN's Sustainable Development Goals (SDGs) aim at ensuring long-term economic and social sustainability (UN, 2015). To achieve these goals, both public and private actors need to repeatedly engage in investment projects that meet the sustainable development criteria. These are usually projects with a green, ethical, or socially-oriented focus in today's financial markets. Implementing such long-term investment projects, however, requires sustainable funding which depends on financiers' trust in these projects. This issue has gained much attention in recent years prompting the Review of Financial Studies to initiate a competition in 2017 to encourage scholars to develop research proposals on this topic (Hong et al., 2019).

These recent developments and efforts highlight the recognition that without initial trust, a project's funding will not materialize at all. While without long-term trust, financiers might be willing to provide funds initially, they will withdraw them as soon as better investment opportunities arise. This lack of long-term trust defeats the idea of long-term investments in sustainable projects, which will not only threaten the

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funding for sustainable projects but may also induce systemic risk. This problem of large-scale withdrawals has been integrated in the Basel III Framework, specifically within the aspect of Net Stable Funding which sets incentives for relatively stable medium- and long-term funding sources for banks (Lang & Schmidt, 2016). However this addresses the problem from the supply side (banks), but not from the demand side (depositors). To create incentives for depositors to provide medium- and long-term funding they require a degree of long-term trust. These trust problems are particularly severe for (less sophisticated) private investors who are the backbone and primary source of funding for the banking and insurance industries, which in turn act to finance larger projects.

8.1.1 Solutions for Trust Problems in the Literature

One commonly employed method to assure and gain the trust of private individuals and help them judge the quality of running projects has been the development of rankings/ratings for different financial investments (Binici & Hutchison, 2018). Yet utilizing ratings/rankings to ensure trust in long-term projects has two problems: First, how can it be guaranteed that ratings/rankings concentrate on long-term quality (in excess of 5 years) and not just give short-term investment recommendations that do not suit long-term sustainability (and thus are useless for ensuring long-term funding)? Second, how can it be guaranteed that systemic risk would not arise because of these investment recommendations by advising financiers to withdraw funds from investments with low ratings/rankings?

Regarding the first problem, the literature seems at a dead end: Friend and Blume (1970) clarify that long-term return averages have no meaning in a Capital Asset Pricing Model (CAPM)-world because on average and in the long-term the misvaluation always equals zero. This can be interpreted as a consequence of the efficient market hypothesis, according to which, long-term mispricing cannot occur since the (free) market regulates itself and reverts to its long-term average. Consequently, misvaluation can only exist for short-term deviations yielding short-term investment recommendations. Having hit this dead-end, the literature abandoned the idea of long-term investment recommendations and explored other topics in connection with short-term investment recommendations and performance measurement: One strand of the literature concerned itself with the data input for valuation models: Admati and Ross (1985) and Glosten and Jagannathan (1994) argue in favor of conditional expectations and reject unconditional ones. Ferson and Schadt (1996) compare unconditional and conditional approaches. Mamaysky et al. (2007) consider five-year rolling estimation windows to capture conditional expectations, while Elton et al. (2011) advocate computing mutual fund betas from individual security betas using holdings data at a point in time instead of estimating them from time series regressions. Another strand concerned itself with disentangling the effects of selectivity/investment recommendations and market timing in performance measurement: To name just a few pioneering examples from this strand: Jensen (1968), Henriksson

and Merton (1981), Admati et al. (1986), and Lehmann and Modest (1987)—Of this strand, only, Brown and Goetzmann (1995) point towards the lack of long-term recommendations and try to address this by analyzing repeated short-term successes of managers at stock picking. Yet repeated short-term success should not be confused with long-term success because repeated short-term investments still focus on short-term return distortions over the next period (stock picking), whereas long-term investment is concerned with investment project selection and asset allocation. In a similar approach, Agudelo, Byder and Yepes-Henao (2019) differentiate short- and long-term performance by changing the return frequency from daily to monthly or annual returns which simply puts limitations on the ability of the investor to rebalance their asset allocation for one month or one year but does not imply long-term investment orientation in the sense of investment project selection.

However, we believe it may be premature for the literature to completely abandon the idea of long-term investment recommendations. On the one hand, transparent products are a prerequisite of efficient markets meaning that any lack of transparency might make long-term misvaluation economically possible. The fact that transparency can in fact be lacking is handled first within the information CAPM of Merton (1987), which explicitly addresses the problem that some assets are not transparent in the sense that investors do not have information about them. Similarly, green/socially responsible stocks are niche products and are assumed to be less transparent than their counterparts (Durand, Koh & Limkriangkrai, 2013 or Nofsinger & Varma, 2014). Finally, non-capital or non-money market assets might be subject to more transparency issues than capital or money market assets. For example, Islamic investment accounts, which belong to the broader group of socially responsible investments (Akhtar et al., 2017), while at the same time acting as an equivalent to conventional savings accounts or time deposits, are regarded as highly intransparent because their returns depend not only on the underlying investments, but also on cash flow transformations undertaken by the bank that offers the Islamic investment account (IFSB15). Cash flow transformations comprise the diversification/pooling strategy of the financial institution, management fees to be deducted along with any practices of income smoothing using reserves or equity. These transformations make investment accounts distinct from a simple mutual fund structure.

On the other hand, Friend and Blume (see footnote 26 in Friend and Blume 1970) already suggested that, if a market is segmented, several capital market lines arise instead of just one, a further fact that might make long-term misvaluation technically possible. This possibility seems to have been overlooked since, to the best of our knowledge, no long-term investment recommendations have been developed as of today (for segmented markets or otherwise). This is especially puzzling because valuation formulas for ESG investments (segmented markets with respect to ethical investments) are well known since Heinkel et al., 2001 and the performance of ESG-assets is analyzed quite intensively (see for example, Arouri et al., 2012; Deng et al., 2013; Capelle-Blancard and Monjon 2014, as well as Nofsinger and Varma 2014).

Regarding systemic risk (second problem), there seems to be a trade-off between transparency and withdrawal of funds. On the one hand, with no transparency there will be very limited funding. On the other hand, full transparency which

includes publication of bad news can result in very high, not to say systemic, withdrawal risk. Del Guercio and Tkac (2008) find for Morningstar ratings statistically and economically significant positive abnormal inflows into mutual funds following rating upgrades and negative abnormal outflows following rating downgrades. Jitmaneeroj, Lamla and Wood (2019) find that transparent communication can crowd out private information leading to overreactions by individuals to public signals which leads to a loss of accuracy in expectations but reduces uncertainty and disagreement. With Islamic investment accounts withdrawal risk and its potential systemic relevancy is even mentioned by the regulator (IFSB, 2010 Guidance Note 3, Article 9). Even though the problem of fund flows is recognized, no solution to the transparency/withdrawal tradeoff has been provided until now.

8.2 Objectives and Contribution

Therefore, the two objectives of this chapter are, first, to develop long-term (sustainable) investment recommendations applicable to real-world products and second, to propose transparency recommendations that mitigate the transparency/withdrawal trade-off. These recommendations are then empirically applied, providing sustainable investment and transparency recommendations to Islamic investment accounts.

In the next section we introduce the design of the analysis including the methodology of development of sustainable investment recommendations, followed by a section presenting the empirical data set and data cleaning. The fifth section contain the empirical results regarding sustainable investment recommendations for Islamic investment accounts and the application of the rating system addressing transparency recommendations under consideration of systemic withdrawal risks followed by a sixth section which discusses the potential forms of communicating investment recommendations, as well as our final recommended form. The last section concludes.

8.3 Design of the Analysis

8.3.1 Institutional Background of Islamic Finance and Islamic Investment Accounts

Since Islamic investors are not allowed to invest in riskless interest-bearing assets like bonds, savings accounts or time deposits, Islamic investment accounts have been developed as an alternative.

Islamic investment accounts are owned by the depositors and their returns depend on the cash flow of the underlying investments (which follow either a mark-up or a profit and loss sharing structure). However, the cash flows of the underlying contracts

Table 8.1 Investment accounts as a percentage of total liabilities for 71 banks in 12 countries at 2016 Q2

Investment accounts	Arithmetic average at 2016 Q2	Investment accounts	Arithmetic average at 2016 Q2
Bahrain	68.49%	Malaysia	82.28%
Bangladesh	75.93%	Pakistan	57.40%
Egypt	77.98%	Qatar	56.55%
Indonesia	58.29%	Syria	16.28%
Jordan	69.58%	Turkey	45.02%
Kuwait	68.09%	UAE	80.05%

are not directly transferred to investment account holders; instead, cash flow transformations occur first using a number of different techniques, namely (1) pooling, (2) management fees, and (3) smoothing and reserves. The extent to which these techniques are practiced is not published and for that reason it becomes unclear how the final cash flows received by the investment accountholders compare to the original ones. Therefore, returns on Islamic investment accounts are both stochastic and intransparent.[1] Islamic investment accounts account on average for 63% of Islamic banks' funding as Table 8.1 illustrates and, therefore, constitute systemic funding.

In addition, Islamic financial assets and Islamic financial intermediaries cannot and should not be considered independent of one another since Islamic financial intermediaries must, by definition, invest in Islamic financial assets: 73% of all Islamic financial assets held for investment purposes are owned by Islamic banks, 3% by Islamic mutual funds, and 2% by Islamic insurance companies (The Economist, 2014; Reuters, 2015). Consequently, Islamic investment accounts should be seen as being of systemic relevance to countries where Islamic banks operate.

In summary, even though in absolute numbers, the volume of Islamic financial assets comprises only 0.7% of global financial assets whereas socially responsible investments encompass approximately 7% of global financial assets (Ro, 2015), Islamic investment accounts are more systemic than green investing.

8.3.2 Development of Sustainable Investment Recommendations

Sustainable investment recommendations comprise (i) a consistency aspect; (ii) a robustness aspect; (iii) ranges. Each of these aspects are discussed after introducing the valuation formulas used:

[1] For more details on institutional aspects of Islamic investment accounts and data availability for different countries, see Badreldin (2018).

Valuation Formulas on Segmented Markets

Valuation formulas for Islamic investment accounts are available from Badreldin (2018), and provide the required expected return on Islamic investment accounts in market equilibrium on both double and single segmented markets:

On a double segmented market Islamic investors can neither invest in non-Islamic stocks (first segmentation) nor in interest-bearing riskless assets (second segmentation). Such a double segmented market is relevant for countries like Bahrain, Bangladesh, Indonesia, Kuwait, Malaysia, Nigeria, Oman, Pakistan, Qatar, Sri Lanka, Saudi Arabia, Thailand, Turkey, and the United Arab Emirates (UAE). On a single segmented market with respect (only) to the riskless asset refers to countries that do not publish an Islamic stocks index. Hence, investors cannot (effortlessly) differentiate between Islamic and non-Islamic stocks. However, these markets possess an Islamic banking sector and, thus, investors are still able to distinguish between interest-bearing and non-interest-bearing riskless assets. Such a single segmented market with respect to riskless assets is of relevance for countries like Algeria, Egypt, Iraq, Jordan, Lebanon, Libya, Maldives, Philippines, and Syria. It should be noted that investors are may be able to differentiate between Islamic and non-Islamic stocks using independent (commerical) stock-filtering providers, however here we refer only to the absence of an official provider (through the stock exchange for example).

Double segmented market:

$$E\{R_{IA,i,t+1}\} = \frac{cov(R_{M_{IS},t+1};\, R_{M,t+1}) - cov(R_{IA,i,t+1};\, R_{M,t+1})}{cov(R_{M_{IS},t+1};\, R_{M,t+1}) - cov(R_{M_{IA},t+1};\, R_{M,t+1})} \cdot E\{R_{M_{IA},t+1}\} + \frac{cov(R_{IA,i,t+1};\, R_{M,t+1}) - cov(R_{M_{IA},t+1};\, R_{M,t+1})}{cov(R_{M_{IS},t+1};\, R_{M,t+1}) - cov(R_{M_{IA},t+1};\, R_{M,t+1})} \cdot E\{R_{M_{IS},t+1}\} \tag{8.1}$$

where t denotes the point in time at which the decision is made, $t+1$ the planning horizon, $R_{j,i,t+1}$ the return of asset i from asset class j between t and $t+1$, $R_{j,t+1}$ the return of the entire asset class j between t and $t+1$, $E\{.\}$ the expected value operator, $cov(.)$ the covariance, IS the asset class of Islamic stocks, IA the asset class of Islamic investment accounts, M the market portfolio of all assets, M_{IA} the market portfolio of the asset class (in short: sub-market portfolio) Islamic investment accounts, and M_{IS} the market portfolio of the asset class Islamic stocks. Single segmented market with respect to the riskless asset:

$$E\{R_{IA,i,t+1}\} = \frac{cov(R_{M_{AS},t+1};\, R_{M,t+1}) - cov(R_{IA,i,t+1};\, R_{M,t+1})}{cov(R_{M_{AS},t+1};\, R_{M,t+1}) - cov(R_{M_{IA},t+1};\, R_{M,t+1})} \cdot E\{R_{M_{IA},t+1}\} + \frac{cov(R_{IA,i,t+1};\, R_{M,t+1}) - cov(R_{M_{IA},t+1};\, R_{M,t+1})}{cov(R_{M_{AS},t+1};\, R_{M,t+1}) - cov(R_{M_{IA},t+1};\, R_{M,t+1})} \cdot E\{R_{M_{AS},t+1}\} \tag{8.2}$$

where AS denotes the asset class of all (Islamic and non-Islamic) stocks and M_{AS} the sub-market portfolio of (all) stocks.

Sustainability: The Aspect "Long-Term Perspective"

Investment recommendations in the classical CAPM framework are implemented as follows: The conditional expectation $E\{R_{i,t}|R_{M,t}\} = \beta_{i,0} + \beta_{i,1} \bullet R_{M,t}$, which represents the required expected return, is computed with the help of $R_{M,t}$, which is is observable at time t. Then $E\{R_{i,t}|R_{M,t}\}$ and $R_{i,t}$, the actual observable return at time t, are contrasted to identify whether asset i is correctly or incorrectly valued. In the latter case, price adjustments at time $t + 1$ must occur that can be used for trading gains.

Due to the focus on $R_{M,t}$ only the market portfolio's return realization at time t is considered. Therefore, just a forecast for one period is obtained, i.e., a kind of snapshot regarding mispricing is offered. A longer history of returns, i.e., several periods are not taken into consideration. Moreover, price adjustments between times t and $t + 1$ imply a rather fast restructuring of invested funds. For both reasons, the approach of specifying expectations in valuation Eqs. (8.1), (8.2) with the help of conditional expectations is clearly short-term and not suited for implementing the "long-term perspective" of sustainable investment recommendations for Islamic investment accounts.

To integrate the "long-term perspective" into valuation Eqs. (8.1), (8.2), the expected values $E\{R_{M_{IA},t+1}\}$, $E\{R_{M_{IS},t+1}\}$, and $E\{R_{M_{AS},t+1}\}$ are specified as return averages over τ periods thereby allowing forecasts over τ-periods and not just for one period as it would be the case with the conditional expectation $E\{R_{IA,i,t}|R_{M_{IA},t}, R_{M_{IS},t}, R_{M,t}\}$ for example. Note, however, that in an unsegmented market setting like the classical CAPM, τ-period return averages have no meaning because on average the misvaluation always equals zero as it is known since Friend/Blume (1970) explained that the regression coefficient (beta) is determined in a way so that variance of errors is minimized where the expected value of errors equals zero. In a segmented markets model, however, factor loadings deviate from regression coefficients, which is why the unconditional expected value is usually unequal to zero and thus economically meaningful.

All expected values, variances, and covariances in valuation Eqs. (8.1, 8.2) are estimated based on the past τ observations. Consequently, two immediate questions arise:

- What is a reasonable number for τ?
- Do investment recommendations of different number of τ coincide? and, if not, how can they be combined to yield consistent investment recommendations?

To answer the first question, we use our full sample as a first specification of τ as long as the number of observations is relatively small; let us say 40 quarters or less. Otherwise, we use the last 40 quarters (10 years) because 40 observations contain enough observations to apply statistical methods and double the time period of the commonly used long-term rolling estimation window length of five-years

(Mamaysky et al., 2007). As a second specification, we choose five-year rolling estimations, since on the one hand it contains enough observations to be regarded as long-term. On the other hand, five years can be considered long enough to capture changes in the real economy (structural breaks) and, hence, allow observing whether management is able to react to this modified economic environment. The five-year window is then rolled by one quarter to encompass a potentially different economic environment. In the process of rolling, we use overlapping estimation windows, i.e., only the oldest observation is replaced by a new observation, because non-overlapping periods would require too many observations that are not currently available (see the section on data set).

In answering the second question, a classification and weighting of inconsistencies must be undertaken. Given that the following cases can occur, we would like to suggest a translation of inconsistencies into investment recommendations as follows (see Table 8.2).

The economic idea behind this implementation of consistency is the following: If an Islamic investment account is overvalued, bank management might want to replace the managers who are responsible for this Islamic investment account. However, replacing managers does not necessarily make Islamic investment accounts immediately better. The new managers must demonstrate that they are able, first, to generate repeatedly good returns and, second, to compensate for the past performance deficit. Therefore, both rolling and full-sample valuations as well as their comparison (consistency) are needed. On the flip side, if a good Islamic investment account has a bad quarter, nothing will happen as long as the performance in that one bad quarter is not significant enough to bring down the five-year rolling estimation.

Sustainability: The Aspect "Robustness"

The aspect "robustness" consists of two components, namely statistical estimation problems as well as accuracy issues with the identification of mispricing, both of these components will be explained below.

Statistical Estimation Problems

Statistical estimation problems can arise from length of estimation window (sample size effects), estimation at different points in time, and/or the use of different statistical estimators.

- **Length of the estimation window:**

  This particular statistical estimation problem describes the sample size effect, i.e., mispricing judgements may vary based on the number of observations used. From an economic point of view, investment recommendations will not be sustainable if, for example, an undervalued valuation based on 30 observations is suddenly reversed to an overvaluation when 100 observations are taken into account. Therefore, sustainable investment recommendations must acknowledge the effect of different estimation windows.

  Formally, the effect of different estimation windows is already captured within the comparison of full sample versus rolling estimation windows: Full sample contains more observations than the subsample of rolling estimation windows. Therefore, the solution to the problem of inconsistent investment recommendations due to different estimation windows

Table 8.2 Translation of inconsistencies into investment recommendations

Case 1: No inconsistency	**Description:** Investment recommendations of full sample and all rolling windows coincide **Investment recommendation:** Follow the investment recommendation of full sample or any rolling window (since they are identical) **Example:** Full sample and all rolling windows read "overvalued" **Consequence:** Overvaluation/withdraw funds
Case 2: Inconsistency, but no contradiction	**Description:** Full-sample is correctly valued, but all rolling windows indicate an identical incorrect valuation or Full-sample reports incorrectly valued and all rolling windows indicate correctly valued **Investment recommendation:** Follow the investment recommendation that indicates incorrectly valued since a correctly valued report, although not consistent, does not contradict the mispricing recommendation. In other words, correctly valued is regarded as neutral **Example:** Full sample is "correctly valued", all rolling windows indicate "overvalued" **Consequence:** Overvalued/withdraw funds are obtained as final judgement
Case 3: Inconsistency and complete contradiction	**Description:** Full-sample and all rolling windows reach different conclusions than the full sample regarding correctly/incorrectly valued **Investment recommendation:** No recommendation possible since there is no distinct direction of mispricing **Example:** Full sample indicates "overvalued", all rolling windows "undervalued" **Consequence:** No recommendation

(continued)

is already included within the aspect "consistency". In fact, "consistency" already captures the two statistical estimation problems: "length of estimation window" and "different points in time".

- **Different points in time:**

Table 8.2 (continued)

Case 1: No inconsistency	**Description:** Investment recommendations of full sample and all rolling windows coincide **Investment recommendation:** Follow the investment recommendation of full sample or any rolling window (since they are identical) **Example:** Full sample and all rolling windows read "overvalued" **Consequence:** Overvaluation/withdraw funds
Case 4: Inconsistency and partial contradiction	**Description:** Full-sample and some rolling windows reach different conclusions than the full sample regarding correctly/incorrectly valued **Investment recommendation:** If the last "x" quarters, where "x" is the less than the full sample number of quarters of data available, of the rolling window do not contradict each other (internal consistency) and do not contradict full-sample (external consistency), the investment recommendation follows the full-sample. This behavior can be justified by means of a "trend" argument: rolling estimation windows move in the same direction as full sample If the last "x" quarters do contradict each other or contradict the full-sample recommendation, no investment recommendation is given. There is no sustainable "trend" regarding the direction of mispricing For our empirical application we decide to set "x" equal to four. The decision to take only four quarters is an attempt to isolate one business cycle across a year; however, one may decide to use more (or less) quarters to identify a longer (shorter) trend. Thus, the choice to use four quarters should be considered anecdotal in this paper. Further testing of how many quarters would perform best would be required if a set standard is to be achieved **Example:** Full sample indicates "overvalued". From the overall 10 rolling windows' valuations, six are "overvalued", one is "correctly valued", and three "undervalued" **Consequence:** If the last four rolling windows read correctly valued and overvalued, the overall valuation is overvalued (no contradiction with full sample, since correctly valued is regarded as neutral) If the last four rolling windows read correctly valued and undervalued, the overall valuation is "no recommendation" (contradiction with full sample)

Different points in time reflects the fact that mispricing might change over time. While the changing quality of Islamic investment accounts over time might have economic reasons—namely managers adjusting to new economic conditions—it must nevertheless be separated from a purely statistical effect. For example, an overvaluation in the 1st quarter of 2015 that suddenly changes to an undervaluation in the 2nd quarter of 2015 is not a reliable component for a sustainable recommendation. Management quality takes more than one quarter to exert an effect that can be deemed sustainable.

Since the formal effect of different points in time is already contained in the comparison of full sample versus rolling estimation windows, the solutions presented there already address the problems of different points in time as well by concluding "no recommendation" as a conservative approach indicating that such sudden shifts in valuation are most likely the effect of a statistical error or short-term economic fluctuations rather than sustainable economic reasons.

Sustainability: The "Ranges" Aspect

In real market situations Islamic investment accounts will never meet the strict definition of being correctly valued since an exact zero difference between the actual and required expected returns is unlikely to occur. One option would be to test if the differences between actual and required τ-period return averages are statistically different from zero as done quite often in the literature, yet these statistical tests overlook economic significance. Statistical differences from zero may not be worth acting upon in an economic setting, i.e., moving funds may be more costly than abnormal gains/losses from every statistically significant mispriced asset. For that reason, it is important to define a range where an Islamic investment account can still be considered as correctly valued even though the differences between actual and required τ-period return averages is close to but not exactly equal to zero. These ranges capture economic significance instead of statistical significance because they specify buffers that separate correct from incorrect valuation instead of relying on statistical significance.

In general, ranges can be formalized as follows:

- "Actual return > Required return + buffer"
  - o → asset undervalued → recommendation: deposit funds
- "Required return + buffer < Actual return < Required return + buffer"
  - o → asset correctly valued → recommendation: hold
- "Actual return < Required return - buffer"
  - o → asset overvalued → recommendation: withdraw funds

In our empirical application, we choose a buffer of 5% and 10% relative to the required return.

Table 8.3 Sustainable investment recommendations scheme

			Full sample		
			Overvalued	**Correctly Valued**	**Undervalued**
Rolling estimation window	**Overvalued** (across all observations)		Withdraw Funds	Withdraw Funds	No Recommendation
	Correctly Valued (across all observations)		Withdraw Funds	Hold	Deposit Funds
	Undervalued (across all observations)		No Recommendation	Deposit Funds	Deposit Funds
	Inconsistent across observations ("x" was chosen to equal 4 in our analysis)	Last "x" Quarters **Overvalued**	Withdraw Funds	Withdraw Funds	No Recommendation
		Last "x" Quarters **Correctly Valued**	Withdraw Funds	Hold	Deposit Funds
		Last "x" Quarters **Undervalued**	No Recommendation	Deposit Funds	Deposit Funds
		Last "x" Quarters' Inconsistent Valuations	No Recommendation		

Sustainable investment recommendations can now be implemented with the help of "consistency", "robustness", and "ranges" as follows:

Improved Scheme for Reaching "Sustainable" Investment Recommendations.

It is important to note that the resulting scheme for sustainable investment recommendations (deposit, hold and withdraw) as presented in Table 8.3 has two limitations, namely that it does not distinguish strength of mispricing nor does it differentiate between degrees of consistency at different point in time. The first limitation can be illustrated with the following example: An asset that is considerably undervalued receives a "deposit" recommendation with equal meaning as an asset that is barely undervalued (but exceeding the set range for correctly valuation). This limitation is intentionally not addressed since we assume the objective is to identify, differentiate and eventually fund the "good" long-term sustainable projects as opposed to "bad" ones, and not to differentiate *within* the group of "good" ones. This is based on the focus on long-term and distancing away from short-term oriented investments and speculation which are sufficiently addressed in the short-term mispricing literature.

Addressing the second limitation implies that valuations consistent across all rolling window observations should translate into stronger investment recommendations than those valuations that are not consistent across all rolling window observations and instead depend on only the last four rolling window valuations being utilized (case 4 from the section on the "consistency" aspect). To address this limitation and transparently communicate recommendations that differentiate investment recommendations with regards to the degree of consistency of recommendations, an aggregation scheme for the "consistency" aspect must be designed. Since the design of such a scheme does not in itself hinder the ability to reach sustainable investment

Table 8.4 Number of stars and explanation of their implied quality assessment

Number of stars	Explanation of the Quality assessment
★★★★★ 5 stars	Strong deposit, i.e., deposit recommendation from both 10 years evaluations and all rolling five-year evaluations
★★★★ 4 stars	Weak deposit, i.e., deposit recommendation from both 10 years evaluations and only the last 4 rolling five-year evaluations
★★★ 3 stars	Hold, i.e., hold recommendation from both 10 years evaluations and all rolling five-year evaluations
★★ 2 stars	Weak withdraw, i.e., withdraw recommendation from both 10 years evaluations and only the last 4 rolling five-year evaluations
★ 1 star	Strong withdraw, i.e., withdraw recommendation from both 10 years evaluations and all rolling five-year evaluations
⊙ No recommendation	Contradiction between 10 years evaluations and at least the last four rolling 5-year evaluations

recommendations, it therefore does not belong to the general research design. We discuss its design in the section on transparency recommendations.

To integrate the strength of the recommendation, the following rating system is established (Table 8.4):

8.4 Data Set and Data Cleaning

8.4.1 Data Set

The data set that is needed to empirically implement Eq. (1 and 2) can be illustrated best if the composition of the market portfolio's return is inspected in detail. The market portfolio's return equals the wealth-weighted return of all asset classes on a segmented market (Islamic stocks, non-Islamic stocks, Islamic investment accounts, riskless asset, current account), where wealth invested in asset i from asset class j divided by total wealth over all assets from all asset classes is used as a weight for the return of asset i from asset class j:

$$
\begin{aligned}
R_{M,t+1} = & \frac{W_{M,IS,t}^{T}}{1^{T} \bullet W_{M,IS,t} + 1^{T} \bullet W_{M,nIS,t} + 1^{T} \bullet W_{M,IA,t} + W_{M,0,t} + W_{M,CA,t}} \cdot \\
& \begin{pmatrix} R_{IS,1,t+1} \\ \vdots \\ R_{IS,n_{IS},t+1} \end{pmatrix} + \frac{W_{M,nIS,t}^{T}}{1^{T} \bullet W_{M,IS,t} + 1^{T} \bullet W_{M,nIS,t} + 1^{T} \bullet W_{M,IA,t} + W_{M,0,t} + W_{M,CA,t}} \cdot \\
& \begin{pmatrix} R_{nIS,1,t+1} \\ \vdots \\ R_{nIS,n_{nIS},t+1} \end{pmatrix} + \frac{W_{M,IA,t}^{T}}{1^{T} \bullet W_{M,IS,t} + 1^{T} \bullet W_{M,nIS,t} + 1^{T} \bullet W_{M,IA,t} + W_{M,0,t} + W_{M,CA,t}} \cdot \\
& \begin{pmatrix} R_{IA,1,t+1} \\ \vdots \\ R_{IA,n_{IA},t+1} \end{pmatrix} + \frac{W_{M,0,t}^{T}}{1^{T} \bullet W_{M,IS,t} + 1^{T} \bullet W_{M,nIS,t} + 1^{T} \bullet W_{M,IA,t} + W_{M,0,t} + W_{M,CA,t}} \bullet r + \\
& \frac{W_{M,CA,t}^{T}}{1^{T} \bullet W_{M,IS,t} + 1^{T} \bullet W_{M,nIS,t} + 1^{T} \bullet W_{M,IA,t} + W_{M,0,t} + W_{M,CA,t}} \bullet 0
\end{aligned}
\tag{8.3}
$$

where $R_{j,i,t+1}$ denotes the return of asset i from asset class j in the period between t and $t+1$, 1^T transposition of vectors and matrices, $W_{M,j,t}$ is the vectors of wealth invested in asset i from asset class j in market equilibrium, subscript CA refers to the asset class current accounts, and subscript 0 refers to the asset class "riskless asset".

Equation (8.5) clarifies three aspects regarding the data set: First, the length of the time between t and $t+1$ must be specified, otherwise, returns cannot be computed properly. Second, the weight of each asset is needed, i.e., volume figures in addition to return figures must be provided. This implies that a stock index can no longer be taken as a proxy for the market portfolio since the market portfolio is no longer structurally identical to the stock index. Third, both the riskless asset as well as current accounts are not in zero net supply. On the one hand, this follows simply from an empirical observation, on the other hand, this is due to the construction of portfolio weights: Portfolio weights of risky investments and current accounts are optimally determined given the interest on these assets (exogenous interest rate) and then aggregated in market equilibrium. The interest rate is not endogenously determined to yield zero net supply of riskless assets and current accounts in equilibrium.

Length of the Time Period Between t and $t+1$

We specify the length of the time between t and $t+1$ as one financial quarter since this is the shortest investment horizon, we can observe for Islamic investment accounts using banks' quarterly financial statements. For that reason, all returns (including interest rates) are computed as discrete quarterly returns even if returns are available on a daily basis (which is the case for stocks for example).

Observation Period

We obtain observations from 2008Q1 to 2016Q2. Before 2008Q1 the majority of Islamic banks provide no or only annual data on their websites.

Computation of Weights of the Market Portfolio

When determining weights of the market portfolio, we use the wealth at a base quarter, namely 2016Q2. We must not take historical wealth levels invested at each quarter since these vary across time. For example, the composition of an Islamic stock index suffers from a massive constituent bias over time because some stocks lose their classification as "Islamic". This is further explained in the section on stocks data below. This constituent bias can be eliminated if the constituents as of 2016Q2 in their respective weight of 2016Q2 are taken for all quarters.

Data on Asset Classes

Data on individual assets and on sub-market portfolios (asset classes) are needed. Since, however, the volume of the sub-market portfolio is simply the sum of the volume of the individual assets and the return of the sub-market portfolio equals the sum of the volume-weighted returns of the individual assets, only individual assets require further consideration.

Islamic Investment Accounts

The data on individual Islamic investment accounts is obtained directly from each individual bank's published financial reports. The quarterly volume of Islamic investment accounts of each bank is taken as the position "Volume of Investment Accounts" or its respective equivalents such as "Volume of *Mudharabah*-based deposits".

Returns on individual Islamic investment accounts are calculated as revenue distributed at the end of the investment period divided by the funds invested. The quarterly return of one particular bank's Islamic investment accounts can thus be computed as "Income attributable to *Mudharabah*-based deposits" divided by the "Volume of M*udharabah*-based deposits" at the last day of each quarter. We cannot make any claims whether these returns have been smoothed prior to being made available to investment account holders, nor can we guarantee that Islamic banks which belong to a broader bank holding company do not obtain funding "aid" from their holding company.

Note in this connection that the computation of returns of Islamic investment accounts does not involve differencing as it is the case with stock returns, i.e., $\frac{P_{stock,t+1}-P_{stock,t}}{P_{stock,t}}$, which explains why their time series possesses a unit root, as outlined in the previous section on "statistical estimation problems".

Stocks

On double-segmented markets we collect data on indices of All-stocks and Islamic stocks and compute a non-Islamic stocks index as the difference between the two; given that, by definition, the All-stocks index is a weighted average of Islamic and non-Islamic stocks. We cannot observe a non-Islamic stocks index as no country publishes such an index (since it is unclear who would be interested in investing only in stocks that do not comply with Shariah criteria), this is why we must compute the index ourselves. It is important to note that the composition of indices in general and Islamic indices in particular changes dramatically over time (S&P Dow Jones, 2011). Companies that do not comply with Shariah, by engaging in non-Shariah-compliant business activities or taking out non-Islamic loans, are periodically eliminated from the Islamic index (subject to periodic review by the index's review board). These changes in index constituents are compensated by the index provider by using a specific compensation factor when rebalancing (S&P Dow Jones, 2011). On single segmented markets with respect to the riskless asset, we collect data on All-stocks since, by definition, no distinction between Islamic and non-Islamic stocks is publically available on these markets.

Data on the volume of single stocks is not required for our calculations since the volume of the sub-market portfolios of stocks can be captured by the market capitalization of the published indices. In this connection we take net market capitalization figures of the indices, which is simply the full market capitalization adjusted for free float (S&P Dow Jones, 2015). Most stock exchanges were found to publish net market capitalization while information on full market capitalization was rarely available.

Returns of stocks were obtained from Thomson Reuters- EIKON DataStream, while returns on indices were obtained from the respective stock exchange or from direct contact with S&P Dow Jones Indices.

Data on Riskless Assets

Conventional investors have the choice between a number of riskless assets such as T-Bills or a more accessible conventional saving deposit (or a mixture of both). The data for volume and returns of all riskless assets was collected from the periodic reports of the respective central banks or reports of finance ministries of each country. We decide to include both riskless assets in our analysis for the following economic reasoning: Many of the countries in our sample tend to have relatively weak credit ratings implying that their T-Bills are not entirely riskless and therefore investors may be indifferent—with regards to risk—between T-Bills and conventional saving deposits.

We take the sum of volume of T-Bills and conventional saving deposits as a proxy for the volume of the riskless asset. The return on the riskless asset was calculated as a weighted average of the returns on 90-day T-Bills and the average interest rate on 3-month conventional savings deposits. Returns on the riskless asset are collected as per annum returns and then transformed into quarterly returns.

Data on Current Accounts

We assume that the only current accounts[2] relevant for our market are those offered by Islamic banks since they are not demanded by conventional investors for investment purposes (since conventional investors have access to riskless assets). Furthermore, it is unlikely that Islamic investors who have the possibility to deposit in current accounts of Islamic banks would do so in conventional banks.

The overall volume of Islamic current accounts was taken as the position "volume of demand deposits" from the quarterly financial statements of each bank offering Islamic current accounts in the respective country and was summed up across all banks within that country to generate the overall volume of Islamic current accounts for each quarter.

Countries Covered in the Analysis

We conduct our empirical analysis on a comprehensive sample of markets where Islamic banks are active (a total sample of 27 countries) based on E&Y's Islamic Banks Universe (Ernst & Young, 2017) as well as additional countries found in the World Database for Islamic Banking and Finance (2019). Since we include all countries mentioned in these two sources, we consider our sample to be quite representative as it includes the entire population of countries with a significant number of Islamic banks, i.e., a representative number of available Islamic investment accounts. The complete list of countries and stock indices taken is available in Table 8.10 in the appendix.

[2] Current accounts do not generate returns, i.e., have a return of zero.

A couple of countries, however, could not be integrated into the empirical analysis. First, Iran: Iranian banks do not publish their financial statements (online) on a regular basis and due to economic sanctions, they were not audited by international firms. Second, Sudan: since no (online) access existed to the Khartoum Stock Exchange nor to the Sudanese Central Bank, which are both main sources of our input data. Third, and fourth, Yemen and Brunei were eliminated for not having a running stock exchange until the time of data collection, which implies inaccessibility for investors to a large portion of the financial market thus practically eliminating the asset class of stocks. Four more countries also had to be removed due to problems with data collection: Algeria, Iraq, Lebanon, and Nigeria, since their Islamic banks only publish annual rather than quarterly financial reports—if at all—i.e., only very few observations on Islamic assets are available. Ninth, Libya is eliminated since it neither has Islamic banks nor does it publish an Islamic stock index. Tenth, Saudi Arabia had to be removed as it has a unique financial reporting problem, namely, that all banks in Saudi Arabia, whether Conventional or Islamic, are obliged to report "Special Commission Income" and "Special Commission Expense" instead of interest and non-interest income/expense or their Islamic alternatives. This makes it impossible to identify and differentiate the type of bank (Islamic or conventional) (Warde, 2000). Eleventh, India does not have an Islamic banking system but only an Islamic stock index. Twelfth to fourteenth, the three countries (Oman, Sri Lanka, and Philippines) that have an observation size of less than 20 quarters were eliminated as well because we focus on a minimum of 5 years in our empirical analysis. In summary, we end up with 13 countries that are included in our empirical analysis.

8.4.2 Data Cleaning

Within the data set for Islamic investment accounts, missing values existed for some banks in some countries. Missing values of one quarter were linearly interpolated as the arithmetic average of the quarter before and the quarter after. This was done for a total of 50 observations. Such a procedure has been necessary since eliminating banks with missing values would shorten the time series to possibly below 20 quarters for some banks. However, for longer spells of missing values (more than four consecutive quarters), the bank would be dropped from the sample. This brought down the total number of banks from 121 to 72.

For stock indices, several indices existed for some countries, e.g., Bahrain Islamic Index and S&P Bahrain Domestic Shariah Index. Our index selection criteria are (lexicographic order), first, completeness of observations during the observation period and, second, representativeness of the stock market. This might mean that we are forced to choose an index for which we have complete data at the expense of having the index not covering the entire stock market, but only the majority of stocks in a specific country. This is not entirely problematic given that most followed indices are usually only representative for their markets and not covering the entire stock market. Coming back to the example of Bahrain, our index selection criteria

mean that the more representative Bahrain Islamic Index (covering all Islamic stocks in Bahrain) cannot be chosen since data before 2015 are missing, so we select the less comprehensive S&P Bahrain Domestic Shariah Index instead.

Finally, no data for T-Bill rates for UAE or Syria were available. UAE had not issued any T-Bills until time of data collection, while no data for Syrian government finances have been available since 2010. For these two countries, the riskless rate is completely represented only by conventional banks' deposit rates.

8.4.3 Final Data Set

After data cleaning, the final data set is outlined in Table 8.5.

8.5 Empirical Results

Applying the sustainable investment recommendations scheme as presented at the end of the research design section to our final data set allows us to develop sustainable investment recommendations for all Islamic investment accounts.

Table 8.5 Number of islamic banks, type of market segmentation and quarterly observations for each country analyzed in the sample

Country	Number of islamic banks	Number of observations for islamic investment accounts
Double Segmented Markets		
Bahrain	6	30
Bangladesh	7	29
Indonesia	6	29
Kuwait	5	29
Malaysia	16	33
Pakistan	5	29
Qatar	4	29
Thailand	1	29
Turkey	4	29
UAE	11	29
Single Segmented Market with Respect to Riskless Asset		
Egypt	3	26
Jordan	2	29
Syria	2	26

8.5.1 Estimation of Parameters

The time series of Islamic investment accounts seem to show stochastic trends (unit roots) using the Augmented Dickey-Fuller[3] test. For example, ADF test reveals a unit root for Malaysia's $R_{M_{IA}}$ with p-values: 0.7724 (without constant), 0.232 (with constant), and 0.1194 (with constant and deterministic linear trend). Consequently, we fit a first-order autoregressive model (AR (1)) to the returns of Islamic investment accounts to compute the mean of the stationary process as $\frac{\beta_0}{1-\beta_1}$ (Hamilton, 1994, p. 53). Doing so results in a stationary process, which from a statistical perspective it holds $|\beta_1| < 1$. From an economic perspective returns cannot explode because that would violate no-arbitrage. Therefore, parameters are estimated using this AR (1) specification instead of using the arithmetic mean. Note that the AR (1) specification does not change the estimation of variances/covariances: The mean of the AR (1) specification and the arithmetic mean differ by a constant and constants do not influence variances/covariances.

8.5.2 Sustainable Investment Recommendations for Islamic Investment Accounts

Table 8.6 gives sustainable investment recommendations for 72 Islamic investment accounts in 13 countries:

Table 8.6 illustrates two aspects about investment recommendations: First, even though the scheme for sustainable investment recommendations seemed to be somewhat complex, it can deliver investment recommendations in most cases. The judgment "no recommendation" is obtain in only 11 (10) cases, i.e., only in 15% (14%) of all cases using the 5% (10%) range. Second, investment recommendations are non-trivial in a sense that within each country a mixture between withdraw and deposit recommendations can be observed. Exceptions include the two countries Syria and Thailand as well as a clear exception in the case of Pakistan where not a single sustainable investment recommendation could be obtained.

It is interesting to observe how some countries have polarized recommendations with only one or two deposit (withdraw) recommendations and the rest withdraws (deposits). This can be easily explained when one considers the construction of the sub-market portfolio of investment accounts which is used as a benchmark against which the risk of investment accounts is measured. Investment accounts that are

[3] In principle, the Kwiatkowski-Phillips-Schmidt-Shin (KPSS)-test would be best suited to test for stationarity because it tests the null hypothesis that a time series is stationary. However, the KPSS suffers from a significant size distortion especially for "quarterly data based on small samples" (Caner & Kilian, 2001 p. 655) which may result in rejecting stationarity more often in small samples such as ours: our time-series of quarterly returns of the sub-market portfolios consists of a maximum number of 29 observations: 33 observations minus four lags. Four lags are the recommendation for testing of stationarity in quarterly data (Mahadeva & Robinson, 2004). For this reason, it is not recommended to apply the KPSS-test in our case.

Table 8.6 Sustainable investment recommendations for islamic investment accounts using 5% and 10% ranges

	5% Range	10% Range
Bahrain		
Al Baraka Islamic Bank	Deposit Funds	Deposit Funds
Al Salam Bank	Withdraw Funds	Withdraw Funds
Bahrain Islamic Bank	Withdraw Funds	Withdraw Funds
Ithmaar Bank	Deposit Funds	Deposit Funds
Khaleeji Commercial Bank	Withdraw Funds	Withdraw Funds
Kuwait Finance House Bahrain	Withdraw Funds	Withdraw Funds
Bangladesh		
Islamic Bank Bangladesh	Withdraw Funds	Withdraw Funds
Al-Arafah Bank	Deposit Funds	Deposit Funds
Export Import Bank	Deposit Funds	Deposit Funds
Social Islami Bank	Deposit Funds	Deposit Funds
Shahjalal Islami Bank	No Recommendation	No Recommendation
First Security Islami Bank	No Recommendation	No Recommendation
ICB Islamic Bank	Withdraw Funds	Withdraw Funds
Egypt		
Faisal Islamic Bank	Withdraw Funds	Withdraw Funds
Al Baraka Islamic Bank	Deposit Funds	Deposit Funds
Abu Dhabi Islamic Bank	Deposit Funds	Deposit Funds
Indonesia		
Bank BRI Syariah	Deposit Funds	Deposit Funds
Bank Muamalat Indonesia	Deposit Funds	Deposit Funds
Syariah Mandiri	Withdraw Funds	Withdraw Funds
Syariah Mega Bank	No Recommendation	No Recommendation
Syariah Bukopin	Deposit Funds	Deposit Funds
Bank Jaber Banten*	Deposit Funds	Deposit Funds
Jordan		
Jordan Dubai Islamic Bank	Deposit Funds	Deposit Funds
Jordan Islamic Bank	Withdraw Funds	Withdraw Funds
Kuwait		
Ahli United Bank	Withdraw Funds	Withdraw Funds
Kuwait International Bank	Withdraw Funds	Withdraw Funds
Kuwait Finance House	Deposit Funds	Deposit Funds
Boubyan Bank	Withdraw Funds	Withdraw Funds
Warba Bank	Withdraw Funds	Withdraw Funds
Malaysia		
Affin Islamic Bank Berhad	Deposit Funds	Deposit Funds
Al Rajhi Bank Malaysia	Deposit Funds	Deposit Funds
Alliance Islamic Bank	Deposit Funds	Deposit Funds
AmBank	Deposit Funds	Deposit Funds
Asian Finance Bank	Deposit Funds	Deposit Funds
Bank Islam Malaysia	No Recommendation	No Recommendation

(continued)

Table 8.6 (continued)

Bank Muamalat	Deposit Funds	Hold
CIMB Islamic	Deposit Funds	Hold
HSBC Amanah	Withdraw Funds	Withdraw Funds
Hong Leong Islamic	Deposit Funds	Hold
Kuwait Finance House	Deposit Funds	Deposit Funds
Maybank Islamic	Withdraw Funds	Hold
OSBC Al Amin	Withdraw Funds	Hold
Public Islamic Bank	No Recommendation	No Recommendation
RHB Islamic Bank	Deposit Funds	Deposit Funds
Standard Chartered Saadiq	Withdraw Funds	Deposit Funds
Pakistan		
Al Baraka Bank Pakistan	No Recommendation	No Recommendation
Bank Islami Pakistan	No Recommendation	No Recommendation
Burj Bank	No Recommendation	No Recommendation
Dubai Islamic Bank Pakistan	No Recommendation	No Recommendation
Meezan Bank	No Recommendation	No Recommendation
Qatar		
Barwa Bank	Deposit Funds	Deposit Funds
Qatar Islamic Bank	Deposit Funds	Deposit Funds
Qatar International Islamic Bank	Deposit Funds	Deposit Funds
Masraf Al Rayan	Withdraw Funds	Withdraw Funds
Syria		
Al Baraka Bank Syria	Deposit Funds	Deposit Funds
Syria International Islamic Bank	Deposit Funds	Hold
Thailand		
Islamic Bank of Thailand	Hold	Hold
Turkey		
Asya Bank	Withdraw Funds	Withdraw Funds
Al-Baraka Turk	Deposit Funds	Hold
Kuveyt Turk	Withdraw Funds	Withdraw Funds
Turkiye Finans	Deposit Funds	Deposit Funds
United Arab Emirates		
National Bank of Abu Dhabi*	Deposit Funds	Deposit Funds
Abu Dhabi Commercial Bank*	No Recommendation	Withdraw Funds
Dubai Islamic Bank	Deposit Funds	Deposit Funds
Emirates NBD*	Deposit Funds	Deposit Funds
Emirates Islamic Bank	Deposit Funds	Deposit Funds
Mashreq Al Islami*	Deposit Funds	Deposit Funds
Sharjah Islamic Bank	Deposit Funds	Deposit Funds
National Bank of RAK*	Deposit Funds	Deposit Funds
Abu Dhabi Islamic Bank	Withdraw Funds	Withdraw Funds
Al Hilal Bank	Deposit Funds	Deposit Funds
Ajman Bank	Deposit Funds	Deposit Funds

The "*" symbol next to some banks refers to Islamic windows of conventional banks and not standalone Islamic banks

exceptionally good (bad) will shift the sub-market portfolio upwards (downwards)—given sufficient weighting volume of that investment account—and toughen (weaken) the required returns for all other investment accounts in the market. Two illustrations show this effect: First, Thailand, having only one single Islamic investment account means that the sub-market portfolio of investment accounts is exactly identical to the single investment account, i.e., it will always earn a "hold" recommendation since it will never overperform or underperform in comparison to the sub-market portfolio. Another illustration of this effect is Kuwait where Kuwait Finance House's investment account is performing exceptionally well (in the sense of risk adjusted returns) compared to the sub-market of investment accounts, and thus earns a "deposit funds" recommendation, while all other investments accounts are relatively worse and earn a "withdraw funds" recommendation. This effect is expected to weaken and disappear as the number of Islamic investment accounts and their respective funds volume grows, as can be seen in the cases Malaysia or UAE that have the two largest numbers of investment accounts in the sample.

This characteristic of our valuation formula has two major advantages: first, not any "well performing" investment account can have this effect, but only those with sufficient weight as well as performance in the sub-market portfolio. This means that a newly founded investment account that has little funds but is able to achieve above average returns will not necessarily be able to shift the sub-market portfolio upwards since its weight is expected to be negligible. The second advantage is that market competition is clearly captured by the recommendations, encouraging investment account managers to compete against one another since achieving positive returns is not sufficient to earn a "deposit funds" recommendation, instead an investment account must be able to meet the required return given its risk profile and benchmarked against other alternative investments on the market. However, it is important to remember that these recommendations capture long-term returns and therefore minor or temporary management strategies that are not long-term oriented will only result in erratic fluctuations that may bring about a "no recommendation" due to inconsistencies across time, rather than the desired "deposit funds" recommendation.

We now turn to analyzing the empirical effect of the different aspects integrated into our investment recommendations scheme, namely our interest in knowing what mistakes investors would make if they did not take the "sustainability" aspects into account, i.e., if indeed "consistency", "statistical estimation problems", and "ranges" exert influence on investment recommendations.

Effect of "Consistency"

The effect of "consistency" involves consistency between full sample and rolling windows, length of estimation windows, and different points in time. It can be measured by comparing investment recommendations based on full sample with those from the rolling estimation and categorizing them into the different cases explained before (in the section on "consistency" aspect).

Cases 2, 3 and 4 of Table 8.7 are the cases where deviations (inconsistencies) between full sample and rolling estimation occur, yet only cases 3 and 4 are those that are critical in the sense that they are contradictory between full sample and rolling

Table 8.7 Overview of investment recommendations using full-sample and rolling estimation window using 5% and 10% ranges

Cases based on consistency across Full-Sample and Rolling Estimation Window	Percentage of Cases (using 5% range)	Percentage of Cases (using 10% range)
No inconsistency (Case 1)	59.7%	62.5%
Inconsistency, but no contradiction (Case 2)	13.9%	15.3%
Inconsistency and complete contradiction (Case 3)	1.4%	1.4%
Inconsistency and partial contradiction (Case 4)	25.0%	20.8%

estimation and thus result in altering investment recommendations across time or reaching no recommendation. Deviations occur in a total of 40.3% of all cases within the 5% range (and 37.5% within the 10% range), 62% of these deviations (59.2% in the 10% range) are partially or completely contradictory, i.e., the error potential of ignoring "consistency" across full-sample and rolling estimation is severe. In other words, we explicitly discourage using *only* one or the other (of full-sample and rolling estimation) to base sustainable recommendations upon and advise always checking consistency and not shying away from accepting a "no recommendation" if consistency is not assured.

Effect of "Ranges"

The effect of ranges is concerned with the economic significance of investment recommendations, i.e., whether the differences between actual and required returns are high enough to justify action in the form of an investment recommendation to deposit or withdraw. To measure the effect of "ranges", the sustainable investment recommendations of Table 8.6 and the overview of cases of Table 8.7 are computed once more using a range of zero and presented in Table 13 in the appendix, column AR1 Mean, and Table 8.8.

By comparing looking at our results using the 0% range, two aspects are of interest. First, it is still possible to make sustainable investment recommendations using a range of zero; however, the number of hold cases are eliminated. This is because

Table 8.8 Overview of empirically obtained investment recommendations using full-sample and rolling estimation window using a range of zero

Cases based on consistency across full-sample and rolling estimation window	Percentage of cases (using 0% range)
No inconsistency (Case 1)	62.5%
Inconsistency, but no contradiction (Case 2)	0.0%
Inconsistency and complete contradiction (Case 3)	4.2%
Inconsistency and partial contradiction (Case 4)	33.3%

with a range of zero virtually no Islamic investment accounts are deemed correctly valued since the empirical difference (due to rounding) never yields a 0% excess return. Second, the number of cases of "no recommendations" increases: Compared to the 5% range, the number of no recommendations increases by seven, with five of these changes coming from previously deposit recommendations, and one each from hold and withdraw recommendations. This comes as no surprise: Recall that "correctly valued" is defined as non-contradictory (neutral). Without allowing for the neutral effect of "hold" recommendations forces every excess return (no matter how small) to factor into a deposit or withdraw recommendation, consequently raising the instances of partial and complete contradictions, as well as the cases of "no inconsistencies". Although the rise of the latter is desirable, the rise in contradictions is not. Therefore, we discourage the extreme case of having no ranges at all since it is not justifiable, neither statistically (due to rounding errors) nor economically (may not be worth the active change in funds).

If one desires the increase in "no inconsistencies" as shown in Table 8.8 without the increase in contradictions, one is advised to widen the range. As could be seen in Table 8.7, the use of the more lenient 10% range led to a comparable 62.5% no inconsistencies while bringing down the overall contradictions. This comes at the expense of the non-critical non-contradicting inconsistencies which can be seen in the considerable increase in "hold" recommendations. We discourage the use of even more lenient ranges since one must remember that lenient ranges act as a very tough hurdle for investment accounts to earn a "deposit" recommendation, while being very "patient" before issuing a "withdraw" recommendation. An unbalanced range can solve this problem, i.e., having the upper range not equal to the lower range, albeit difficult to justify and possible to communicate. In the rest of our analysis, we focus on the use of the balanced 5% range as we consider it fair: not being too lenient nor too strict.

8.5.3 Transparency Recommendations for Islamic Investment Accounts

Volume of Withdrawals/Deposits to Illustrate the Need for Transparency Recommendations

To motivate the need for transparency recommendations, we provide data on the actual withdraw/deposit behavior for Islamic investment accounts. Using a time plot gives a first impression regarding the current rather random behavior of withdrawals/deposits over time. If this time plot is contrasted with sustainable investment recommendations, the erratic nature of withdrawals/deposits can be illustrated. True, investors so far are not aware of our suggested sustainable investment recommendations and cannot withdraw or deposit funds on that basis.

In the figures above, the coloring represents deposit (green), hold (yellow) and withdraw (red) recommendations using the 5% range. The exemplary figures offer

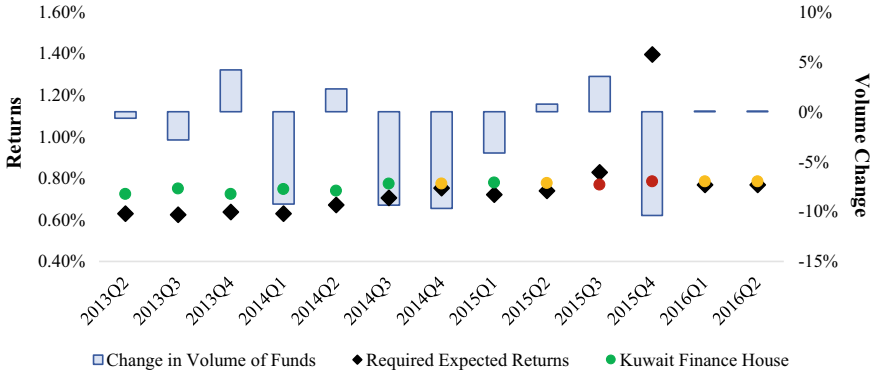

Fig. 8.1 Kuwait Finance House (Malaysia) Rolling Estimation with Changes in Volume of Funds for Private Investors

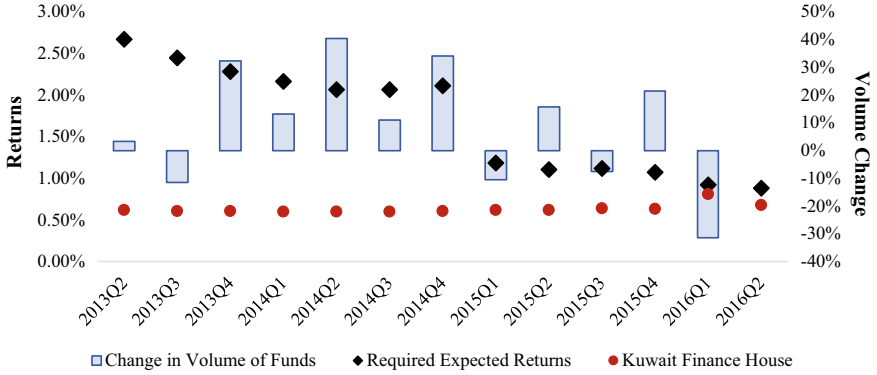

Fig. 8.2 Kuwait Finance House (Malaysia) Rolling Estimation with Changes in Volume of Funds for Institutional Investors

a number of insights: First, as seen in Fig. 8.1, Kuwait Finance House (Malaysia) faced withdrawals of funds by private investors in the first 8 quarters of the sample even though the investment recommendations are either deposit or hold. The opposite is true in the case of institutional investors as shown in Fig. 8.2, where consistent withdraw recommendations are given, but nevertheless mostly net influxes of funds are observed. Second, across both figures once can observe that withdraws/deposits do not seem to follow a consistent time pattern. Sometimes withdrawals are followed by withdrawals, sometimes by deposits and vice versa. Third institutional investors do not seem to exhibit a more "rational" behavior regarding their withdraw/deposit behavior than private investors.[4]

[4] Malaysia was chosen for illustration purposes since Malaysia is the only country where private and institutional Islamic investment accounts are separately published. Malaysia's investment recommendations in previous tables referred to combined investment accounts.

Admittedly, personal reasons for fund movement might overrule investment recommendations: First, personal liquidity needs. While this argument may be true on an individual basis, it cannot explain the withdrawals from/deposits to Islamic investment accounts on a net aggregate basis as shown in the figures. Second, the availability of bank services. For example, a larger bank can offer a dense network of ATMs. However, bank services may speak for holding a current account with a certain bank, but not necessarily an Islamic investment account. Third, private investors may take a bank's size simply as proxy for its quality because they cannot judge the Islamic investment account itself ex-ante. In other words, the personal reasons mentioned cannot categorically eliminate lack of transparency as a reason for (erratic) withdrawals/deposits either.

Even if one might entertain these arguments within the private investor sphere, the results for institutional investors, who should possess a higher degree of financial literacy, nevertheless show a similar unpredictable withdrawal/deposit behavior, which gives some indication that transparency is the real cause. In all cases, we believe both private and institutional investors will profit from transparency recommendations.

8.5.4 Sustainable Investment Recommendations for Islamic Investment Account

By applying the ratings system to the previous set of investment recommendations, we are able to differentiate between degrees of sustainable investment recommendations by not simply and naively communicating "deposit", "withdraw" and "hold" recommendations, but instead the recommendations as shown in Table 8.9. This ensures that fund movement based on investment recommendations becomes smoother and more predictable for depositors, managers, and regulators alike, thus reaching a reasonable equilibrium within the transparency/withdrawal trade-off.

8.6 Potential and Recommended Final Form of Transparency Recommendations

Potential forms of transparency recommendations depend on three aspects: Who should implement the transparency recommendations? Should the recommendations be published? What exactly should be published? —All three aspects must also take aspects of systemic withdrawal into account since there might be a transparency/withdrawal trade-off.

Table 8.9 Transparency recommendations using the 5-star rating system for sustainable investment recommendations using the 5% range

Country	Bank Name	Rating
Bahrain	Al Baraka Islamic Bank	★★★★★
	Al Salam Bank	★
	Bahrain Islamic Bank	★★
	Ithmar Bank	★★★★★
	Khaleeji Commercial Bank	★
	Kuwait Finance House Bahrain	★
Bangladesh	Islamic Bank Bangladesh	★
	Al-Arafah Bank	★★★★★
	Export Import Bank	★★★★★
	Social Islami Bank	★★★★★
	Shahjalal Islami Bank	⊙
	First Security Islami Bank	⊙
	Icb Islamic Bank	★
Egypt	Faisal Islamic Bank	★
	Al Baraka Islamic Bank	★★★★★
	Abu Dhabi Islamic Bank	★★★★★
Indonesia	Bank Bri Syariah	★★★★★
	Bank Muamalat Indonesia	★★★★★
	Syariah Mandiri	★
	Syariah Mega Bank	⊙
	Syariah Bukopin	★★★★★
	Bank Jaber Banten*	★★★★★
Jordan	Jordan Dubai Islamic Bank	★★★★★
	Jordan Islamic Bank	★
Kuwait	Ahli United Bank	★
	Kuwait International Bank	★
	Kuwait Finance House	★★★★★
	Boubyan Bank	★
	Warba Bank	★
Malaysia	Affin Islamic Bank Berhad	★★★★★
	Al Rajhi Bank Malaysia	★★★★★
	Alliance Islamic Bank	★★★★★
	Ambank	★★★★★
	Asian Finance Bank	★★★★★
	Bank Islam Malaysia	⊙
	Bank Muamalat	★★★★★
	Cimb Islamic	★★★★★
	Hsbc Amanah	★
	Hong Leong Islamic	★★★★★
	Kuwait Finance House	★★★★★
	Maybank Islamic	★★
	Ocbc Al Amin	★★
	Public Islamic Bank	⊙
	Rhb Islamic Bank	★★★★★
Pakistan	Al Baraka Bank Pakistan	⊙
	Bank Islami Pakistan	⊙
	Burj Bank	⊙
	Dubai Islamic Bank Pakistan	⊙
	Meezan Bank	⊙
Qatar	Barwa Bank	★★★★★
	Qatar Islamic Bank	★★★★★
	Qatar International Islamic Bank	★★★★★
	Masraf Al Rayan	★
Syria	Al Baraka Bank Syria	★★★★★
	Syria International Islamic Bank	★★★★★
Thailand	Islamic Bank of Thailand	★★★
Turkey	Asya Bank	★
	Al-Baraka Turk	★★★★★
	Kuveyt Turk	★
	Turkiye Finans	★★★★★
United Arab Emirates	National Bank of Abudhabi*	★★★★★
	Abu Dhabi Commercial Bank*	⊙
	Dubai Islamic Bank	★★★★★
	Emirates Nbd*	★★★★★
	Emirates Islamic Bank	★★★★★
	Mashreq Al Islami*	★★★★★
	Sharjah Islamic Bank	★★★★★
	National Bank of Rak*	★★★★★
	Abu Dhabi Islamic Bank	★★
	Al Hilal Bank	★★★★★
	Ajman Bank	★★★★★

8.6.1 Who Should Implement the Transparency Recommendations?

Potential candidates are individual decision makers, the banks offering Islamic investment accounts, or external agencies.

Individual decision makers comprise private and institutional investors. Given the complex inputs required for developing sustainable investment recommendations (data set, consistency rules, correct statistical estimators, and ranges) private investors may not be able to compute the valuation of Islamic investment accounts by themselves, let alone translate them into sustainable investment recommendations. Institutional investors, in particular those with high financial literacy, should theoretically be able to implement those investment recommendations. However, the observed withdraw/deposit behavior of institutional investors suggests that they might find external recommendations helpful. Moreover, institutional investors might wish to concentrate on their core business instead of investing time in computing investment recommendations. This situation might be similar to bond investing: Institutional investors might possess the financial literary to assess the quality of bonds. Nevertheless, they rely on external rating agencies that specialize in the matter. Finally, the group of institutional investors encompasses Islamic banks as well, a fact that creates additional problems as the next paragraph illustrates.

The banks offering Islamic investment accounts themselves might consider issuing investment recommendations. Yet these banks are subject to an agency problem when developing investment recommendations that is to be used by their potential and current customer base thus introducing a degree of conflict of interest and contradicting the idea of transparency. Since the computation itself includes many variations that can influence the result, a bank may manipulate its rating, thus decrease transparency and comparability as was shown in the section on ranges for example. Therefore, it is not recommended that the banks offering Islamic investment accounts implement investment recommendations.

Finally, an external agency, like a credit rating agency, or even the financial regulator itself can implement the recommendations. The financial literacy and specialization are available while the agency problem regarding transparency is absent. Moreover, a centralized judgement guarantees the use of an identical methodology across all Islamic investment accounts, thus maintaining comparability. Finally, an external agency might encounter less data problems: A central bank profits from banks' reporting obligations; for an external company data collection belongs to its core business.

8.6.2 Should the Recommendations Be Published?

The background of this question is the tradeoff between transparency and systemic withdrawal risk. On the one hand, publication of investment recommendations sends

a strong quality signal that mitigates the transparency problem of Islamic investment accounts. Moreover, it can help stabilize the Islamic financial system because Islamic financial institutions are a heavy investor in Islamic investment accounts and might not want to invest in Islamic investment accounts given the lack of transparency of these assets.

On the other hand, published investment recommendations might trigger withdrawal from overvalued Islamic investment accounts. In the extreme case this might result in a problem for the whole Islamic banking system and increase systemic risk. Even though one might argue this is a desired result if the asset is indeed overvalued, the associated systemic risk should not be overlooked.

For an indicator of how investors may react to such negative investment recommendations, we look at the literature on mutual funds where it was found that investors withdraw money from mutual funds after a downgrade in the Morningstar rating in a rather asymmetric manner (Del Guercio & Tkac, 2008): A reduction from 5 to 4 stars in the Morningstar rating did not lead to extensive withdrawals of funds. However more severe downgrades created economically relevant withdrawals. Böninghausen and Zabel (2015) state that rating downgrades tend to have negative spillover effects to other countries, which is the reason why the European Commission was considering a temporary restriction on the issuance of ratings for sovereign debt except at pre-defined dates. However, Del Guercio and Tkac (2008) still argue that it is better for the financial system as a whole if money were to be withdrawn from bad investments instead of keeping bad investments alive by holding money in them. The argument for keeping money in a bad investment in order to mitigate systemic risk is as if one is asking private investors to subsidize the banking system for possible mismanagement and will not be appreciated by the general public.

8.6.3 What Exactly Should Be Published?

This question has two dimensions, namely, first whether recommendations are published in a pooled or separated way and, second, the exact scope to be published.

Separating means that deposit, hold, withdraw, and no recommendations are all published (symmetric treatment) for each Islamic investment account. Pooling, on the other hand, publishes only recommendations to deposit. The remaining recommendations: hold, withdraw, and no recommendation are pooled (asymmetric treatment). Alternatively, no recommendation can be separated and only hold and withdraw recommendations pooled. The most extreme form of pooling would be that no specific recommendation is published. Instead, a guarantee is published that an external agency, e.g., the banking supervisory, closely monitors the quality of Islamic investment accounts and intervenes immediately if the quality drops to a level that induces a withdraw recommendation. The common idea behind all pooling approaches is that withdrawal pressure is mitigated for fear of systemic risk.

The exact scope to be published can be broken into a number of possible tools: a traffic-lights-system, a ranking, and a rating score. A traffic-lights-system translates the sustainable investment recommendations of Table 8.6 into a color scheme: red means withdraw, yellow hold, and green deposit. It is, therefore, easy to understand, however, it cannot take the strength of recommendations into account, e.g., whether there is "no inconsistency" (strong recommendation) or "inconsistency, but no contradiction" (weaker recommendation), since there is just one color per recommendation. In particular bad and really bad investments are treated equally a fact that might make a traffic-lights-system susceptible to systemic risk.

A ranking can, in principle, address this issue because investors then know for example that the Islamic investment account under consideration is number 50 out of 72. However, important information that is contained in the traffic-lights-system is now missing: Does being number 50 imply withdraw or deposit? Is the number 1 good in absolutes terms? To illustrate the last argument, have a look at Table 8.5: In Pakistan or Syria at the 5% range, it is not helpful to know that a particular Islamic investment account is number one in the country because the country itself has no withdraw recommendations.

A rating system tries to combine the strength of the traffic-lights-system and ranking while avoiding their weaknesses. This is done by providing additional information—ratings are multi-dimensional—and aggregating many dimensions into one score. These dimensions in the context of sustainable investment recommendations are absolute and not just relative ranking, strength of recommendation, and ease of communication.

The dimensions absolute and not just relative ranking and strength of recommendation have just been discussed in the two paragraphs immediately above. The dimension ease of communication addresses the problems that in particular private investors cannot compare several evaluation criteria simultaneously. They need one aggregated score instead. A recent paper by Balakrishnan, Ertan and Lee (2019) clearly states for mortgage-backed securities that too complex evaluation schemes create an information asymmetry because only institutional investors will be able to interpret complex information correctly. Therefore, private investors will drop out of the market. The difficult part is, however, to document the information aggregation so that the score does not start a life of its own and the underlying economic information is forgotten.

8.6.4 Final Recommendation

Having discussed potential remedies to intransparency as well as their advantages and disadvantages, we would like to suggest the following form for transparency recommendations for Islamic investment accounts:

Sustainable investment recommendations should be implemented by an external (rating) company that must get the approval from the country's regulator. The regulator itself is not a good choice for implementing recommendations because it might

be subject to a conflict of interest between financial stability (avoidance of systemic risk) and economic growth like, e.g., the European Central Bank currently is.

The sustainable investment recommendations should be published. Otherwise intransparency cannot be reduced enough to communicate trust to potential investors and prevent them from withdrawing their funds erratically and in an uninformed manner. From that perspective, we follow Del Guercio and Tkac (2008), who argue that it is better for the financial system to withdraw money from bad investments instead of keeping bad investments alive by holding money in them.

Sustainable investment recommendations should take the form of a rating, i.e., should be separated instead of pooled. To help Islamic investment account investors recognize the rating, we mimic Morningstar's use of stars. The rating consists of two pieces of information that should be placed equally next to each other: the number of stars and the explanation what the stars mean as a quality assessment as shown in Table 8.4.

While these transparency recommendations in the form of the rating system is able to enhance trust and thus ensure informed investments in and withdrawals from Islamic investment accounts, it is not clear that it can also handle systemic withdrawal risk. On the one hand, the 5-star system of Table 8.4.contains a self-stabilizing mechanism: Islamic investment accounts with five stars will receive additional funds that must be invested. This might bring down the performance of this particular Islamic investment account in the short-term and only if managers are able to utilize these funds well, will their long-term rating remain unaffected. On the flip side, Islamic investment accounts with 1 star will experience withdrawals of funds, a fact that makes it then easier for managers to achieve higher risk-adjusted returns. This reasoning, however, hinges upon the assumption that withdrawals remain moderate, which is to an extent the core function of banking supervision which should be involved to prevent systemic withdrawal.

Based on the ratings of Table 8.4.banking supervision can identify two risks: First, funding side risk, which can be identified by utilizing the rating directly and anticipating which Islamic banks might be subject to an increased withdrawal risk. Second, investment side risk, by combining the rating with information regarding interbank investments, banking supervision can identify which Islamic banks invest in other banks' Islamic investment accounts that are bad investments because they possess a withdrawal recommendation. To give banking supervision the chance of reacting on bad rankings, however, they must obtain the rating information earlier than the market. One possibility of implementing this would be the following: Ratings are published publicly quarterly or semiannually, whereas banking supervision obtains the ratings on a monthly basis. Such a lagged publication will give banking supervision the possibility of communicating with the management of banks whose Islamic investment accounts underperform or prepare for any upcoming withdrawals in case correction strategies fail.

8.7 Conclusion

Sustainable investments, such as those envisioned within the UN's SDGs, are impossible without sustainable financing, which in turn can only be secured if investors have long-term trust in these investment projects. Without initial trust, a project will not materialize, and without long-term trust, financiers might be willing to provide funds initially, but withdraw them as soon as better investment opportunities arise. These withdrawals might—in an extreme case—reach systemic proportions.

These problems are particularly severe in Islamic financial systems where Islamic investment accounts are responsible for 63% of the funding of Islamic banks, i.e., possess systematic relevance. Moreover, Islamic investment accounts are regarded as highly intransparent: Their returns depend on unobservable diversification/pooling strategies, management fees as well as practices of income smoothing using reserves or equity conducted at the hands of the managing institution.

Therefore, the two objectives of this paper are: first, to develop sustainable investment recommendations that facilitate long-term trust; second, to propose transparency recommendations based on these investment recommendations.

We obtain the following results from our analysis: First, for investment recommendations to be sustainable, they must comprise the aspects "long-term perspective", "consistency", and "robustness". These aspects can be achieved by combining investment recommendations using full sample and rolling estimation as well as ranges to ensure economic significance of identified mispricing. These sustainable investment recommendations are developed further into a rating system, which takes into account the consistency of investment recommendations at different point in time. Second, the transparency recommendations should be published by an external (rating) agency to address the trade-off between transparency and systemic withdrawal.

Our findings have practical implications in two fields: First, Islamic banks can better market their products within the Islamic financial sector but also against conventional banks' time and savings accounts. Second, regulators can use these ratings as an early-warning system that can let them know if, first, an Islamic bank may face massive withdrawals in the future (funding side risk) or, second, an Islamic bank is creating a dangerous contagion effect by (unknowingly) investing in another banks' Islamic investment accounts that hold a low rating (investment side risk).

8.8 Appendix

See Table 8.10.

Table 8.10 Sample Country List Including Number of Islamic Banks and Stock Indices Used In Analysis

Country	Number of islamic banks	All-stocks index	Islamic stocks index
Algeria	2	Index	None
Bahrain	6	Bahrain Bourse All Share Index	S&P Bahrain Domestic Shariah
Bangladesh	8	DSEX Broad Index	S&P Shariah Index Bangladesh

(continued)

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Table 8.10 (continued)

Country	Number of islamic banks	All-stocks index	Islamic stocks index
Brunei	1	None	None
Egypt	2	EGX 30 (Top 30 only)	Not Publicly Available
India	0	S&P BSE 500	S&P BSE 500 Shariah
Indonesia	6	Jakarta Composite Index	Jakarta Islamic Index (JII)
Iraq	12	ISX	None
Iran	29	Tehran Stock Exchange Total Index	
Jordan	3	Amman Stock Exchange Index	None
Kuwait	6	Kuwait Stock Exchange Index	S&P Kuwait Domestic Shariah
Lebanon	3	Blom Beirut All Shares	None
Libya	0	None	None
Malaysia	16	EMAS Index	EMAS Shariah Index
Nigeria	1	Nigeria All Share Index	NSE Lotus Islamic Index (15 Stocks)
Oman	8	MSM30 (Top 30 only)	S&P Oman Domestic Shariah
Pakistan	5	Karachi Stock Exchange (KSE) All Share Index	KSE-Meezan Index (KMI30)
Philippines	1	PHP Dow Jones Philippines Price Index	None
Qatar	4	QE All Share Index	QE Al Rayan Islamic Index
Saudi Arabia	6	Tadawul All Share index	S&P Saudi Arabia Domestic Shariah
Sri Lanka	1	All Shares Price Index	Dow Jones Islamic Market Sri Lanka Index
Sudan	32	Khartoum Stock Index	
Syria	4	Index	None
Thailand	1	FTSE SET All-Share Index	FTSE Shariah SET
Turkey	4	XUTUM BIST All Shares	Dow Jones Islamic Market Turkey
UAE	18	Dow Jones UAE Total Stock Market Index	S&P UAE Domestic Shariah
Yemen	4	None	None

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Chapter 9
Sustainability, Trust, and Blockchain Applications in Islamic Finance and Circular Economy: Best Practices and Fintech Prospects

Ahmet Faruk Aysan and Fouad Bergigui

Abstract Since the adoption of the SDGs in 2015, it has been a 5-year journey of trial-and-error experimentations all over the world to come up with innovative solutions beyond business-as-usual and get the job done. In this paper, we assess blockchain-backed solutions beyond the hype. While the technology has a promising potential to trigger disruptive innovations to fulfill the SDGs, it is not mature yet with many gaps in terms of approaches and tools to develop blockchain use cases, monitor and evaluate blockchain experiments, mitigate associated risks and ethical considerations while managing changes within organizations leading blockchain-powered platforms. It is only by filing these gaps that blockchain can deliver its promises and may be effectively used as an SDG accelerator. Islamic finance can play a key role in shaping the transition towards a more circular economy. One promising way of doing so, is by scaling-up the use of blockchain-enabled solutions in the practices of circular economy and Islamic finance. As the technology is still getting mature, more innovative and applied research is needed to capitalize on the lessons learned within various geographies and across a wide range of economic, social, and environmental spectrums.

9.1 Introduction

Undeniably, blockchain, and distributed ledger technologies are disrupting traditional business models in so many ways, including within the international development space. Driven by the hype to embrace, blockchain-powered pilots, and experiments to design minimum viable products and test proofs of concepts are burgeoning across

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spectrums all over the world. Against this backdrop, to produce sustainable development impact and accelerate the ongoing efforts to meet the SDGs by 2030, many are willing to prototype promising use cases in an attempt to harness the potential of blockchain-enabled solutions.

Now, while virtually there is so much one can do with blockchain-backed applications, there is also a huge lack of evidence to truly assess the contribution of the blockchain technology to sustainable development. Even more, thought-provoking is the chronic lack of data along the blockchain industry. Ironically, in contrast with its promising potential to foster trust and accountability, the overall blockchain industry appears relatively opaque because of the overall scarcity of data from pilots and experiments which remain largely under-studied especially with regards to blockchain-based applications for social impact and sustainable development.

In the absence of aggregate data to build the body of knowledge about blockchain use cases for the SDGs, organizations, and individuals implementing blockchain projects for sustainable development may not be able to learn from the existing practices and consequently improve their own projects. Such knowledge is critical to extract good practices and lessons learned, to share experiences and to catalyze joint efforts towards reaching economies of scale. Besides, such knowledge paves the way to functional blockchain ecosystems that can produce nationwide solutions instead of experimentation silos with little or no proven impact at scale.

Admittedly, this could be explained by the fact that we are still in the early days of the blockchain technology as it is getting mature, and the wave of its adoption is building and breaking across the shorelines of the international development practice. While we can learn from the trials and errors on experimentations conducted by the early movers at the early days of a nascent technology, no one can accurately predict the trajectory and impact that blockchain-enabled applications can have on development practice in terms of enabling development workers and organizations to overcome new challenges or even achieve better developmental outcomes.

Currently, even if we cannot predict its outcomes till the technology becomes more mature, we argue that we can still make sure that blockchain use cases experimented by the development community are properly designed and implemented to live up to their promises. To do so, we argue that more research is needed to go beyond the hype-driven by the mainstream awareness behind the rapid rise of what we refer to here as the "let's blockchain it" movement which suggests that blockchain applications are superior compared to other alternatives in terms of their ability to deliver development outcomes.

Researchers, experts, and resource persons at the frontlines of innovation for development are called upon to develop actionable toolkits and toolboxes. Providing individuals and organizations with tools and approaches to guide their efforts step-by-step can not only yield sound use cases of blockchain enabled solutions for sustainable development, but also break the hype-cycle for blockchain to maintain its reputation and live up to its promises.

In this paper, we aim to add our contribution to the ongoing reflections within the international development community regarding the use of blockchain-based applications, in the practices of Islamic finance and circular economy, to solve specific

development challenges and accelerate the achievement of the Sustainable Development Goals (SDGs). To do so, we first provide an overview of blockchain technology, looking at its mechanics and dynamics, at how it evolved, the different types of blockchains, and what are the possibilities for using blockchain-powered solutions to solve some of the most pressing development challenges we are facing today.

Similarly, we shed the light on the "Agenda 2030" for sustainable development, the implementation gaps, and the challenges ahead to meet the global goals by 2030. After that, we explore real-life case studies of blockchain experiments, highlighting some of the areas where blockchain-enabled solutions may drive disruption, in ways that could yield huge development dividends and accelerate the SDGs with a special focus on Islamic finance, and circular economy. We conclude by highlighting the promising potential of blockchain technology to deliver development outcomes, while at the same time pointing the gaps that should be addressed for it to deliver its transformational impact (Fig. 9.1).

9.2 Blockchain in Simplistic Terms

To avoid using the crypto jargon behind blockchain, a simplified way of describing it is to present it as the technology that enables consumers and suppliers to connect without the need for a trusted middleman to conduct transactions, removing thus the need for having a third party factored into the equation (Hutt, 2016). Technically, a blockchain can be explained as a sort of a database that is shared across a network of computers. One key difference with blockchain is that a database is centralized, while blockchain removes the need for a database administrator (Schlapkohl, 2019). It is similar to making thousands of copies of a spreadsheet and sharing it within a network including many computers, and that spreadsheet is regularly updated by the network (Rosic, 2016). Transactions are kept secure by using cryptography on a decentralized database that anyone in the network can monitor (Hutt, 2016).

Records on a blockchain can be any type of information, blocks are formed by bundling records, and chains are made by linking blocks together. Records provide transaction details and include a digital signature of the parties involved in the transaction. These details are then checked by the computers in the networks called nodes, following which the accepted records are added to a block (Murray, 2018). Each block has a code called a hash, which are strings of letters and numbers generated by mathematical functions. A block also contains the hash of the previous block in the chain. Once a block is added to the chain, the hash codes connect the blocks in a specific order (Murray, 2018).

Another way to visualize this process is the following: one person has a spreadsheet on his computer, while two government accountants have the same spreadsheet on their computers as well. Now, every time you make a transaction you send an email to inform each one of them, they both rush to check. The first to get the job done hits a reply-all button attaching evidence showing that the transaction is valid to get paid a salary. If the other accountant agrees all spreadsheets are updated. In this illustrative

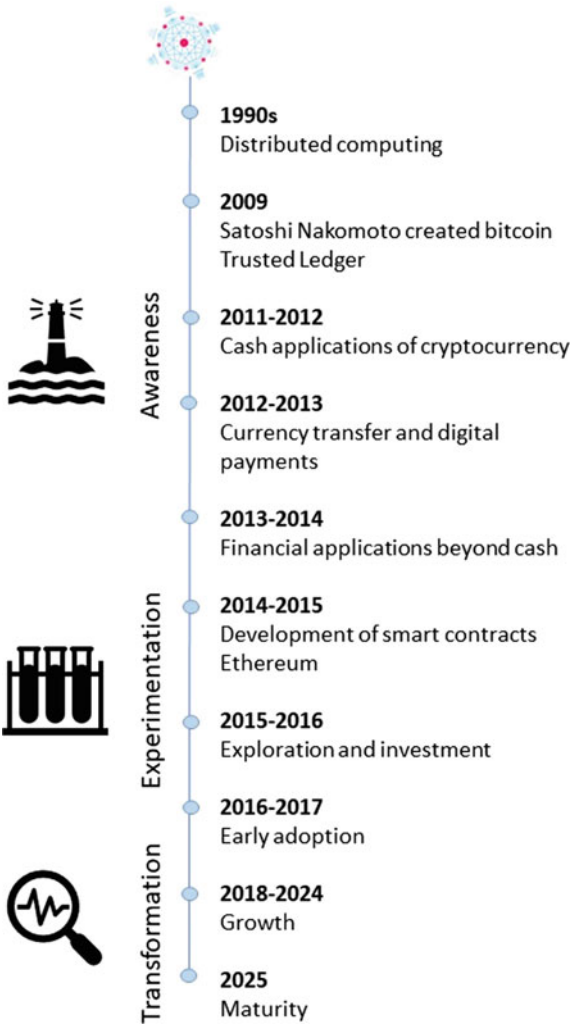

Fig. 9.1 How did blockchain evolve over time? *Source Authors based on data from* (Accenture, 2015), (PwC, 2017), (Capgemini, 2018)

example, the person with the spreadsheet is the node, the spreadsheet is the ledger, the accountants are the miners, the salary is a token or cryptocurrency, the attachment is the Proof of Work, and the whole process is powered by blockchain technology (Deloitte, 2019).

Unlike centralized networks, a blockchain is a database with no Master. Computers or nodes willing to join the network and add blocks to the chain will have to pass tests dubbed consensus models, during which new members are required to prove themselves (Murray, 2018). For instance, a proof of work is about nodes demonstrating that they have solved an increasingly complex computational puzzle, this process is called mining. Miners invest huge computing powers and are rewarded in exchange for their work by tokens or cryptocurrency such as bitcoin. Now, any change to the

original information recorded, will generate a new hash, that breaks the chain, and a potential hacker will have to recalculate the hash for the next block in the chain and so on which requires a huge computing power (Murray, 2018). With blockchain technology, no single entity controls the data, no one can override it and can be independently verified, making it virtually impossible to hack (SelfKey, 2020).

9.2.1 A Quick Dive into Blockchain Technology

Blockchain can be used for any transactions of values such as money, goods, and properties with its use cases seemingly having a limitless potential (Hutt, 2016). It is an open-source technology that excludes the traditional third parties to rely on collective verification, thus offering a great alternative in terms of costs, traceability, security, and speed. When two financial entities such as banks receive a request to transfer money from one account to another, they have to update the balances of their respective customers. This costly and time-consuming coordination and synchronization exercise can be simplified on a blockchain by using a single ledger of transactions reflecting a single version of records instead of two different databases (Mougayar, 2016). But blockchain applications can be much broader than just finance, as the digital-physical gap is closing the technology to encompass a myriad of use cases (Deloitte, 2019). Blockchains can be designed either as private or public, while decentralization remains a common denominator to both forms, there is a key difference in the level of access granted to participants (SelfKey, 2020).

In the case of a public blockchain, participants are typically encouraged to join the network through an incentivizing mechanism such as the case of Bitcoin (Jayachandran, 2017). Anyone can join the network; decentralization is pushed to the fullest extent (SelfKey, 2020). On the other hand, private or permissioned blockchain are closed networks where participants face restrictions in terms of who can write data and who can read it. Hence, while public blockchains maximize the anonymity, permissioned blockchains know the identity of its participants and determine which information they should or should not have access to (Massessi 2018).

While perceptions suggest that public and permissioned blockchains are competing with each other, they have different offerings and could be rather complementary in terms of the solutions they offer (Massessi, 2018). While public blockchains offer high security, an open environment, anonymity, and no restrictions, private blockchains on the other hand prioritize full privacy, high efficiency, and stability. We can argue that permissionless blockchains empower the user by pushing transparency and decentralization to their full extents, while permissioned blockchains empower enterprises instead of individual employees (Anwar, 2020). The convergence of public and private blockchains is expected to pave the way for virtual ecosystems where a wide range of players can collaborate in a secure and auditable way (Deloitte, 2019). Then, which blockchain is better for which applications? Indeed, public and private blockchains have distinct use cases.

In general terms, public blockchains address business to consumer scenarios while private blockchains are more applicable to business-to-business relationships with some shared infrastructure between businesses (Massessi, 2018). The transparency and security features of public blockchains make it more suitable to develop blockchain-enabled solutions serving larger communities where trust is a key concern (SelfKey, 2020). It is a viable option in situations where all users should be treated equally and when the protection of users' anonymity brings an added value to the solution (Massessi, 2018). There are however some concerns whether confidential data should be recorded on a public blockchain assuming the encryption could be hacked one day (SelfKey, 2020). For instance, anyone should be able to own cryptocurrency like bitcoin or Ethereum; having role-based access would defeat the purpose in this case (Massessi, 2018).

In the world of private blockchains, there are quite opposite concerns, since the players are reluctant to publicly share their business data. This is more appealing to financial institutions and corporates so they can know and predetermine who has access to what (SelfKey, 2020). The downside though is that trust comes down to the credibility of the authorized nodes, besides a relatively higher vulnerability to malicious attacks (SelfKey, 2020). As blockchain technology keeps evolving, hybrid solutions could perhaps offer the best of both options by bringing together trust and security alongside efficiency and speed (SelfKey, 2020). Giving the current momentum in adopting blockchain applications across a large spectrum of industries, blockchain technology can only gain in popularity as the world entering the uncharted territories of a new normal in the post-COVID-19 era where technologies are poised to play an extremely important role in redefining business as usual.

Figure 9.2 shows the types of platforms used by blockchain projects based on 71 entries listed in the Blockchain Impact Ledger which uses the SDGs to breakdown listed projects into impact areas (Goldstein & Tillemann, 2020).

There is a myriad of platforms to develop blockchain applications, project managers need to do their due diligence by navigating variables from the type of blockchain needed, popularity of the platform and scalability requirements to smart contracts (Toshendra, 2020). These platforms use different types of networks,

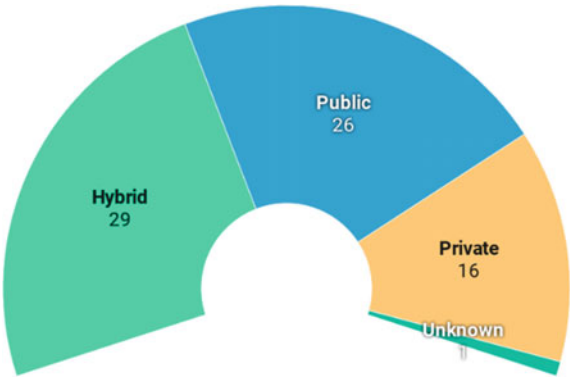

Fig. 9.2 Types of blockchains used by blockchain projects for social impact *Source Created by the authors based on data from* (Goldstein & Tillemann, 2020)

consensus algorithms, and programming languages. Ethereum and Hyperledger remain one of the most popular platforms (Malhotra, 2020). In terms of programming languages, C + + and Go are among the top used by programmers for blockchain-related projects (Deloitte, 2017). Ethereum backed projects on GitHub for instance rose from just 3 in 2013 to 9970 by mid-2017 covering a wide range of applications such as identity management, crowdfunding platforms, remittances, and new cryptocurrencies (Deloitte, 2017).

9.2.2 Smart Contracts

A key feature of blockchain technology is undeniably its ability to accommodate smart contracts. Smart contracts are agreements between two parties recorded as computer code on the blockchain, which is automatically activated when the conditions agreed upon in the agreements are met (BitDegree, 2020). In other words, assets or currencies are transferred into a program, which runs a code that automatically validates the conditions to decide on asset allocation. What smart contracts do is that they take intermediaries out of the equation, as they are stored on the blockchain and transactions are automatically executed—there are no trust-related issues (CoinTelegrap, 2016). In simplified terms, it works like a vending machine. By inserting the right amount of cryptocurrency into the smart contract, the asset be it a house ownership right or a driver's license drops into the designated account (CoinTelegrap, 2016).

There are virtually endless possibilities in the usage of smart contracts from financial services, trade, healthcare, insurance, fundraising, and to virtually everything. For instance, by using smart contracts in the healthcare industry one can securely transfer data without the need for transiting via a third party. Patients can have control over their medical data, they can get paid for it or simply choose not to sell it (Encrypgen, 2018). When smart contracts are used to write voting transactions on a blockchain, a token will be sent to the address representing the winner once the vote is over (FollowMyVote, 2012).

While smart contracts can be a miraculous solution to save costs, gain speed and disintermediate transactions, there are also questions about the future in terms of their impact on jobs that will be replaced and not needed anymore in the digital age of blockchain.

9.3 Understanding Trust

Among blockchain enthusiasts who believe that blockchain-powered solutions can be used to solve virtually anything, and crypto-skeptics who argue that the bubble driven by the overhype may fail to deliver its promises and burst, we believe that one of the key elements, worth examining is the notion of trust. Considering the

multidisciplinary definitions of trust, the rising complexity of networks in modern societies drives a composite trust that results from the interplay of features specific to a complex network (Cho, Chan, & Adalı, 2015). In the digital age, blockchain may shift the trust from analog to digital. Nevertheless, blockchain may not replace trust but rather become the future of trust, depending on how fast the transition can be from trusting legacy trust intermediaries to digital trust in the form of blockchain-backed crypto-trust (Blasingame, 2019). What blockchain does, is to shift from trusting people and institutions to trust technology from the cryptography to the software, the network, the computers, and the people making the system work (Shein, 2019).

In one research, a blockchain-backed model of trust was proposed in the field of higher education, to enable training institutions to adapt curricula to match the specific needs as endorsed by employers (Lizcano, Lara, White, & Aljawarneh, 2020). In another research, a trust model was proposed for blockchain-backed identity management, which is based on a numerical trust metric as an independent basis to characterize assurance levels (Grüner, Mühle, Gayvoro, & Meinel, 2018). In the case of tourism crowdsourcing platforms, false data can distort realities hence the rising interest in trust and reputation modeling to assess the quality of the information outsourced from the crowds and its trustworthiness. Blockchain can associate contributions to contributors and make transactions reliable, which makes the case for blockchain-backed built-in trust and reputation modeling within crowdsourcing platforms to enhance trust between consumers and service providers (Velosoa, Leal, Malheiro, & Moreira, 2019).

A recent book on blockchain and the new architecture of trust examined blockchain as a new form of trust by looking into its blend of social, technical, and legal features upon which the architecture of trust is built. Trusting a blockchain-enabled solution goes beyond the integrity of transaction ledgers and audit logs. It entails effective governance mechanisms which operate in decentralized environments (Werbach, 2019). Indeed, there are several tension points between law and blockchain, the latter may remove mechanisms for legal enforcement, create barriers to prosecute criminal activity, and can be less accurate in dealing with human variables when compared to courts and lawyers (Werbach, 2019). Yet, blockchain can also offer new opportunities to lawyers by removing the traditional frictions in transactions that are algorithmically executed using smart contracts (Werbach, 2019).

Critics argue that verification cannot replace trust, that institutional trust is still needed as well as governance outside the system to override the rules and introduce changes when they are required. Furthermore, several questions persist as to whether the trust intermediaries of the novel crypto architecture are better than their predecessors, the possibilities of abusing trust under in such a new system, and whether the benefits of public blockchains outweigh the issues they bring (Shein, 2019). As there are still more questions than answers, we argue that the future of blockchain technology may well depend on the viability of its new architecture of trust. Whether or not it will become the future of trust to replace or co-exist with traditional trust intermediaries, academic discussions and experimentations will continue exploring trust models in the crypto-space to bring-in some of the critical answers.

9.4 The Sustainable Developments Goals (SDGs)

The Sustainable Developments Goals (SDGs) replaced the Millennial Development Goals (MDGs) as the leading global development framework since their inception in 2015 to 2030. In contrast with the truncated approach of the MDGs, which were not achieved overall by 2015 despite the tremendous progress made, the 17 goals and 169 targets are universal and represent an ambitious agenda for sustainable development spanning social, economic and environmental considerations all over the world uniting both developed and developing countries to raise a historical challenge of delivering on their ambitions by 2030 while leaving no one behind (Fig. 9.3.

While recognizing the great efforts made and the significant progress achieved worldwide as reported by countries in their national voluntary reviews (UN DESA, 2020), there is no country in the world on track to achieve all the SDGs by 2030 (Sachs et al., 2019). We can argue that the international community has so far failed to create the conditions needed to achieve such an ambitious agenda. The multilateralism canopy which used to lay the foundations for the international community is shrinking driven by rampant unilateralism and trade wars (Ghosh, 2019). In an increasingly multipolar world, this could be explained by the worrying trends in the global economic architecture and patterns in trade and capital flows that are fueling inequalities. From intellectual property rights, the privatization of natural and social assets, market monopolies to corporate tax avoidance, regressive indirect taxations to fiscal austerity measures (Ghosh, 2019).

Before the new Coronavirus disease, the funding gap to meet the SDG targets by 2030 was estimated at US$ 2.5 trillion annually (Burgess & Turner, 2019). To bridge the gap in development finance needed for the SDGs, there is a need to attract private capital flows and consider innovative and scalable approaches (Runde et al., 2020). This is a key area where blockchain-enabled applications can play a vital role in areas such as remittances, impact investing, crowdfunding, and Islamic finance.

Uncertainties under a new normal may indeed derail current efforts to meet national global targets (Aysan et al. 2019). Initial assessments are already showing that the Coronavirus pandemic is affecting all the SDGs from loss of income drowning entire segments of societies below poverty lines, increased levels of violence against women, reduced commitment for climate action, to backlashes against globalization (UN DESA, 2020). The Preliminary findings from a recent survey of the public opinion on the impact of the pandemic on achieving the SDGs by 2030, suggest that the majority of participants with 43.6% believe that the crisis will both accelerate and slow down the SDGs in the same proportions, while another 36% see a negative impact and are of the view that on the long run it will only slow down the SDGs (Lafortune, 2020). In order not to derail the current momentum for meeting the SDG targets by 2030, countries will need to implement coordinated packages that support financial stimulus, concessional finance, debt relief, market liquidity, resilient infrastructures, crisis prevention, social protection systems, trade and supply chains (Subhanij & Hasannudin, 2020).

Fig. 9.3 The Sustainable Development Goals (SDGs) *Source* (United Nations, 2020)

9.5 Can Blockchain Offer Superior Solutions to Achieve the SDGs?

An overview of initiatives using Distributed Ledger Technologies (DLTs) suggests that blockchain could transform the ambition for good into tangible results (Kewell et al., 2017). Blockchain can be an enabling technology to develop sustainable and secure solutions. This can be explained by its ability to enhance operational efficiency in global partnerships, but also to deliver the key functions of transparency, traceability, accountability, and cyber-resilience to fulfill the SDGs (Fraga-Lamas & M. Fernández-Cara, 2020). While there is a growing interest in blockchain technology, there are not many examples in the literature explaining how blockchain is operationalized in concrete terms (Nikolakis et al., 2018). There are also technological barriers facing the adoption of blockchain such as in the field of sustainable supply management that can be technical, inter-organizational, intra-organizational, or external (Saberi, Kouhizadeh, Sarkis, & Shen, 2018).

The notion of blockchain for good in reference to the SDGs can be questioned through the lenses of the existing cautionary literature. It is still unclear whether DLTs can deliver a better society that is more democratic, inclusive and sustainable, or rather becomes another tool deployed by organizations and authorities for control and surveillance purposes (Kewell et al., 2017). Some of the most promising use cases for a successful implementation of blockchain-enabled solutions were found in the areas of affordable and clean energy under SDG 7, and in the areas of responsible consumption and production under SDG 12 (Shermin, Tatjana, Wildenberg, & Rammel, 2019).

Despite a noticeable increase in blockchain-related research, little attention was given to the issues of sustainability and open innovation while developing academic and commercial solutions, most of which are still at their early stages (Fraga-Lamas et al., 2020). The usefulness of blockchain-powered solutions for instance to increase financial inclusion can be negatively affected by the absence of protocols and definitions, which hinders its ability to make a significant difference (Danho & Habte, 2019). Similarly, for blockchain to fulfill its promise for instance to enhance sustainability within global value chains, there is a need to establish proper safeguards (Nikolakis et al., 2018). More research is needed for a better understanding of the extent to which DLTs can be deployed and their ability to deliver the SDGs purposes (Kewell et al., 2017).

While virtually there is an undeniable potential for blockchain use cases to accelerate achieving each one of the SDGs, there is also a huge lack of data to truly assess the contribution of blockchain to sustainable development. Unlike its financial and commercial applications, blockchain-enabled solutions for social impact remain relatively understudied (Goldstein & Tillemann, 2020). In the absence of aggregate data to build the body of knowledge about blockchain use cases for the SDGs, organizations, and individuals implementing blockchain projects for social impact may not be able to learn from it. We argue that such knowledge is indeed critical to extract good practices, lessons learned, share experiences, and catalyze join

efforts towards reaching economies of scale and perhaps pave the way to functional blockchain ecosystems.

Several initiatives are working to fill in the information chasm within the arena of blockchain for sustainable development by building online databases of blockchain projects such as the Positive Blockchain database reportedly the largest with more than 850 impact blockchain projects (PositiveBlockchain, 2020), the Blockchain Impact Ledger (Goldstein & Tillemann, 2020), and the Canonical Blockchain List (Brand, 2018). While many agree on the promising potential of blockchain technology, critics highlight its early stage of development and the need for a better understanding of what can be done and what cannot be done with blockchain, when to implement it, which underlying ethics to consider, and how to monitor and evaluate its system-wide improvement and measure its impact on the international humanitarian and development practice (Joost & Andrej, 2018). Other critics emphasize the absence of appropriate data and evidence to support claims throughout the chain of results from outputs, outcomes to the impact of blockchain-backed solutions. The same applies to lessons learned and practical insights which remain understudied compared to other emerging technologies (Vota, 2018).

At the core of the relationship with donors and partners funding the SDGs are the imperatives of trust and accountability. While both can be achieved to some extent via traditional reporting mechanisms, such practice can surely benefit from appropriate technological innovations. Against this backdrop, the adoption of blockchain technology within the international development community should not be solely approached through the lenses of testing new technological gadgets. The ongoing trial and error experiments of blockchain technology should also consider blockchain standards such as those being developed by ISO TC 307 (Ryan & Horner, 2019). A more transparent and efficient international development is critical to sustaining healthy levels of trust between donors, governments, businesses, multilateral organizations, and civil society organizations. It is also necessary to maintain the reputation of blockchain technology (Ryan & Horner, 2019). Blockchain is not a risk-free technology and has its own set of transparency and cybersecurity risks, regulatory challenges, and interoperability problems resulting from fragmented digitalization (ADB, 2019).

Deploying blockchain-backed solutions comes with its own set of challenges from talent shortages, to scalability concerns, regulatory issues, governance, and change management concerns (Ranjan, Hung, Mohindroo, & Vignesh, 2019). The blockchain deployment toolkit released by the World Economic Forum on April 2020 for instance, may provide some of the very much needed tools needed in the blockchain space, which guide organizations and individuals in their journey to galvanize more responsible deployment and de-risk adoption by the early movers in their industries (WEF, 2020).

The map in Fig. 9.4 shows a breakdown by region of the cumulative numbers of the SDGs to which blockchain projects for social impact contribute based on 71 entries listed in the Blockchain Ledger Impact database. This visualization suggests that East Asia and Pacific comes first as the region where blockchain projects contribute to the largest number of SDGs (Goldstein & Tillemann, 2020). It is followed by

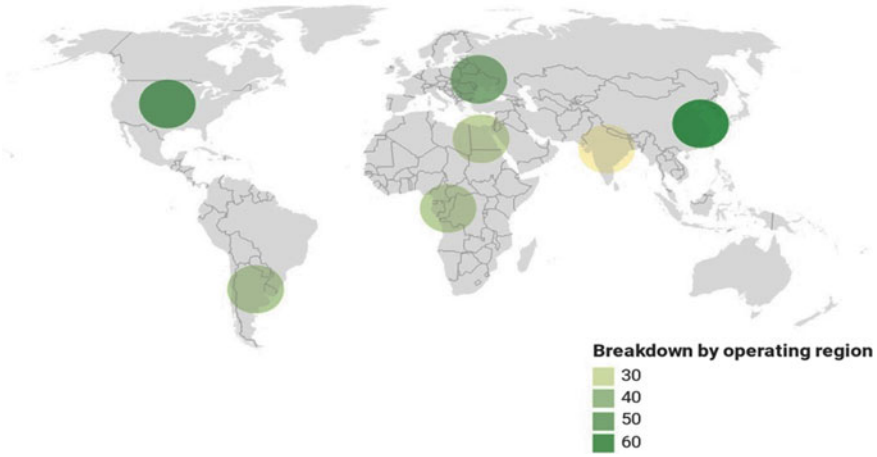

Fig. 9.4 Map showing the contribution of blockchain projects to the SDGs per region *Source Created by the authors based on data from* (Goldstein & Tillemann, 2020)

North America, Europe, Central Asia, Latin America and the Caribbean, Sub Saharan Africa, the Middle East and South Africa, and South Asia. While the map itself offers much-needed insights into the dynamics of the contribution made by blockchain-enabled solutions to the SDGs, it is only based on a limited number of blockchain projects for social impact ($n = 71$) and naturally falls short of providing the full picture. This shows that blockchain-powered solutions remain largely understudied, which stresses the need for reliable sources of data to study how blockchain projects deliver or not, social impact on the ground (Goldstein & Tillemann, 2020). Such insights are critical learning tools for organizations and individuals alike in an exciting but demanding journey to develop blockchain-backed solutions for social good.

9.6 Blockchain and the SDGs in the Age of COVID-19

The year 2020 is a symbolic landmark within the international development community marking 10 years to achieve the ambitious sustainable development agenda by 2030. As the world declared war to the invisible enemy, the uncertainties and volatilities that followed are posing serious risks to sustain the momentum in meeting the SDG targets by 2030 as the world priorities may shift towards managing the pandemic. At the very time where financial markets were tumbling, borders shutting down, people panic buying and millions losing their jobs, development financing may be repurposed to solve pressing domestic issues at home first, as countries inject stimulus packages to revive their economies. During unusual times, unusual solutions may be required, and disruptive technologies may be needed more than ever before.

As the world is walking into the uncharted territories of the post-COVID-19, and as disruption waves are building and breaking on the shores of the international development practice as we once knew it, business-as-unusual will undeniably become the new normal. With that in mind, there is a need to rethink the architecture of international development as the current practice might become obsolete before we know it in the race to the unknowns. So how do we adapt to a new normal? With initial estimates indicating that the Coronavirus disease will cost the global economy around US$ 1 trillion (UNCTAD, 2020), disruptive solutions are needed in the face of a looming socio-economic crisis to avoid reversing the hardly achieved development gains during the recent decades. Luckily, the new normal is not only a matter of uncertainties and volatilities driven by skepticism, fear, and fragility, it is also an era-defining moment of opportunities.

In the aftermath of the Coronavirus disease, we are witnessing a historical opportunity to reboot our systems and rebuild our economies based on the triple bottom line of social, economic, and natural capitals. As we are rebuilding our economic systems, many questions remain however as to how we address inequalities, reverse the loss of biodiversity, or tackle the climate crisis. While there are no easy one-size-fits-all answers, we argue that we cannot solve an issue with the same thinking that created the issue. For instance, to embrace a true sharing economy we do not have to redistribute wealth once it is created but instead pre-distribute productive assets to the crowds upfront through a decentralized system.

Tech trends during the pandemic provided a pre-taste of what would a new normal look like. Online shopping, contactless payment, remote working, e-learning, digital health, e-entertainment, data-based supply chains, 3D printing, 5G, robotics, and drones are all part of the rich landscape of digital readiness (Xiao & Fan, 2020). Similarly, some technologies are expected to boom in the aftermath of the pandemic, this is the case for example of data-enabled health care, digital supply chains, e-commerce, digital collaboration, and entertainment (Ruokonen, 2020).

The current economic and development landscapes suggest that disruptive technologies such as blockchain will play a leading role in defining and adapting to the new normal in the post-COVID-19 era (Banafa, 2020). Consequently, we can safely assume that the blockchain technology will only gain further attention, which will in return boost its adoption and growth making it perhaps the new internet of tomorrow, the internet of value.

9.7 Use Cases of Blockchain-Enabled Solutions Across the SDGs

The digital wave of disruption is having a far-reaching scope with many blockchain applications currently testing the waters of Islamic finance. With its assets reaching $2.5 trillion in 2018, a 3% increase compared to 2017 (ICD, 2019), the Islamic finance industry is being shaped by Financial-technology or Fintech. Scholars and

regulators alike are exploring the potential of crypto-assets and blockchain-powered digital platforms. Giving its multiple applications designed for Islamic social finance, blockchain has the potential to lay out the foundations for a booming industry while accelerating the achievement of the SDGs (ICD, 2019).

Blockchain can be harnessed in Islamic finance in different ways such as smart contracts which can be used for managing profit-sharing agreements and partnerships, the verification of Islamic financial transactions for banks and customers to avoid conflicts and increase transparency, and the integration with mobile technology in countries lacking banking infrastructure (OConnell, 2019). While Islamic FinTech faces the challenge of blockchain-related "sharia" compliance, Islamic financial institutions can increase efficiency, transparency, and customer satisfaction by adopting FinTech (Rabbani, Khan, & Thalassinos, 2020).

For instance, the Zakat ecosystem is facing several challenges that are related to reporting, transparency, and traceability. From Zakat (Blossom, 2018), to charitable donations (KryptoPal, 2018), halal certification (Mirchandani, 2018), and Sukuk transactions in the financial markets (Al Hilal Bank, 2018), the winds of blockchain-based technological innovation are blowing and driving substantial change in the Islamic finance industry, in particular with millennials (ICD, 2019). The snowball is getting bigger and bigger.

In an attempt to tap into the unseized potential of the Zakat given worldwide which stands at $76 billion, far below its potential of $356 billion (DinarStandard, 2019), UNHCR's Zakat Refugee Fund was launched in September 2016 (UNHCR, 2019) and so far $38.1 million has been raised, helping about 111,209 refugee and IDP families (approximately 648,476 individuals) in Yemen, Lebanon, Iraq, Egypt, Jordan, Mauritania and Bangladesh (UNHCR, 2019). The potential of Zakat combined with its ability to contribute solving some of the most pressing issues such as the refugee crisis, paves the way for blockchain-based applications to ensure the much-needed accountability and transparency in the Zakat industry. By building a decentralized social impact network on the blockchain, social organizations can use smart contracts to capture end-to-end transactions and ensure that donor's impact is independently verifiable and accessible to everyone.

Blossom Finance uses Bitcoin to provide microfinance services to entrepreneurs and small businesses (Blossom, 2020a). During the month of Ramadan, Blossom reportedly offered a free Zakat via Blockchain service, the transfers were made to a designated wallet and used to support the poor in central Java and Sumatra (Blossom, 2020a).

In the Halal certification industry, giving its vulnerability to fraud, blockchain-backed solutions are being experimented. KT, a telecom company, and partners are working to establish a Halal Certification Platform which will issue certificates on the blockchain while allowing customers to use QR cods on their products to verify their status (Wood, 2019). OneAgrix, a trading marketplace, provides a B2B platform using a blockchain ledger to trace halal ingredients and authenticate halal certificates (Whitehead, 2019).

With the emergence of circular business models across global supply chains (WEF, 2014), and while circular economy practices can contribute to a wide array of SDGs,

such contributions may be particularly significant for SDG 6, SDG 7, SDG 8, SDG 12, and SDG 15 (Schroeder et al., 2018). We will examine how blockchain-backed solutions do also contribute to these SDGs in a transition towards a circular economy.

9.7.1 Sustainable Water Management

Blockchain-based schemes can transform the future of water management and trade by recording transactions between parties to boost transparency in times of water scarcity, crises, and mistrust towards governments and corporations. Blockchain platforms can also fund water treatment projects, while waste management systems powered by blockchain can increase efficiency and transparency. The technology can also enable water trading, smart meters, monitoring of rainfall and water quality in catchment areas, and automated crop insurance during droughts (WEF, 2018).

Bundling blockchain-based solutions with other digital water technologies such as IoT, AI, and big data can bolster smart water management systems using sensors to collect valuable data about water quality, pressure, leaks and pipe bursts and trigger adequate management responses. Such innovations do not only have the potential to optimize the use of water resources, but also nudge rational behavioral changes among consumers. Nevertheless, early movers will have to overcome the high start-up cost, secure the expertise needed, and comply with health standards and regulations.

Watering, an off-grid network powered by blockchain and IoT aiming to facilitate the exchange of surplus water and food, proposes a water production solution through its installations by capturing atmospheric water, purifying grid water, collecting rainwater and by treating free water for irrigation purposes. It also harvests renewable energy from solar, aeolian, underground, and waste sources which can be fed into water production and processing or used to power nearby vertical food farms. The system broadcasts water and food data on the blockchain to track and monitor water usage and quality (Suen, 2020). This innovation targets participants such as hub micro-owner, water token traders, vertical farms operators, mainly benefiting people with limited mobility to acquire water and food such as the elderly. The pilots can be financed by crypto tokens from local micro-investors, where the token signifies micro-ownership and can be freely traded on a dedicated platform (Suen, 2020).

Civic Ledger, specialized in data-driven solutions for the public sector, was tasked to examine the reluctance of some irrigators to trade water in the Australian water markets. A blockchain-backed solution dubbed Water Ledger was proposed in the feasibility study offering a digital peer-to-peer water entitlement registry and trading platform. While it simplifies and automates water trading, it also improves transparency related to water prices and volumes while enables non-traders to offer unused water allocations (Civic Ledger, 2020). WaterChain, a blockchain-backed water-funding platform, aims to open up investments in clean water projects, investors can by WaterChain tokens to hold a stake in specific water projects and get dividends. It is also exploring ways to process payments and blend blockchain with IoT to track the usage and quality of water (WaterChain, 2018).

9.7.2 Sustainable Energy

Giving its complexity the energy sector needs a great deal of intelligence and transparency which provided a fertile ground for new business models to evolve and emerge driven by blockchain technology, including through power trading and financing for renewables (IRENA, 2019). Blockchain can be a true disruptor for the energy industry which remains despite its technology-rich landscape a complex and costly transactional ecosystem (Deloitte, 2018). Its use in the energy market is predicted to reach record high driven by a surge in interconnection and digitalization raising security concerns of grids and networks. Most of the blockchain energy projects are building peer to peer energy markets, with many countries reaching energy parity. Individuals producing their energy will be able to trade it with their neighbors and peers.

Other blockchain applications are used to redesign the wholesale electricity distribution by supplementing retailers and allowing users to connect directly to the grid, to securely manage energy data, support commodity trading, share information and data among utility providers, facilitate and track the trade of gas and oil, allow regulators access transparent data for reporting and compliance, reduce and track carbon emission and to reward the adoption of renewable energy.

In Australia, the City of Fremantle is using blockchain-backed solutions to power renewable solar energy systems through the RENeW Nexus project. In its trial the platform enabled neighbors from about 40 households to trade the excess in rooftop produced solar energy, providing real-time tracking of energy transactions among the participants (Power Ledger, 2020). In Estonia, WePower tokenized national energy production and consumption data in the blockchain. A total of 26.000 h and 24 TWh of energy data was uploaded to a blockchain-backed platform creating 39 billion smart energy Tokens. By linking smart contracts with power grid data, the tokens represent self-settling power purchase contracts of 1 KWh which can be traded and liquidated in the local energy wholesale market (Invest In Estonia, 2018).

9.7.3 Reducing Inequality

Blockchain can play a vital role as a core enabling technology for the sharing economy that has the potential to rebalance wealth distribution between and within countries based on pre-distribution of productive assets in contrast with wealth re-distribution once inequalities have already occurred (Berggruen, 2018). In other words, the ability of blockchain to transfer wealth over the internet makes a strong case for a contemporary solution to enable a true sharing economy that is secure, efficient, and transparent (Avendano, Pico, & Igunma, 2019).

By issuing Sharia-compliant Sukuk using blockchain, Blossom Finance and partners raised USD 50,000 using a profit-sharing structure and carrying a one-year maturity to expand financing to local entrepreneurs. Its impact investing platform is

financing social impact projects using Ethereum smart contracts while ensuring an audit trail on transactions carried on at every step of the process (Blossom, 2019). Consumers can be also empowered to trace back the origin of their food supply. Food Trust is a blockchain platform that connects consumers with smallholder coffee farmers to trace coffee throughout the supply chain from the moment beans are picked (IBM, 2020). To tackle a changing climate and boost the resilience of rice farmers in Sri Lanka, Oxfam and partners are developing a blockchain-enabled micro-insurance platform to lower costs and enable rice farmers to access affordable insurance options (Aon, 2018).

9.7.4 Sustainable Consumption and Production

The current business model according to which goods and services are produced and consumed is facing unprecedented scrutiny driven by an increasingly conscious consumer base, the pressure on planetary boundaries and the devastating consequences of over-production and over-consumption on natural equilibriums whether it is about climate change, loss of biodiversity and ecosystem services, besides damaging other assets of natural capital. A supply chain for a given commodity, for instance, may involve a dozen middlemen and brokers between the smallholders and the consumers while adding no significant value to the products or services supplied. Not only the consumers will end up having no information if the price they are paying is fair, but the smallholders will be missing all the value addition downstream of the supply chain. This is indeed one of the scenarios where blockchain-based solutions can come into play. In fact, by recording data and keeping it safe in a decentralized manner, it can increase transparency, renew confidence, and restore trust within peer-to-peer transactions (University of Canterbury, 2019).

A growing body of research conducted on sustainable production and consumption points towards the need to increase efficiency at the production stage while reconsidering consumption patterns. This entails considering technological improvements, generating reliable data for consumers to make informed decisions, which can influence consumption, distribution and pave the way for institutional changes (Bengtsson, Alfredsson, Cohen, Lorek, & Schroeder, 2018).

Swachhcoin, is a blockchain-based platform working to reinvent waste management through an integrated ecosystem of blockchain, Big Data, IoT, and AI. By using smart bins capable of recognizing and recording the type of waste the latter is turned into 20 different types of useful products such as electricity, precious metals, and timber (Gopalakrishnan & Radhakrishnan, 2019).

9.7.5 Solving the Climate Crisis

To solve a disruptive climate crisis, one should consider disruptive solutions. In the climate change arena, numerous blockchain use cases are emerging to give an impetus to the much-needed climate action. The technology can be used to improve carbon emission trading, enable peer-to-peer renewable energy trading platforms, facilitate all sorts of financial transactions, and most importantly provide more transparency in the reporting of GHG emissions, and the progress made in implementing the NDCs (UNFCCC, 2017). However, to truly unleash the potential of blockchain for climate action, more research is needed to design meaningful approaches according to which blockchain-enabled solutions can become part of the climate action landscape. Experimentations at the crossroads of blockchain and climate change are expected to shed some light on good practices and lessons learned. The most promising use cases for blockchain in climate action were reported to be those related to registries and tracking, MRV systems, and access to clean energy and finance (CLI, 2019).

A blockchain-backed carbon trading platform created by IBM and Energy Blockchain Labs allows high carbon emitters to buy carbon credits from low emitters to comply with the applicable Government quotas (IBM, 2018). CarbonX, a peer-to-peer voluntary personal trading platform, operates by sourcing carbon credits and recasting offsets as tokens on the Ethereum blockchain, which are then distributed through a loyalty rewards program to offset the carbon footprint of products and services and allow its customers achieve carbon neutrality in their consumption behaviors (CarbonX, 2018). ClimateTrade, another blockchain-enabled platform is offering services from acquiring carbon credits to offset emissions, impact investing, and blended finance by allowing customers to invest in equity and generate revenues by funding climate change mitigation and adaptation projects (ClimateTrade, 2020).

Carbon market applications of the blockchain technology offer advantages ranging from high speed to immutable audit trails, lower transaction, and management costs and the traceability of emissions reduction (UNEP DTU, 2019). In a comparative study of 4 blockchain platforms, Ethereum blockchain stood out as the best benchmark for climate policy instruments which was attributed to its architecture and key features such as self-made cryptocurrencies, limited operational costs, flexibility for programming and ease of use (Braden, 2019).

9.7.6 Blue Economy

For the ocean's conservation and the sustainable use of our marine resources, it is necessary to ensure full traceability of the seafood supply chain by tracking the resource from ship to supermarket. This can be facilitated through the use of promising technologies such as radio frequency identification tags, DNA barcoding, or blockchain (WEF, 2017). By enabling transparency and traceability along the seafood supply chain, blockchain-backed platforms can empower markets and

consumers to reward sustainable producers while flagging unethical practices (Cook, 2018). In the maritime shipping and logistics industry, disruptive solutions are pursued by maritime transport operators to reduce costs and ensure efficiencies (OECD, 2019). While global ocean governance instruments such as the UN Convention on the Law of the Sea (UNCLOS) are vital for the sustainable management of oceans and marine resources, they fall short in terms of policing and reinforcing the regulations they entail. Disruptive technologies can be the key to transparency and traceability (Scruggs, 2018).

Fishcoin, a blockchain-enabled data ecosystem approach to transform the seafood industry, offers an incentive for seafood harvesters to capture and communicate data in exchange for rewards such as top-ups for mobile data plans. Therefore, the economic burden of data collection is shifted downstream to the supply chain by using tokens while ensuring traceability and transparency (Chase, 2018). WWF and partners initiated a blockchain-based project to tell the story of Fijian tuna fish. By assigning QR codes or sensor devices to assets, consumers can view the journey of the product they are buying using a smartphone application and get to know the actors behind it from the fishermen to the plate (Cook, 2018). To trace Indonesian skipjack and yellowfin tuna from vessel to factory, fishermen send text messages to register the catch which results in an asset being issued on a blockchain and transferred as the fish moves along the supply chain (Leber, 2018).

9.7.7 Green Economy

The key feature to foster environmental sustainability relies on the ability of the blockchain technology to guarantee immutable and verifiable records of how biodiversity, natural resources, and ecosystem services were managed as a reliable alternative in the absence of trust and poor confidence in the existing environmental governance schemes.

The Earth Bank of Codes, a digital platform to map out the genetic sequences of biological diversity in key terrestrial and maritime biomes, works on registering assets on blockchain recording the origin of the resource as well as the rights and obligations associated with its utilization. Once the value is created through products and services derived from bio-inspired innovations, benefits can be shared via smart contracts with the resource providers which will contribute to the conservation and the sustainable use of biodiversity (Earth Bank of Codes, 2018). To fight deforestation in the Amazon, GainForest empowers donors and caretakers to protect the rainforest through smart contracts. The way it works is that volunteer caretakers commit to ensuring that a forest patch is protected from deforestation and stake a voluntary amount which they can claim back in addition to a reward after the conservation period is over (Murtaza, 2019).

9.8 Concluding Remarks and Discussions

Blockchain can be visualized as this cryptographic book of truth upon which robust foundations of trust can be built. Coping with relentless technological advances is not an easy task, riding the wave of disruptive innovations such as the blockchain technology can be illustrated with climbing a mudslide raging down the mountain. More research is required to assess the true extent to which development workers ability to transform the promising potential of blockchain-backed solutions into tangible development results beyond the hype.

With blockchain experiments demonstrating disruptive solutions, the surge in recent years looking into an increasingly diversified pool of use cases to rethink a wide array of applications across the SDGs, combined with the progressive removal of some of the key barriers slowing its adoption at scale, are all encouraging signs of its maturation. Despite all the existing challenges and those yet to come, we can argue that the blockchain technology made it to the much-cherished pool of game-changers that have the power to disrupt our ways of thinking, those have undeniably become the tools for today's and tomorrow's business as unusual. Nevertheless, it is very important to distinguish between those cases where blockchain can deliver tangible value and stay away from unnecessary investments amounting to "blockchain washing".

The blockchain technology has a tremendous potential to disrupt traditional ways in which we used to do development towards achieving the Sustainable Development Goals by 2030 but there are caveats. When use cases are properly chosen, adequately designed, and implemented, blockchain can deliver its promises beyond the hype mainly by restoring trust and enabling efficiencies. As blockchain is peaking, project managers and development practitioners down the road should anticipate the slow but steady emergence of disruptive new business models, to deliver sustainable development results by moving from log frames to acceleration labs, and from aggregate expertise to disruptive co-creation.

Within the development community, there is a clear need to reboot our expectations in terms of what can be done with and without blockchain technology. The tendency to ride the wave of the blockchain hype under all circumstances without prior due diligence is not the right path forward and can be even detrimental to the very concept of aid effectiveness. The critical starting point for development practitioners would be to build rational use cases for blockchain to solve specific development challenges taking into consideration the variety of contexts in which such solutions are needed.

By weighing the tangible benefits expected from a blockchain-backed solution against the extra cost attributed to the additional complexity inherent to the blockchain technology, development workers can seek meaningful tradeoffs and create promising use cases to unlock the truly transformational potential of blockchain as an SDG accelerator that can truly disrupt the way we do development.

As we are heading towards the uncharted territories of the new normal in the aftermath of COVID-19, whatever this will entail for the global order in an increasingly multipolar world, trust is in rare supply more than ever before. The alternative to a

system prone to failure could be to replace blind trust by a trustless ecosystem where transactions are fast, secure, verifiable through an audit trail, and cost-efficient.

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Chapter 10
Financial Development and Ecological Footprint in OIC Countries: Islamic Perspectives and Empirical Evidence

Muhammad Tariq Majeed

Abstract The rising importance of financial development in affecting environmental quality has attained the attention of various researchers in the recent decades. Whereas financial sector contributes to dominant 'linear economy paradigm' at the cost of environmental quality, it also contributes to 'circular economy paradigm' thereby preserving the environment for future generations. This chapter analyzes the relationship between financial development and ecological footprint using the panel data of 38 Organization of Islamic Cooperation (OIC) countries over the period 1971–2017. The empirical results are estimated using panel data estimators. The findings show that financial development helps to improve the quality of environment by lowering ecological footprint in OIC countries. However, the results also reveal that financial development is a source of high environmental degradation in affluent OIC countries. Thus, financial sector can contribute to 'linear economy paradigm' as well as 'circular economy paradigm' depending upon the priorities of financial sector. Findings of this chapter are shown to be robust to several robustness checks. The chapter offers important policy implications for the Muslim world.

10.1 Introduction

The contemporary world is confronted with two major challenges: achieving high economic development and preserving the earth's environment. The environmental degradation has become a global threat to humanity as a result of accumulation of greenhouse gases (GHGs) in the atmosphere. The rapid growth of industrialization over the past 200 years has resulted in a substantial rise in energy demand that is largely fulfilled by non-renewable fossil fuels. Accordingly, policy makers find it increasingly difficult to maintain the trade-off between economic development and environmental degradation.

In this background, the role of financial sector in influencing environment has become critical. Whereas financial sector has the power to improve the quality of

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environment, it can also deteriorate environment. Zhang (2011) argues that financial development attracts more environmentally friendly projects through research and development. Financial development also facilitates the investment in energy efficient technologies such as renewable energy. Similarly, it can increase economic efficiency by reducing the capital risk and financial cost that minimize the overall resource inefficiency.

In contrast, financial development upsurges the environmental degradation by facilitating the credit facilities to the customers for purchasing electrical devices, automobiles, and houses. These facilities help the investors to expand their business horizons and set up new plants that in turn increase the carbon emissions (Danish et al., 2018; Zhang & Zhang, 2018). Moreover, rise in foreign direct investment (FDI) in response to well-developed financial system also contributes to environmental degradation (Sarkodie & Strezov, 2019).

A major weakness of these studies is that they rely on CO2 emissions as an indicator of environment (Maji et al., 2017). The carbon emissions are, however, a part of environmental degradation caused by large scale energy consumption (Al-Mulali et al., 2015). In contrast, the ecological footprint (EFP) is a more reliable indicator of anthropogenic pressure on the environment. It has certain strengths.

First, it is one of the comprehensive indicators of environmental quality. Second, it deals with the information of numerous natural resources that are required for the production and support of the overall economy (Katircioglu et al., 2018). Third, it tracks the information about ecological deficit and surplus (Castellani & Sala, 2012). Fourth, it provides the efficient measure of depleted natural resource reproduction by capturing the information on water and land (Aydin et al., 2019). Fifth, by providing the information about resource metabolism, it allows the state/government to compare the economy's resource demand with its actual supply and handles the distributional process efficiently. Lastly, it can build the economy's competitiveness by monitoring resource supply/deficit (Wackernagel et al., 2006).

Another issue with empirical literature is that the empirical studies generally focused on country-specific evidence or regional base evidence. The studies have generally ignored developing world including Organization of Islamic Cooperation (OIC) countries. The developing world is more prone to be affected rapidly by environmental issues than developed countries. Since Muslim majority countries are geographically located within developing countries, assessment of their ecological issues is important. Islamic countries have declared their commitment to preserve the environment under the umbrella of the Organization of Islamic Cooperation.

The concerns of Muslim majority countries about environmental protection are not clear. In recent decades, a rapid social change has been observed in many countries including OIC countries. Traditional and religious norms, culture, and care for environment have been declining. For example, some Islamic countries are blamed for wasteful consumption of food during the holy month of Ramadan (Saniotis, 2012). Some of Muslim countries are questioned for whether they have contaminated the image of Islam by escalating man-made environmental problems. Such problems include the devastation of the Aral Sea in Central Asia, desertification in

Sub-Saharan Africa, exhaustion of oil deposits in the Middle East, deforestation, and loss of biodiversity in Islamic countries (Kula, 2001).

The literature has paid little attention to ecological issues of the OIC countries. This chapter contributes to the emerging literature on ecological aspects of financial sector by answering the following two questions. Does financial development reduce ecological footprint? Is the effect of financial development on ecological footprint different in affluent OIC countries?

10.2 Literature Review

10.2.1 Environmental Context of Islam

Allah, the Almighty, says in the Holy Quran (20:53–54): "He Who has spread out the earth for you and threaded roads for you therein and has sent down water from the sky: With it have We brought forth diverse kinds of vegetation. Eat and pasture your cattle; verily, in this are signs for men endued with understanding".

In effect, Allah has created diverse resources for the use and welfare of human beings. Islamic teachings refer to just and sustainable use of natural resources, whereas abstaining from extravagance and wastefulness. As believers, thus, Muslims are duty bound to achieve higher level of environmental preservation and preservation of natural resources (OIC Environment Report, 2017).

The religion of Islam is the third of Abrahamic religions and shares its religious heritage with Judaism and Christianity. Environmental context of early Islam was characterized by its simplicity and respect for nature. As Islam spread into different continents such as Asia, Africa, and Europe during the seventy centuries, it maintained its naturalistic approach. A fundamental feature of early Islam, which has informed Muslims for 14 centuries, is its emphasis on nature.

The Quran and the teachings of prophet (PBUH) are the main sources of Islamic environmental ethos that have been integrated within Islamic jurisprudence. Islamic ecological ethics base on three founding ideas that are *tawhid* (Divine unity), *khilafah* (stewardship), and *akhirah* (the hereafter). The main implication of *tawhid* is that Allah is the Creator of whole universe and that all existence reveals unity in plurality (Dutton, 1996; Foltz et al., 2003; Saniotis, 2004).

According to Muslim scholars, "universe is governed and regulated by the principles of unity, balance and harmony that characterize the interactive unifying principle—*tawhid*" (Saniotis, 2012). It is repeatedly quoted in Quran (14:19–20; 46:3; 15:85–86) that the universe characterizes by proportion, harmony, and beauty, which reflect Divine craftsmanship (Saniotis, 2004: 101; Wersal, 1995: 453; Ozdemir, 2003; Nasif, 1987). The universe is retained in balance, and it is controlled by the interdependency of ecological systems (Wersal, 1995: 453; Faruqi, 1980: 24–31). Therefore, "nature provides a source of inspiration and guidance for understanding Divine

action in creation. In human terms, *tawhid* is the basis of human action and thought, penetrating every dimension of subjective and social life" (Shariati, 1979).

Stewardship is the second source of Islamic environmental ethics (Idris, 1990; Khalid & O'Brien, 1992). The Quran declares humans as stewards of Allah's creation. Behold, the Lord said to the angels: "I will create a vicegerent on earth" (Quran 2:30). Moreover, humans need to abstain from mischief (actions leading to the corruption of the environment). "Do no mischief on the earth after it hath been set in order but call on him with fear and longing in your hearts: for the Mercy of God is always near to those who do good" (Quran 7:56).

The importance of ecology in Islam is endorsed by the fact that one-eighth of the Quran urges Muslims to mediate on nature. Khalid (1996) highlights that the concept of stewardship implies that humans are friends of the earth, not its masters.

The third concept of Islamic environmental ethics is belief on hereafter life. It implies that humans are not only obliged as Allah's steward on the earth but also would be held accountable in the hereafter, if there is any straying. "Each generation of humans is obliged to improve the condition in which preceding generations have left the earth. No generation has a right to pollute the earth in a manner that depletes its resources and degrades its biological systems" (Weeramantry, 1988: 61).

Scholars maintain that "humans have the rights and privileges of living from the earth in a sustainable manner" Zaidi (1981: 35), Faruqi (1980: 30–31), and Ateshin (1989: 179). Quran and prophetic traditions explicitly recommend a criterion for responsible human trusteeship of the earth.

Islam, as a major world religion has been under-represented in contemporary environmental debates. Foltz (2000) considers environmental problems in the Muslim countries as an outcome of social injustice that is ubiquitous throughout the world. Muslim scholars consider usury-based banking system responsible for environmental degradation as this system rewards few at the costs of many.

This is because it encourages conspicuous and wasteful consumption. Ecological problems are reflectors of usury-driven global financial structure. According to political Islam, the contemporary environmental issues neither due to increasing population nor biblical misunderstanding, but these problems are outcomes of Western economic principles that have been leading the world economy for a long period (see Kula, 2001). Scholars have explored Islamic perspectives of economics, law, politics, and architecture. However, environmental concerns of Islam have received least attention (Foltz, 2000). Even Muslim scholars discuss environmental issues generally related to the Western orientation rather than to the environmental itself.

Khan (2019) considered linear economy responsible for environmental problems. He asserts that 'the interest-based financial system essentially becomes as an engine for driving such a linear economy.' He emphasizes the importance of 'circular economy' which takes care of ecological problems. He argues that Islamic economy can be both more and less circular (Fig. 10.1). Moreover, Islamic economy can be neither linear nor circular (Khan, 2019).

Hekmatpour (2017) explores how various dimensions of Islamic teaching and philosophy can contribute to protecting the natural environment. On the one hand, concepts such as "dominion of men over the earth" and "specialness of humankind"

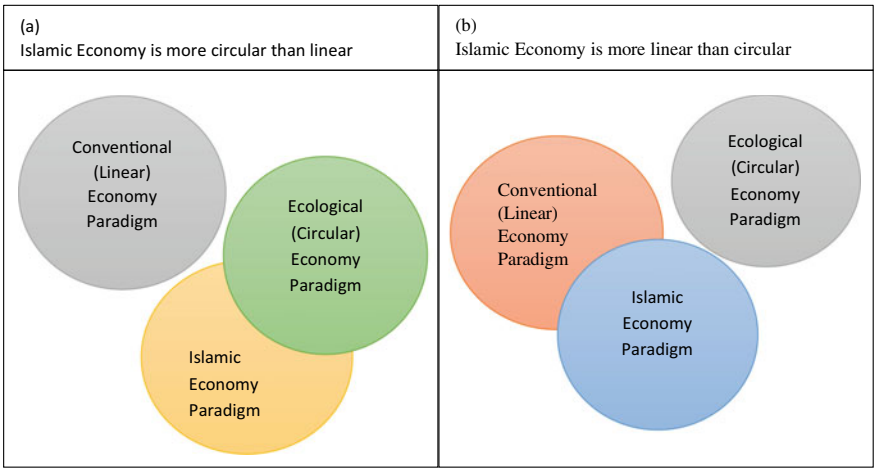

Fig. 10.1 Circular economy: conventional economy versus. Islamic Economy. *Source* Adopted from Khan (2019)

can lead to anti-environmental inferences of Islam. Moreover, a number of Islamic governments have shown a bias against environmental stewardship, mainly in cases when governments are authoritarian or placing emphasis on economic development. On the other hand, Hekmatpour (2017) also shows other interpretations of Islamic teaching that are compatible with environmental stewardship. Islamic Mysticism (Sufism) provides a spiritual context for environmentally conscious action.

Aboul-Enein (2018) explores references from Quran to explain the importance of environment in Islamic literature and concludes as follow: "A total of 88 verses in 42 Quranic chapters were identified with a considerable emphasis placed on the importance of water resource management and water conservation, environmental justice, plant conservation, biodiversity, sustainability, and environmental stewardship. These results suggest that the Holy Quran could serve as best medium and educational resource for environmental health interventions in diverse populations, especially in Muslim communities and for improving and maintaining a healthy environment."

Helfaya et al. (2018) revealed that seven environmental thematic groups have been promoted in the Quran that are human beings, water, air, land, plants, animals, and other natural resources. These seven identified themes have many ethical aspects such as the responsibility to use not abuse. Each of these elements have many implications for business practices such as abolishing abuse of women and child labor, reducing wastewater, decreasing air pollution and noise and preventing exploitation of natural resources. In a recent study, Abdelzaher (2019) advances the extant literature from the belief level of Islamic teaching related to ecology to the action level by addressing questions such as: can we take our belief of "Eco-Islam" to guide behaviors and outcomes.

10.2.2 Environmental Degradation and OIC Countries

According to OIC Environment Report (2017), environmental degradation is problem of the whole world but relatively its negative effects are more pronounced in developing countries. Being a substantial part of the developing world, OIC member countries are vulnerable to various climate related challenges. Majority of the OIC member countries is above medium level of environment vulnerability (Fig. 10.2).

In effect, high environmental vulnerability of OIC countries attributed to their geographic locations, high dependence on climate sensitive natural resources, and low adoptive capacities. Environmental issues of OIC countries pose serious economic and social challenges, particularly for the disadvantaged and poor population.

Kula (2001) argued that some of Muslim countries are questioned for whether they have contaminated the image of Islam by escalating man-made environmental problems. The problems related to environment in Islamic countries are considered as the product of social injustice such as lack of awareness of environmental issues (Foltz, 2000), and failing to compliance the principals of Quran and Prophetic teachings (Foltz et al., 2003).

Saniotis (2012) explored different aspects of Muslim environmentalism to answer the question that how Islamic environmental ethics influence environmental practices. He concludes that "while Islam provides detailed ethical principles on the environment, the majority of Muslim majority countries show an apparent indifference to environmental issues."

Muslim majority countries are going through rapid social change that challenges conventional cultural norms. Consequently, various socio-political tensions have arisen in many Muslim majority countries. Ecological degradation in various Muslim majority countries is related to social change (Saniotis, 2012). Ismail et al. (2019) explore the different aspects of environmental performance for high income countries of the Muslim world. Their study provides evidence that majority of the rich Muslim

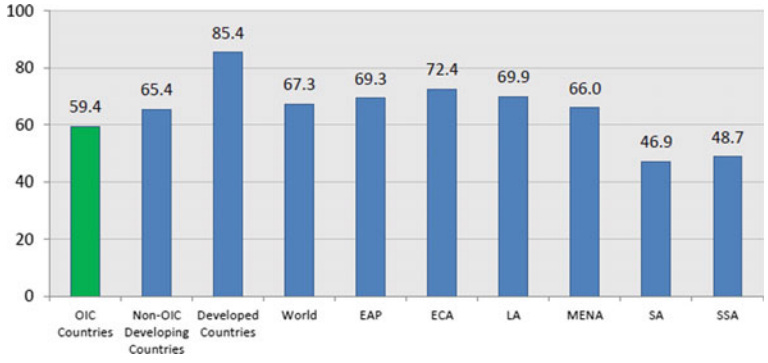

Fig. 10.2 Environmental performance of OIC countries. *Source* OIC Environment Repot (2017)

countries were in the rank of "taking environmental performance as unimportant". Thus, environmental degradation is an important challenge in the Muslim world.

10.2.3 Environment and Financial Development Nexus

The literature on financial development and environment is not yet conclusive. Earlier studies highlighted the role of multilateral banks in affecting the environmental quality. Aufderheide and Rich (1988) argued that World Bank's financial assistance and mechanism often ignore the environmental impact of the loanable funds and lead to serious environmental concerns. For example, in the case of India, financing the energy capital increased soil erosion, the Grand Bereby rubber project resulted in tropical forestland deterioration and micro-finance for the cotton production led to the projected agriculture land useless by exhausting the soil. Similarly, Schmidheiny and Zorraquin (1998) concluded that more often financial institutions encouraged short-term goals and ignored the environmental risks, leading to higher natural resource exploitations.

Tadesse (2007) and Kumbaroglu et al. (2008) argued that financial development helps to control pollutant emissions by encouraging the technological innovations in the energy sector. Similarly, Lanoie et al. (1998) and Tamazian et al. (2009) argued that well-developed financial system mainly capital markets help to improve environment by increasing research and development (R&D) expenditures on energy efficient technology.

Using the annual data for Turkey from 1960–2013, Dar and Asif (2018) also confirmed favorable impact of financial development on environment. Using the annual data for Pakistan Majeed et al. (2020) also found the favorable role of financial development for environmental quality. Likewise, using a sample of 89 economies over the period 1992 to 2014, Samreen and Majeed (2020) confirmed that financial development helps to improve the environmental quality by introducing modern and environment friendly technologies and supporting R&D projects.

Recently, Mohammed et al. (2019) found favorable impact of financial development on environment of Venezuela from 1971–2013. Their finding suggested that well-developed financial institutions reduce the financing cost (i.e., information asymmetry) by channelizing the resource in to new and energy efficient technology. Similarly, Seetanah et al. (2019) confirmed that financial development is beneficial for environmental quality of selected 12 Island developing economies from 2000 to 2016.

Apart from affirmative effects of financial development on environmental quality studies also identified the detrimental effects of financial development on environment. Moghadam and Dehbashi (2018) pointed out undesirable effects of financial development on environmental quality of Iran over the period of 1970–2011. Mesagan and Nwachukwu (2018) also found similar results for Nigeria from 1981

to 2016. Similarly, Moghadam and Dehbashi (2018) found out that financial development deteriorates the environmental quality by increasing the industrial activities in Iran over the period 1970–2011.

Recently, Ganda (2019) concluded for OECD countries that the impact of domestic credit to private sector by banks is favorable for the environmental quality, while the impact of domestic credit to private sector and FDI is worsening the environment. Similarly, Baloch et al. (2019) showed the detrimental effect of financial development on environmental quality for Belt and Road Initiative (BRI) countries.

Thus, financial development plays a crucial role in influencing the environmental quality. However, the empirical results of financial development on environmental quality are inconclusive. This chapter contributes to the existing literature by exploiting the more comprehensive indicator of environmental degradation and using three measures of financial development for OIC countries from 1971 to 2017.

10.3 Methodology

Following the empirical literature on financial development and quality of environment following econometric model is used for regression analysis:

$$EFP_{it} = \beta_0 + \beta_1 FD_{it} + \beta_2 LEC_{it} + \beta_3 LGDP_{it} + \beta_4 URB_{it} + \beta_5 FDI_{it} + \mu_{it} \quad (10.1)$$

where t represents the time period and i represents the cross sections. EFP shows ecological footprint measured in global hectares (GHA) per person (see Katircioglu et al., 2018). It is proposed to highlight the natural resource consumption and the productive capacity of the ecosystem (Aydin et al., 2019). "*Ecological Footprint accounts act as balance sheets by documenting for a given population—a household, a district, a city, a region or humanity as a whole—the area of biologically productive land and sea required to produce the renewable resources this population consumes and assimilate the waste it generates, using prevailing technology. It documents the extent to which human economies stay within the regenerative capacity of the biosphere. Overall, it is the sum of built-up land, carbon, cropland, fishing grounds, forest products and grazing land*".

FD represents the financial development. LEC represents the log of energy consumption (LEC) measured in terms of kg of oil equivalent per capita. If energy is efficiently utilized and used in green technologies, then it helps to reduce the harmful environmental effects (Stern et al., 2006). Whereas the higher amount of energy use in terms of higher demand for gas, oil, and coal contributes to the pollutant emissions along with the resource degradation (Majeed & Luni, 2019).

LGDP represents the log of GDP per capita constant 2010 US dollars (economic growth). It can affect the environment through three channels. First, it increases the environmental degradation as inputs utilization increases for the higher production (scale effect). Second, with the composite change of growth path from agriculture to

the industrial sector environmental deterioration increases initially and then declines in the later stage with the expansion of service sector (composite effect). Lastly, technological advancement helps to curb the pollutant emissions by introducing the green technology (technique effect) (Stokey, 1998).

URB represents urbanization measured through the urban population as a percentage of total population. Urbanization increases the environmental degradation by increasing the energy and resource demand and their consumption (Majeed, 2018; Wang et al., 2016). However, urbanization increases the economies of scale and boosts the green technology in the long run, reducing the resource inefficiency and improving the environmental quality.

Lastly, FDI inflows as a percentage of GDP are incorporated in the model. Foreign enterprises use cleaner technologies following the environmental protection laws and promote R&D in the energy-efficient technology, thus leading to higher environmental quality (Asghari, 2013). This relationship is referred as "pollution halo hypothesis". However, FDI can increase greenhouse gas emissions in the economies having weak environmental protection laws, poor infrastructure, and weak institutional framework (Solarin et al., 2018). This relationship is referred as "pollution heaven hypothesis". The term μ_{it} is the error term that captures the effect of all omitted variables.

Three measures of financial development are used. First measure is domestic credit by the private sector as percentage of GDP (FDP). "*It refers to financial resources provided to the private sector by financial corporations, such as through loans, purchases of nonequity securities, and trade credits and other accounts receivable, that establish a claim for repayment.*"

The second measure is domestic credit to private sector by banks as percentage of GDP (FDB). "*It refers to the financial resources provided to the private sector by other depository corporations (deposit taking corporations except central banks), such as through loans, purchases of nonequity securities, and trade credits and other accounts receivable, that establish a claim for repayment.*"

Finally, the last proxy for the financial development is the domestic credit to private sector provided by the financial sector (FDF). "*It includes all credit to various sectors on a gross basis, with the exception of credit to the central government, which is net.*" Since alternative measures of financial development are highly correlated, their effects are estimated separately using Eqs. (10.1.1–10.1.3).

$$EFP_{it} = \beta_0 + \beta_1 FDP_{it} + \beta_2 LEC_{it} + \beta_3 LGDP_{it} + \beta_4 URB_{it} + \beta_5 FDI_{it} + \mu_{it} \quad (10.1.1)$$

$$EFP_{it} = \beta_0 + \beta_1 FDB_{it} + \beta_2 LEC_{it} + \beta_3 LGDP_{it} + \beta_4 URB_{it} + \beta_5 FDI_{it} + \mu_{it} \quad (10.1.2)$$

$$EFP_{it} = \beta_0 + \beta_1 FDF_{it} + \beta_2 LEC_{it} + \beta_3 LGDP_{it} + \beta_4 URB_{it} + \beta_5 FDI_{it} + \mu_{it} \quad (10.1.3)$$

10.4 The Data and Descriptive Analysis

This chapter used the panel data over the period 1971–2017 for 38 OIC countries. The data for all variables is extracted from World Bank (2018) except ecological footprint which is collected from Global Footprint Network (2018). Table 10.1 reports the descriptive statistics. The minimum value of ecological footprint is 0.46472 that belongs to Bangladesh while maximum value is 16.85575 for Qatar. Malaysia has the highest value (158.505) for financial development by private sector, whereas Azerbaijan has the lowest value (1.166).

Table 10.2 presents the correlation between ecological footprint and financial development along with other explanatory variables. All indictors of financial development have positive correlation with ecological footprint. The correlation between financial development by the bank and ecological footprint is relatively high (0.302).

10.5 Results and Discussion

Table 10.3 shows that financial development improves environment by lowering ecological footprint. The coefficients infer that 1 percent increase in FDP, FDB, and FDF will bring about 0.0040, 0.0038 and 0.0028 percent decline in ecological footprint, respectively. These findings are consistent with the findings of Zhang (2011) and Mohammed et al. (2019) who argue that well-developed financial institutions facilitate the funds for energy-saving and environmental-friendly projects. Contrary, financial development worsens environment by increasing ecological footprint in affluent[1] OIC countries.

The effect of energy consumption is significant and positive at 10 percent level of significance. The coefficient of GDP is positive and significant in all estimated model implying that economic growth (GDP) contributes to ecological footprint. This is consistent with the studies of Moghadam and Dehbashi (2018) and Bloach et al. (2019).

The effect of urbanization on ecological footprint is negative and significant. This finding supports the compact city theory that higher urbanization improves the environmental quality by increasing the productivity, efficiency, and economies of scale in public infrastructure. Lastly, the estimated effect of FDI on ecological footprint turned out to be statistically insignificant.

The values of R^2 are quite high and satisfactory (0.73 to 0.80). The probability value of F test is also significant providing the evidence of best model fit. The multicollinearity test suggests that VIF is less than 10 in all models, indicating that the data is free from multicollinearity problem. Breusch-Pagan-Godfrey (BPG) test indicates the presence of heteroskedasticity that is tackled through the robust regressions and system GMM.

[1] High Income Countries, World Bank (2018).

Table 10.1 Descriptive statistics

Variables	Observations	Mean	Median	Maximum	Minimum	Std. Dev.
Ecological footprint	1030	2.692653	1.478062	16.85575 (Qatar)	0.46472 (Bangladesh)	3.032052
DCP	1030	30.731	23.65746	158.5048 (Malaysia)	1.166062 (Azerbaijan)	24.41741
DCB	1030	29.90155	22.94997	154.8921 (Malaysia)	0.934711 (Guinea-Bissau)	23.76886
DCF	1030	40.56419	31.27476	265.8643 (Guyana)	−65.2613 (Libya)	35.29246
Energy consumption	1030	2011.37	645.8924	21,959.44 (Qatar)	63.00522 (Guinea-Bissau)	3465.325
GDP	1030	7750.551	2178.899	113,682 (UAE)	161.8338 (Mozambique)	15,023.92
Urbanization	1030	50.53858	46.671	100 (Kuwait)	9.034 (Bangladesh)	21.39468
FDI	1030	2.658919	1.285496	55.0759 (Azerbaijan)	−15.6172 (Suriname)	5.044606

Note DCP (Domestic-Credit-Private), DCB (Domestic-Credit-Bank), DCF (Domestic-Credit-Financial-Sector)

Table 10.2 Correlation matrix

Correlation								
Probability	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ecological FP	1.000							

DCP	0.285	1.000						
	0.000	-----						
DCB	0.302	0.994	1.000					
	0.000	0.000	-----					
DCF	0.129	0.827	0.823	1.000				
	0.000	0.0000	0.000	-----				
Energy con	0.935	0.211	0.229	0.061	1.000			
	0.000	0.000	0.000	0.051	-----			
GDP	0.868	0.164	0.179	0.061	0.867	1.000		
	0.000	0.000	0.000	0.051	0.000	-----		
Urbanization	0.723	0.477	0.487	0.348	0.699	0.633	1.000	
	0.000	0.000	0.000	0.000	0.000	0.000	-----	
FDI	0.054	0.093	0.092	0.085	0.0464	−0.032	0.092	1.000
	0.082	0.002	0.003	0.006	0.1391	0.297	0.003	-----

Pooled OLS treats all cross sections homogeneous and ignores the significant temporal and country effects. To capture these unobserved country-specific fixed and random effects, fixed effects and random effects models are used. Tables 10.4 and 10.5 provide the results of the fixed and random effects models, respectively. Based on Hausman test, fixed effects model is appropriate for affluent OIC countries while random effects model is suitable for all OIC countries. Overall, results confirm baseline findings. However, the results are relatively sensitive to different measures of financial development.

Table 10.6 illustrates the regression results of Driscoll-Kraay (1998) standard errors for pooled OLS, which deals with the issues of temporal and cross-sectional dependence. The baseline findings remain same.

The problem of endogeneity is resolved by incorporating the instruments in the model using the system GMM. We take the lag of dependent variable as endogenous instruments along with the lag value of explanatory variable and time dummy as exogenous instrument. The results (Table 10.7) indicate that all indictors of financial development have a negative relationship with ecological footprint and statistically significant in all estimated specifications. Hansen test confirms the overall validity of instruments. Moreover, the insignificant value of AR (2) indicates that error term is uncorrelated, and problem of serial correlation does not arise.

Table 10.3 Results of pooled OLS

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	All OIC			**Affluent**		
DCP	−0.00404*			0.0802***		
	(0.00232)			(0.00423)		
DCB		−0.00380*			0.0803***	
		(0.00239)			(0.00423)	
DCF			−0.00283*			0.0643***
			(0.00155)			(0.00349)
Energy consumption	1.803***	1.806***	1.761***	1.085***	1.085***	1.297***
	(0.110)	(0.110)	(0.112)	(0.102)	(0.102)	(0.0984)
GDP	0.478***	0.478***	0.499***	0.393***	0.393***	0.390***
	(0.106)	(0.106)	(0.106)	(0.0914)	(0.0914)	(0.0918)
Urbanization	−0.00953*	−0.00984*	−0.00930*	−0.00645	−0.00647	−0.0111**
	(0.00525)	(0.00524)	(0.00526)	(0.00434)	(0.00434)	(0.00435)
FDI	−0.00910	−0.00925	−0.00896	0.00671	0.00673	0.00560
	(0.0102)	(0.0102)	(0.0102)	(0.00883)	(0.00883)	(0.00887)
Constant	−12.57***	−12.59***	−12.47***	−7.850***	−7.849***	−8.909***
	(0.416)	(0.416)	(0.421)	(0.437)	(0.437)	(0.411)
Results of Post-Estimation Tests						
VIF	4.73	4.73	4.81	5.06	5.06	4.86.06
Wooldridge's test	29.364	29.318	29.395	29.364	29.318	29.395

(continued)

Table 10.3 (continued)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
BPG test	532.97	529.83	557.26	1335.04	1334.91	1050.41
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	1,017	1,017	1,019	1,017	1,017	1,019
R-squared	0.731	0.731	0.732	0.801	0.801	0.799

*Note Standard errors in parentheses (*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$)*

Table 10.4 Results of fixed effects

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	All OIC			**Affluent OIC**		
DCP	0.00292*			0.0137***		
	(0.00173)			(0.00453)		
DCB		0.00300*			0.0137***	
		(0.00175)			(0.00453)	
DCF			−0.00239**			−0.000217
			(0.00117)			(0.00291)
Energy consumption	1.914***	1.914***	1.985***	1.945***	1.945***	1.955***
	(0.133)	(0.133)	(0.131)	(0.130)	(0.130)	(0.130)
GDP	−0.0856	−0.0861	0.00223	0.0335	0.0333	−0.0295
	(0.112)	(0.112)	(0.108)	(0.108)	(0.108)	(0.108)
Urbanization	−0.0201***	−0.0201***	−0.0205***	−0.0223***	−0.0223***	−0.0205***
	(0.00479)	(0.00479)	(0.00477)	(0.00479)	(0.00479)	(0.00482)
FDI	0.000228	0.000175	0.000811	0.000119	0.000121	0.000634
	(0.00519)	(0.00519)	(0.00517)	(0.00517)	(0.00517)	(0.00519)
Constant	−8.576***	−8.573***	−9.533***	−9.601***	−9.601***	−9.175***

(continued)

Table 10.4 (continued)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	(0.890)	(0.889)	(0.820)	(0.811)	(0.811)	(0.811)
Observations	1,017	1,017	1,019	1,017	1,017	1,019
R-squared	0.286	0.286	0.285	0.291	0.291	0.282
Hausman test	7.09	7.01	5.73	31.81	32.12	31.81
	(0.2144)	(0.2197)	(0.3334)	(0.0000)	(0.0000)	(0.0000)
Number of ids	38	38	38	38	38	38

*Note Standard errors in parentheses (*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$)*

Table 10.5 Results of random effects

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	All OIC			**Affluent**		
DCP	0.00238			0.0174***		
	(0.00169)			(0.00436)		
DCB		0.00246			0.0174***	
		(0.00172)			(0.00435)	
DCF			−0.00241**			0.00320
			(0.00116)			(0.00286)
Energy consumption	1.908***	1.908***	1.957***	1.880***	1.880***	1.906***
	(0.127)	(0.127)	(0.126)	(0.124)	(0.124)	(0.124)
GDP	−0.0184	−0.0193	0.0489	0.0978	0.0977	0.0711
	(0.107)	(0.107)	(0.104)	(0.103)	(0.103)	(0.103)
Urbanization	−0.0195***	−0.0195***	−0.0195***	−0.0206***	−0.0206***	−0.0193***
	(0.00466)	(0.00466)	(0.00465)	(0.00463)	(0.00463)	(0.00466)
FDI	−0.000256	−0.000302	0.000376	−0.000429	−0.000429	−0.000411
	(0.00517)	(0.00518)	(0.00516)	(0.00518)	(0.00518)	(0.00524)
Constant	−8.888***	−8.878***	−9.591***	−9.605***	−9.605***	−9.550***
	(0.853)	(0.853)	(0.803)	(0.747)	(0.747)	(0.732)
Observations	1,017	1,017	1,019	1,017	1,017	1,019
Number of id	38	38	38	38	38	38

*Note Standard errors in parentheses (*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$)*

Table 10.6 Results of Driscoll-Kraay standard errors

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	All OIC			**Affluent**		
DCP	−0.00404*			0.0802***		
	(0.00237)			(0.00810)		
DCB		−0.00380***			0.0803***	
		(0.00256)			(0.00810)	
DCF			−0.00283			0.0643***
			(0.00290)			(0.00900)
Energy consumption	1.803***	1.806***	1.761***	1.085***	1.085***	1.297***
	(0.141)	(0.141)	(0.136)	(0.156)	(0.156)	(0.208)
GDP	0.478***	0.478***	0.499***	0.393***	0.393***	0.390***
	(0.110)	(0.110)	(0.103)	(0.0720)	(0.0721)	(0.0942)
Urbanization	−0.00953	−0.00984	−0.00930	−0.00645	−0.00647	−0.0111*
	(0.00667)	(0.00669)	(0.00725)	(0.00550)	(0.00550)	(0.00578)
FDI	−0.00910	−0.00925	−0.00896	0.00671	0.00673	0.00560
	(0.0102)	(0.0102)	(0.00948)	(0.00983)	(0.00983)	(0.0115)
Constant	−12.57***	−12.59***	−12.47***	−7.850***	−7.849***	−8.909***
	(0.617)	(0.615)	(0.639)	(0.793)	(0.793)	(0.966)
Observations	1,017	1,017	1,019	1,017	1,017	1,019
R-squared	0.731	0.731	0.732	0.801	0.801	0.799
Number of groups	38	38	38	38	38	38

*Note Standard errors in parentheses (*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$)*

Table 10.7 Results of system GMM

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	All OIC			**Affluent-OIC**		
DCP	−0.00566***			0.0345***		
	(0.000901)			(0.000893)		
DCB		−0.00735***			0.0345***	
		(0.000801)			(0.000893)	
DCF			0.00111***			0.0165***
			(0.000380)			(0.000784)
Energy consumption	3.072***	2.986***	3.024***	2.611***	2.610***	2.938***
	(0.0867)	(0.108)	(0.0840)	(0.0577)	(0.0577)	(0.0863)
GDP	0.388***	0.417***	0.405***	0.565***	0.565***	0.348***
	(0.0945)	(0.0924)	(0.105)	(0.0714)	(0.0714)	(0.0754)
Urbanization	−0.0357***	−0.0333***	−0.0400***	−0.0473***	−0.0473***	−0.0455***
	(0.00502)	(0.00487)	(0.00401)	(0.00293)	(0.00293)	(0.00370)
FDI	−0.0401***	−0.0402***	−0.0421***	−0.0255***	−0.0255***	−0.0327***
	(0.000977)	(0.000885)	(0.00132)	(0.00156)	(0.00156)	(0.000988)
Constant	−18.90***	−18.56***	−18.58***	−17.07***	−17.07***	−17.34***

(continued)

Table 10.7 (continued)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	(0.372)	(0.392)	(0.623)	(0.392)	(0.392)	(0.612)
Observations	998	998	1,000	998	998	1,000
Number of id	38	38	38	38	38	38
AR (1) Pr > z	0.824	0.839	0.774	0.697	0.696	0.832
AR (2) Pr > z	0.685	0.652	0.644	0.751	0.750	0.735
Hansen test	0.555	0.990	0.990	0.990	0.990	0.990

*Note Standard errors in parentheses (*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$)*

Table 10.8 Sensitivity analysis of variables

Sensitivity variables				
Variables	Trade Openness	Population Growth	Trade Openness	Population Growth
Dependent Variable: EFP (1971–2017)				
	Full sample	Full sample	Affluent OIC	Affluent OIC
DCP $_{\text{Private sector}}$	−0.0085688 ***	−0.00471**	0.0565542 ***	0.081222***
	(0.000)	(0.016)	(0.000)	(0.000)
R-Squared	0.73	0.81	0.84	0.82
DCB $_{\text{Banking sector}}$	−0.00807***	−0.00522**	0.056616***	0.081282***
	(0.001)	(0.009)	(0.000)	(0.000)
R-Squared	0.73	0.81	0.84	0.82
DCF $_{\text{Financial sector}}$	−0.003312 ***	−0.00365**	0.0450725***	0.06634***
	(0.025)	(0.005)	(0.000)	(0.000)
R-Squared	0.73	0.81	0.84	0.82

*Note Standard errors in parentheses (*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$)*

10.5.1 Sensitivity Analysis

To check the robustness of findings, the sensitivity analysis is conducted using two additional explanatory variables namely trade openness and population growth. Then, sensitivity analysis also confirmed the robustness of the results.

10.6 Conclusion

This chapter investigates the relationship between financial development and environment using ecological footprint as a comprehensive measure of environmental degradation. The analysis covers the large panel data set of 38 OIC countries for the period of 1971–2017. The empirical investigation is based on pooled OLS, random and fixed effects models, Driscoll-Kraay standard errors, and system GMM.

The findings reveal that financial development helps to improve the quality of environmental by lowering the overall ecological footprint. In this context, one very important implication is drawn from the findings that if financial institutions are more concerned about environmental preservation, then they will provide loans and relaxation to the industries which are adopting energy-saving technologies. Moreover, they will also assist the funding for the R&D of green technologies that in turn help to improve the environmental quality.

Finally, in affluent OIC countries financial development turns out to be the source of increasing ecological footprint. This finding implies that the impact of financial development on ecological footprint varies depending upon the prosperity level of OIC countries. That is, financial development causes the reduction

in overall ecological footprint only if it supports environmentally friendly projects and investment.

Overall, financial sector tends to contribute to circular economy paradigm by improving the quality of environment. In affluent OIC countries, financial sector tends to contribute to linear economy paradigm by compromising the quality of environment. Thus, priorities of financial sector toward environmentally friendly financing can help to preserve the earth's environment.

This chapter has certain limitations. First, the sample size is limited to 38 OIC countries because of missing data series of ecological footprint and energy consumption. Second, the findings of chapter are generalized for OIC countries as a group, whereas individual country may differ from these findings depending upon country-specific conditions. Third, this chapter focuses on overall financial development whereas Islamic finance is also an important development in OIC countries.

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Chapter 11
A Consumer Perspective of the Circular Economy: An Empirical Investigation Through Structural Equation Modeling

Muhammad Tahir Jan

Abstract The growing concerns about environmental decimation have given rise to a new approach called "The Circular Economy", with the focus on introducing innovative and new methods of responsible production, consumption, and disposal. This is also aligned with the United Nations Sustainable Development Goals (UN SDG), particularly goal number twelve where the focus is on responsible production and consumption. In marketing, there is only a limited number of studies conducted to explore and investigate the circular economy from a marketing perceptive. The present study, therefore, attempts to investigate some inevitable factors with their impact on consumer purchase intention. For this purpose, the theory of planned behavior is adapted with the addition of two more factors related to the circular economy, which are convenience/availability, and environmental impact, as extracted from the literature to examine their effect on consumer purchase intention. Data were collected from 377 consumers of the circular products. Complex statistical techniques like exploratory factor analysis and structural equation modeling with confirmatory factor analysis and hypotheses testing were used to analyze the data. The findings revealed that subjective norm, attitude, and environmental impact are the most influential factors toward consumer purchase intention of circular products. These findings will help policymakers devise strategies that are not only sustainable and aligned with the philosophy of the circular economy but will also ensure positive consumer behavior.

11.1 Introduction

Today the world is faced by numerous challenges, especially due to the increased consumption with almost no solid method of recycling the waste produced by the products. The philosophy where the focus of the businesses around the globe was to produce an unlimited quantity of products and influence people to buy and use those

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products without the conscious and clear understanding of its implications is called "the linear economic system" or simply "the linear economy". Where producers and businesses are mainly concerned to produce and sell their products. As much as, this philosophy sounds good, at least from a financial perspective, it has done enormous damage to the environment and the generation to come. To mitigate the impact of the linear economy, a new approach was introduced called "the circular economy". The focus of this new system is on re-use, repair, refurbishment, and recycling (MacArthur, 2013). The circular economy also emphasizes on producing those products that are durable. Interestingly, the United Nations Sustainable Development Goals (commonly called, SDGs) have many goals related to the concept of the circular economy. The one which is very relevant to the present research is the twelfth SDG, where the focal point is responsible production and consumption. For the scope of this research, responsible consumption would be considered as the key motivation.

There is a lack of consensus when it comes to the definition of the circular economy; however, it is generally agreed that the existing business models should be redesigned from linear (which results in waste) to circular (which reduces/reuses waste) (Chamberlin & Boks, 2018). Further, the existing models are mostly from the perspective of the organizations or businesses, completely neglecting the consumer perspective. This paper, therefore, attempts to bring-in the consumer perspective by empirically investigating factors related to the purchase of circular products and examine their influence on consumer purchase intention.

In the following section, a review of literature is undertaken along with the presentation of the proposed model which is inspired by an underlying theory of planned behavior. Further, the methodology adopted in the present research is explicated followed by data analysis and results, and then by conclusion and suggestions for future research.

11.2 Literature Review

11.2.1 The Circular Economy

The exponential growth in the industrial economy and globalization has criticized, if not obsoleted, the traditional models of production and consumption. These models are usually referred to as "linear models", where the focus is on take, make, and dispose of. The reason behind this stiff criticism on the linear models is mainly because of the inevitable impact it has on everything, negatively. Bocken et al. (2016) had the view that products produced in the linear system lose its value, especially at the end of its life, making it compulsory to dispose it off and eventually harm the environment. This is the main reason these traditional models require continuous unlimited resource inputs to meet the demand, thus impacting the environment

adversely by the emission and generation of waste (MacArthur, 2014). It is, therefore, clear that the linear models are no more compatible with the philosophies of sustainable social, economic, and environmental growth, as desired by the people. Even though there are economic benefits and labor market advantages of the linear system, it also leads to the increase in production and consumption, which consequently degrade the environment (Ekins et al., 2016). This calls for a system where the production and consumption do not put pressure on the environment at large. In this pursuit, a framework is put forward by researchers and experts where the focus is on each stage of production and consumption life cycle. A philosophy where the outputs become the inputs of another process, eliminating the need for new material, thus reducing waste.

Over a period of few years, the concept of circular economy has evolved but there is an agreement concerning the main theme behind it, and that is closing of material and energy flow loops. Across various fields, different names and terms are used to represent the same concept of the circular economy. For example, Stahel (2010) called it the performance economy, Graedel and Allenby (1995) mentioned it using the terms "industrial ecology", and Commoner (2020) named it the laws of ecology. Further, the most interesting and relevant to the present study is the design and business model strategies proposed by Bocken et al. (2016). They provided a model for circular product design where the emphasis is on slowing or closing the flow loops through extended product life cycles, designs for dis-assembly, and encouraging sufficiency (Chamberlin & Boks, 2018) by educating the consumers. Relevant to the scope of the present study, the circular economy can be defined in the words of Geissdoerfer et al., (2017, 579) as, "a regenerative system in which resource input and waste, emission, and energy leakage are minimized by slowing, closing, and narrowing material and energy loops. This can be achieved through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling".

11.2.2 Marketing and the Circular Economy

There are many philosophies of marketing, from production orientation to societal marketing (Armstrong et al., 2018), and quality-of-life marketing (Jan & Zain, 2011; Lee & Sirgy, 2004; Sirgy, 2001). Companies use the traditional marketing mix (4 Ps; Product, Price, Promotion, Place) to create markets (Armstrong et al., 2018; Kotler et al., 2015) and use persuasive techniques to influence people's intention in a manner that needs for unfamiliar products are created (Fletcher, 2010). However, these traditional concepts of marketing are significantly replaced by more sustainable concepts like green marketing, where the emphasis is on producing products with lower impacts on the environment and higher credentials of sustainability (Dangelico & Vocalelli, 2017; Groening et al., 2018). This perspective of marketing with the integration of sustainability in the business models and a focus on environmental impacts is seen as facilitating the circular economy (Tukker, 2015). Another interesting concept of marketing aligned with the philosophy of circular economy is

societal marketing where the focus is on bigger social welfare and positive behavioral change for the benefit of the society (Kotler & Zaltman, 1971; Peattie & Peattie, 2009). Peattie and Peattie (2009) argued that societal marketing is more customer-oriented compared to green marketing (which ignores non-purchase elements of consumption like use and disposal) because it focuses mainly on changing and maintain consumer behaviors (which involves non-purchase elements of consumption like recycling and relationship building), making it very closely aligned with circular economy.

Even though the literature on the circular economy has grown over a period, there is a dearth of research on the circular economy from a consumer perspective (Chamerlin and Boks 2018), especially when it comes to the involvement of consumers in the equation of circular economy. For instance, consumers' performance of activities that encourage circular economy's concept, like the purchase of used products, re-usable products, re-cycle-able products, green products, resisting obsolescence, or rental instead of buying, etc. and what influence them to purchase circular products? To answer this question, the present research attempts to use the theory of planned behavior (hereafter, TPB) in order to find out those significant factors that have an influence on consumer purchase intention of the circular products. TPB was originally introduced by Ajzen (1991) and is considered one of the most widely and frequently used theories for the prediction of human social behavior (Ajzen, 2011). There are three antecedents of intention in TPB, which are attitude, subjective norm, and perceived behavioral control. Altogether the three independent variables (attitude, subjective norm, perceived behavioral control) influence intention, and intention subsequently impacts behavior (Ajzen, 1991). In the TPB, both perceive behavioral control and intention effect behavior. However, it is important to note that the present research did not consider "behavior" in the model, as it is a post-purchase phenomenon, rather "intention" is used as an ultimate dependent variable. Further, in the current research, the original three factors are included to examine their influence on consumers' purchase intention of the circular products along with the extension of TPB. TPB has been extending from time to time with the addition of more contextual variables (Conner & Armitage, 1998). In the present study, two more antecedents of intention related to circular economy and marketing are added in the existing TPB model. These two variables, extract from the extant literature, are convenience/availability and environmental impact (Chamerlin and Boks 2018; Yadav & Pathak, 2016). In the following sections, all these variables are explained in light of the literature, which eventually led to the hypotheses of the current research.

11.2.3 Purchase Intention

Purchase intention has always been a topic of interest for marketing researchers because of its inevitable pre-purchase importance. According to Ajzen (1980), intention is a person's perception of his/her conscious plan or decision in performing a certain behavior or action. TPB posed that intention is the direct antecedent of a

behavior, which itself is determined by three main considerations, namely, attitude, subjective norm, and perceived behavioral control (Ajzen, 2015). Purchase intention plays a vital role in understanding a consumer's perspective, which in the case of this study is circular products or products produced using circular economy's concept. There are numerous studies conducted that indicate the positive influence of attitude, subjective norm, and perceived behavioral control on purchase intention (see, e.g., Afendi et al., 2014; Khalek & Ismail, 2015). As mentioned earlier, many scholars (see, e.g., Aziz and Wahad, 2013; Haro, 2016) investigated other determining factors along with the original factors of TPB and their results indicated positive relationships among the variables. Some added knowledge and safety in the TPB model (Aziz and Wahab, 2013), whereas some included information and availability (Haro, 2016), and religious values with its impact on the purchase of green products (Hassan, 2014). The present research, therefore, added convenience and environmental impact (Chamerlin and Boks 2018) and hypothesize that these will have a positive impact on consumer purchase intention of circular products.

11.2.4 Attitude

Attitude refers to the degree of positive or negative feelings an individual has toward the behavior of interest (Ajzen, 1991). There is a positive relationship between an individual's attitude toward certain behavior and the degree of the strength of his/her intention to perform that behavior (Ajzen, 1991). Attitude is considered as one of the most significant factors that influence consumer's intention to purchase products (Rahman et al., 2015). As an integral part of TPB, the attitude has been known to have a positive influence on purchase intention. For example, Tarkiainen and Sundqvist (2005) found a significant positive impact of attitude on purchase intention in organic and green products. Similarly, other studies (Huong, 2012; Yazdanpanah & Forouzani, 2015) resulted in positive outcomes in the relationship between attitude and purchase intention. It is, therefore, hypothesized that,

H1: Attitude will have a positive impact on purchase intention.

11.2.5 Subjective Norm

According to Ajzen (1991), subjective norm is a person's belief about what others will think of him/her in the event of performing a task or behaving in a certain manner. It is the perception of an individual of the social environment surrounding a behavior. In the case of TPB, the subjective norm is strongly linked with a person's intention and is considered the pressure of social normative presence. People's intention to act in a certain manner is influenced by family and friends, and society around him/her. This disposition to perform or not to perform a certain behavior is dependent on the

approval from the social circle of the person (Ajzen, 1991). Vallerand et al. (1992) found a positive relationship between subjective norm and intention. Many scholars (see, e.g., Govind and Pathak 2016; Othman & Rahman, 2014) argue that in the TPB, subjective norm is the strongest predictor of intention to purchase a product. Further, Dean et al. (2008) conducted a research on organic and environmentally friendly products and found that subjective norm plays a vital role in influencing consumer's intention to purchase these products. Moreover, subjective norm is found not only to positive and significantly influence purchase intention but also other variables, like confidence (Omar et al., 2012). Lastly, Haro (2016) found a strong influence of subjective norms in buying products produced in an ethical manner. Based on the above literature, it is hypothesized that

H2: Subjective norm will have positive impact on purchase intention.

11.2.6 Perceived Behavioral Control

Perceived behavioral control refers to a person's perception about the ease or difficulty of performing a task. It is an individual's perception of the inhibited obstacles in the performance of a certain behavior (Ajzen, 1991). Perceived behavioral control, as an important variable of TPB, is also known to have a positive impact not only on intention but also behavior (as presented in the original TPB model) (Ajzen, 1991). There are two important aspects to keep in mind, especially with regard to this particular variable of TPB. First, the control a person has on performing a task/behavior, and second, the confidence of a person in doing or not doing a task/behavior. Vermeir and Verbeke (2006, 2008) found a positive influence of perceived behavioral control on purchase intention of sustainable product by highlighting that low perceived availability results in lower purchase intention. Further, in an interesting attempt Shin and Hancer (2016) found not only a direct effect of perceived behavioral control on purchase intention but also an indirect affect. Lastly, a study by Rezai et al. (2012) related to green and environmentally friendly products found that perceived behavioral control positive influence consumers' purchase intention. It is, therefore, hypothesized that

H3: Perceived behavioral control will have a positive impact on purchase intention.

11.2.7 Convenience

Convenience refers to the ease of getting access to a product (Chamerlin and Boks 2018). It simply means the efforts that are put by the consumers before gaining initial access to the product. Originally, the concept of convenience emerged in marketing literature with regard to the classification of products. Consumer products are divided into three (3) main classes: convenience, shopping, and specialty.

Convenience products are those products which are purchased with the minimum efforts and time spent by the consumers (Yale & Venkatesh, 1986). In the context of the present study, convenience is included in the TPB because of its strong influence on customer purchase intention and choice (Gunawan et al., 2018; Pham et al., 2018). Studies (see, e.g., Farquhar & Rowley, 2009; Weelden et al., 2016) show that convenience is more of a consumer related variable rather than a product/service related and is considered an imperative construct in marketing. For companies to attract customers to buy their products and add value to customers, convenience should be added as a crucial factor in their overall marketing strategies (Kim et al., 2014). Further, when a customer intends to purchase a product, both monetary and non-monetary costs are considered. Convenience is considered a non-monetary cost that includes time and effort (Berry et al., 2002) and is undeniable because of its influence on purchase intention. This is evident from the past studies (Jiang and Jun 2012; Mpinganjira, 2015; Pham et al., 2018) that shows a direct positive effect of convenience on purchasing trends. Jiang et al. (2012) proposed convenience to have multiple dimensions and includes access, search, evaluation, transaction, and possession. The access dimension is related to the consumer's perceived time and effort spent on accessing the product. The search dimension states the time and efforts consumers devote to searching for the desired product. The evaluation dimension is about consumer's evaluation of the product compared to the competing offers. The transaction dimension is related to the consumer's perceived time and effort used in finally purchasing the product. The last dimension, which is possession, is about consumer's perceived time and effort to own a product (Jiang et al. 2012). In the present study, convenience is taken as a first-order construct following the recommendations of Pham et al. (2018) and is expected to influence consumer's purchase intention of circular products, as agreed by Jiang et al. (2012) and Pham et al. (2018). It is, therefore, hypothesized that

H4: Convenience will have a positive impact on purchase intention.

11.2.8 Environmental Impact

Environmental impact refers to the production and consumption of those products with a lower to no impacts on the environment at large (Dangelico & Vocalelli, 2017; Groening et al., 2018). It has two perspectives, a consumer's perspective and a producer's perspective. In the consumer's perspective, environmental impact means the understanding of consumers toward purchasing and consuming products with no adverse effect on the environment. It further means that before the consumer intends to buy a product, he/she is aware of the harm it may do to the environment. Similarly, from the perspective of the company or producer, environmental impact includes adopting green and sustainable ways that emphasize on both tangible and intangible aspects of production (Segev et al., 2015; Grimmer and Woolley, 2012). In the present study, however, a consumer's perspective is considered keeping in mind the scope

of the research. Even environmental impact of consumers' activities is considered during the use of product stage rather than the purchase stage itself, but the present research considered it as a factor that will positively influence consumer intention to purchase a circular product. The argument put forward in this research is that if consumers are aware of the positive impact of circular products on the environment, they will tend to show positive intentions in buying those products. The literature also supports this argument that environmental concerns positively influence consumer's purchase intention (see, e.g., Hedlund, 2011). This is also supported by Chamerlin and Boks (2018), who stated that people are generally positive and supportive when it comes to environmental concerns or products with positive/negative impact on the environment. It is, therefore, hypothesized that

H5: Environmental impact will have a positive effect on purchase intention.

11.3 Framework of the Study

Based on the above discussion, the model presented in Fig. 11.1 is proposed for empirical investigation. It has four (4) original constructs from TPB, namely, attitude, subjective norm, perceived behavioral control, and intention. Two (2) more variables, namely, convenience and environmental impact, are included after reviewing the literature on the circular economy and marketing. Overall, the model of the current research consists of five (5) exogenous variables and one (1) endogenous variable.

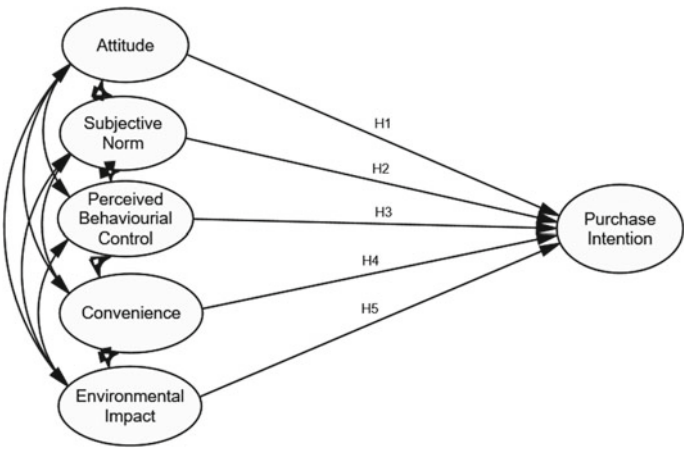

Fig. 11.1 Propose model of the study

11.4 Methodology

11.4.1 Sampling

A convenience sampling technique was used in the present study, where five hundred (500) questionnaires were distributed by the researcher and the appointed assistants. Data were collected from various regions of Klang Valley in Malaysia. Respondents were approached in the shopping malls and universities. The researchers and appointed assistants would first explain the main reason behind the research before letting them fill up the questionnaire. Respondents were guided and briefly educated about the circular economy. They were requested to think of some circular products like re-usable straws, edible straws, reusable water bottles, paper bags, reusable cotton bags, rechargeable batteries, etc. before answering the questions about their purchase intention. An interesting attempt was made to collect data where the soft copy of the questionnaire was provided to the respondents instead of the hard copy, and they were asked to reply to the questionnaire using their smart devices. Out of the total five hundred (500) distributed questionnaires, three hundred and seventy-seven (377) were finally selected for data analyses, yielding a response rate of 75.4%. The main reason behind choosing soft copies for the survey was an attempt to implement the concept of sustainability and circular economy by replacing printed copies of the questionnaire with soft copies, which have little to no effect on the environment. The researcher would like to recommend to the future researcher to adopt this method of collecting data, as the response rate was high and acceptable. The sample consists of 47% female and 63% male.

11.4.2 Research Instrument

For the present study, a self-administered structured questionnaire was used. The questionnaire was divided into two main parts. The first part of the questionnaire was designed to acquire information on various demographic variables, whereas the second part of the questionnaire was designed to collect data on all the dependent and independent variables of the study. In this case, there are five (5) independent variables, namely, attitude, subjective norm, perceived behavioral control, convenience, and environmental impact, and one (1) dependent variable, namely, purchase intention. All the items included in the questionnaire were adapted from previous studies and adjusted slightly to suit the context of the present research. Throughout the instrument, a five-point Likert scale (with "1" strongly agree and "5" strongly disagree) was used to measure the level of agreement with variables. 377 usable responses were gathered in a period of around two (2) months. For data analyses, SPSS and AMOS version 22 were used.

Table 11.1 Reliability Statistics of the Questionnaire

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No. of Items
0.958	0.959	27

11.5 Data Analyses and Results

11.5.1 Respondents' Profile

Data collected on the first section of the questionnaire, which was on various demographic variables, contained questions on gender, age, income level, education, and marital status. Based on the results, the majority of the respondents were males with 63% contribution to this research. The remaining 47% were female respondents. About age, the majority (45.4% or 171) were from the age bracket of 30 years old and above, followed by an age group of 25 to 29 years with a total contribution of 22.5% or 85. Most of the respondents (44.6% or 168) hold a postgraduate degree and were married (66.6% or 251). Lastly, this research was mainly influenced by the respondents with an income level of RM 1000 to RM 4000 (41.6% or 157) followed by RM 1000 and below with a contribution of 23.1% or 87.

11.5.2 Attributes of the Questionnaire

An important step in the data analysis to ensure the stability and consistency of the questionnaire is to undertake a reliability test. For this purpose, Cronbach's alpha reliability coefficient and the item-to-total correlation were calculated. Nunnally (1978) recommended a value of 0.70 and above acceptable, indicating a strong research instrument. Cronbach's alpha of the present questionnaire resulted in a value of 0.959, confirming high consistency and stability of the research instrument (see Table 11.1).

11.5.3 Exploratory Factor Analysis (EFA)

To find out the factors underlying the data, exploratory factor analysis (hereafter, EFA) with Varimax rotation was performed. Hair et al. (2013) provided valuable suggestions which were kept in mind, for example, any item with a loading of 0.4 and below were deleted, and items with the cross-loading of below 0.35 were also removed. Further, Kaiser–Meyer–Olkin (KMO) was 0.943, indicating the suitability of the present data for factor analysis, and Bartlett's Test of Sphericity was significant at $p < 0.001$, indicating the acceptable correlations between the variables.

EFA resulted in a clean six-factor structure, as originally envisaged, using the criteria of eigenvalue > 1. The total variance of these six extracted factors was 79.56%, and all the items loaded on their respective factor than on any other factor, establishing discriminant validity of the measurement. The result of EFA is presented in Table 11.2. The next step followed is confirmatory factor analysis (CFA).

11.5.4 Confirmatory Factor Analysis (CFA)

Confirmatory factor analysis (hereafter, CFA) is a method in the two-step structural educational modeling (SEM) approach, where extracted factors from EFA are first confirmed in a measurement model before proceeding with testing the fitness of the full-fledged structural model and testing the hypotheses. In order to do CFA, AMOS software was used with Maximum Likelihood Estimation (MLE) and fitness of the measurement model was evaluated based on the goodness-of-fit indices recommended by various scholars (Byrne, 2010; Hair et al., 2013; Kline, 2011). The fit indices considered to assess the present measurement model were chi-square (χ^2), normed chi-square (χ^2/df), the comparative fit index (CFI), and the room mean square error of approximation (RMSEA). Figure 11.2 depicts the final measurement model.

Based on the result of the measurement model of the present research, all the fit indices were above the acceptable threshold. In this case, the normed chi-square (χ^2/df) value is 3.251, which is below 5.0. Similarly, CFI is 0.934, which is above the recommended value of 0.90. Lastly, RMSEA emerged with a value of 0.077, which is also below the acceptable value of < 0.08. These values indicate that the measurement model fits well and is ready to be tested in full-fledged model.

11.5.5 Hypotheses Testing

The next imperative step in SEM, after achieving acceptable results in the measurement model and establishing the reliability and validity, is to test the fitness of the full-fledged model and to test the hypotheses. Similar to that of CFA, a full structural model is also assessed based on the result of the fit indices. The most common and recommended indices are normed chi-square (χ^2/df), the comparative fit index (CFI), the normed fit index (NFI) and the root mean square error of approximation (RMSEA). The full structural model and hypotheses were also tested using AMOS software. The baseline structural model is presented in Fig. 11.3 followed by the result of hypotheses testing, which is presented in Table 11.3.

The result of the hypothesized model revealed that it fits the data very well (see Fig. 11.3). In this case, the goodness-of-fit indices were at the acceptable level with normed chi-square (χ^2/df) = 3.251, the comparative fit index (CFI) = 0.934, the normed fit index (NFI) = 0.907, and the root mean square error of approximation (RMSEA) = 0.077. Further, three (3) out of the total five (5) structural paths were

Table 11.2 Exploratory Factor Analysis

Rotated Component Matrix						
Items (Variables)	Components					
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
	Subjective Norm	Purchase Intention	Perceived Behavioral Control	Environmental Impact	Attitude	Convenience
SN2	0.821					
SN5	0.802					
SN4	0.787					
SN6	0.779					
SN3	0.739					
SN1	0.722					
PI12		0.879				
PI13		0.873				
PI14		0.868				
PI11		0.837				
PI15		0.835				
PBC4			0.851			
PBC1			0.826			
PBC2			0.671			
PBC3			0.627			
ENV2				0.801		
ENV3				0.697		
ENV1				0.617		
ENV4				0.599		
ATT2					0.805	
ATT1					0.794	
ATT4					0.507	
CON3						0.806
CON4						0.794
CON1						0.733
CON2						0.710
Initial Eigenvalues	13.599	2.232	1.943	1.469	1.238	1.001
% of Variance	19.645	18.040	11.824	10.100	10.033	9.918
Cumulative %	19.645	37.686	49.510	59.610	69.643	**79.561**

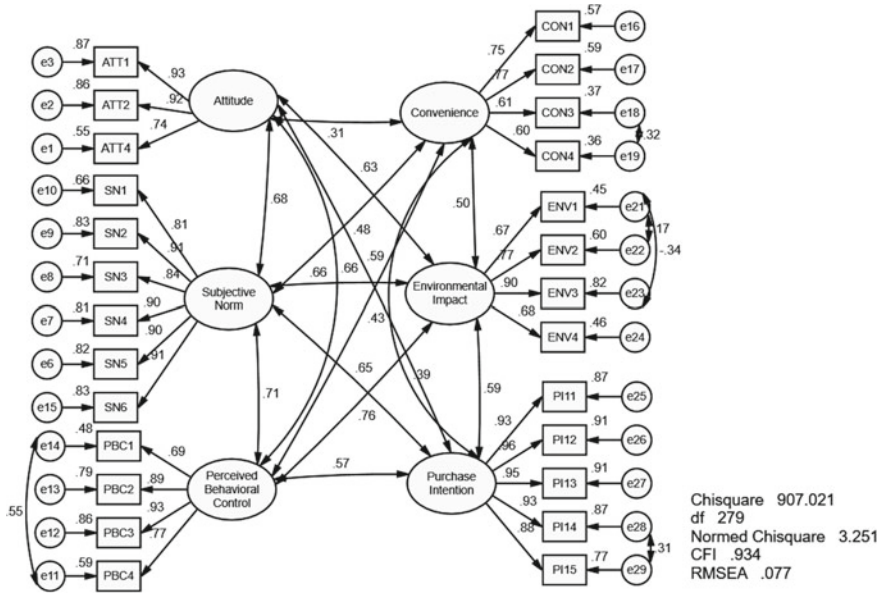

Fig. 11.2 Measurement Model

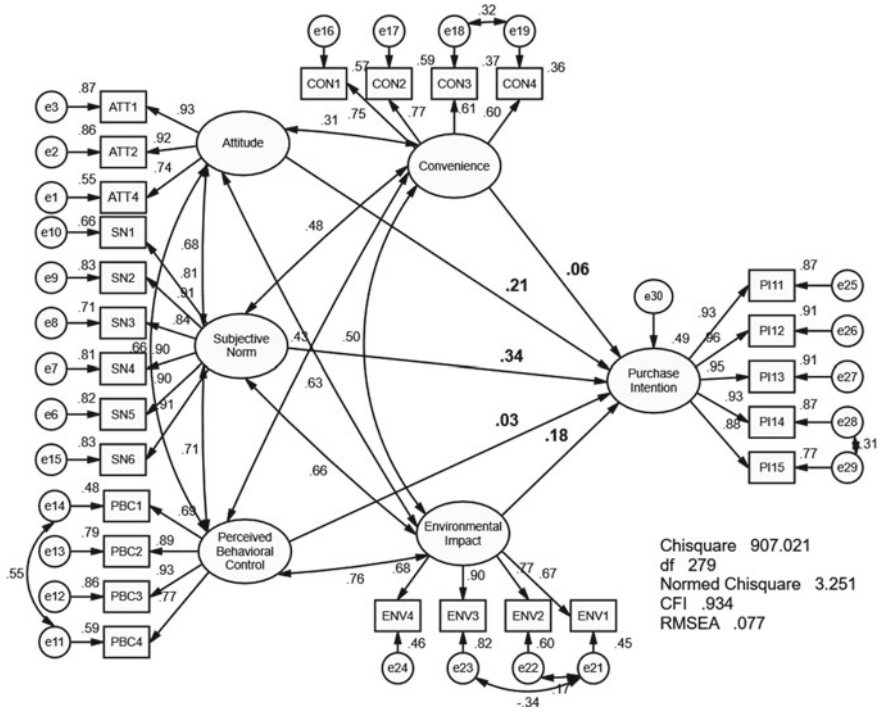

Fig. 11.3 Full Structural Model

Table 11.3 Estimates of the Hypothesized Model

Structural path	Hypothesized Relationship	Std. Reg. Weight	S. E	C. R	P
Attitude → Purchase Intention	$H1^{s}$	0.208	0.088	3.291	0.001
Subjective Norm → Purchase Intention	$H2^{s}$	0.342	0.073	4.984	***
Perceived Behavioral Control → Purchase Intention	$H3^{ns}$	0.032	0.101	0.412	0.68
Convenience → Purchase Intention	$H4^{ns}$	0.064	0.071	1.157	0.247
Environmental Impact → Purchase Intention	$H5^{s}$	0.175	0.137	2.245	0.025
Statistic		Suggested		Obtained	
Chi-square significance		≥ 0.05		0.000	
Normed chi-square (CMIN/*df*)		≤ 5.00		3.251	
Comparative fit index (CFI)		≥ 0.90		0.934	
Normed fit index (NFI)		≥ 0.90		0.907	
Root mean error square of approximation (RMSEA)		≤ 0.08		0.077	

s = Supported at $p < 0.05$, ns = Not supported

both statistically and practically significant. The results of hypotheses testing are provided in Table 11.3.

Based on the results of hypotheses testing presented in Table 11.3, it is clear that only three (3) out of the total five (5) hypotheses are supported. The supported ones are H1 (attitude has a positive impact on consumer purchase intention), H2 (subjective norm has a positive impact on consumer purchase intention), and H5 (environmental impact has a positive effect on consumer purchase intention). There was not enough evidence to support H3 (perceived behavioral control has a positive impact on consumer purchase intention) and H4 (convenience has a positive impact on consumer purchase intention). It is of high import to note that the causal link between "subjective norm" and "purchase intention" was the strongest with the regression weight of 0.342. It was followed by a structural link between "attitude" and "purchase intention" with the regression weight of 0.208, and "environmental impact" and "purchase intention" with the resulted regression weight of 0.175.

11.6 Conclusion and Direction for Future Research

The present research attempted to investigate the consumer perspective of the circular economy by adopting and extending the theory of planned behavior. This contemporary resonating concept of the circular economy is hardly researched in a marketing setting. The uniqueness of the current research lies not only in choosing the interesting concept of the circular economy but also in testing it empirically using complex statistical techniques and revisiting and adding more variables to the theory of planned behavior. It makes this research strong, contemporary, and extremely important with academic, as well as practical implications.

The findings of this research attest the importance of subjective norm when it comes to consumers' intention in purchasing circular products or products produced with the philosophy of the circular economy. Further, the present study also established the importance of the attitude of consumers toward their intention to buy circular products. Furthermore, a positive influence of environmental impact on the purchase intention of consumers is also something undeniable. The aforementioned findings are invaluable for policymakers, practitioners, and global organizations who wish to attract today's environmentally conscious consumers and transform the linear economy to a circular economy.

Perhaps, future researchers may attempt to test the model proposed and tested in this study in other countries and settings. A promising attempt would be to add more constructs to the current model, like cost or financial impact, brand image, design, and customer services or supportive relationship, to name a few, and then test their fitness in a comprehensive model. Lastly, future researchers may test the independent variables of the present study and see their impact on consumer behavior.

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Chapter 12
A Multi-Layer Analysis and Solution for Climate Crisis: From the Restructuring of Production to Restructuring of Knowledge

Omar Javaid

Abstract The globalized system of production and consumption has successfully created a highly unsustainable lifestyle for the global elite. Despite the red flags raised by environmentalists for many decades, the system has not been able to prevent the climate crisis. This chapter attempts to explore the root cause behind this inability using the Hollingsworth framework of institutional analysis. In this chapter, to find the root cause, the Hollingsworth framework was used to excavate the system to reach its axiomatic foundations in at least 6 steps. The path taken to discover the root cause is then reversed by creating an alternative set of axioms where environmental sustainability is a prime ingredient. The alternative set of axioms which are inspired by the core message of Islam is then used to construct an alternative—environmentally sustainable—system of production and consumption. The chapter argues that reconstructing our society on the template provided by Islamic—environmentally friendly—principles and paradigm is fundamentally necessary to prevent worsening of the climate crisis or perhaps even prevent it altogether depending on how quickly the alternative is adopted by a significant number of world's population.

12.1 Introduction

Environmental scientists have warned that if carbon emissions are not cut by half by 2030, then the runaway climate change could not be stopped no matter what measures are taken afterward (Masson-Delmotte er al., 2018). This implies that the planet only has around 10 years (counting from 2020) now to take some serious action to shift from fossil fuels to renewable sources of energy or redesign the system of production and consumption to reduce its energy consumption. The concept of the circular economy is under discussion in this context for a while (WEF, 2014, 2018). However, despite all the noise, multiple global conferences of the world leaders, the system has produced more greenhouse gases than ever. The world indeed has shifted

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7% of its energy production to renewable sources, but only to cover the gap created by the decommissioning of nuclear power projects, while energy production through fossil fuels keep thriving (International Energy Agency, 2018).

There is another dimension of the problem. The modern lifestyle in the so-called first world economies is so resource-intensive that it would require many more planets if everyone on the planet attempts to adopt this lifestyle (Wackernagel et al., 2006). There are not enough resources on the planet even if just all the Indian population, for example, becomes financially capable to copy an average American lifestyle (Thiel & Blake, 2014). It is not just the question of energy, every resource that is required to build a first-world lifestyle, including all the metals particularly steel, plastic, all types of fabrics, wood, just to mention a few examples, is not present in sufficient quantities to satisfy ever-growing wants or even artificial needs.[1] Realizing the resource scarcity problem, some movements like that of Minimalism (Meissner, 2019) or Zero Waste Lifestyle are inspiring people to live with as lesser resources as possible, wasting as little as possible, and seeking joy in human connection instead of one's shallow affiliations with material stuff. However, speculatively speaking, the percentage of the population getting inspired with such movements is perhaps far less than those who aspire to upgrade their lifestyles as per first-world standards, and it will be unlikely that they will comprise of most of humanity, let alone top 10% of humanity by the next decade.

This chapter is not being written to solve the climate crisis within a timeframe presented by climate scientists. Nature of the problem tells us that it is an impossibility to fix the climate crisis without changing the fundamental mindset (paradigm[2]) which created the crisis in the first place (Schumacher, 1973). If the prevailing paradigm does not allow visualization of a solution, then the only way is to replace it with a new one. However, if an entire civilization is standing on a certain paradigm, then one cannot simply replace the paradigm with a new one, as subsequently, the entire civilization would have to be deconstructed and reconstructed to fit into the new paradigm. Paradigms are also like templates, upon which the entire civilizations can be built. So once a civilization has been established, it is impossible to just replace it like it is impossible to replace the foundations of a skyscraper without risking the fall of the skyscraper. So, the author believes that only a miracle can save the contemporary civilization from an imminent climate apocalypse. Nevertheless, the argument here is being made with a hope that if the study survives the apocalypse,

[1] Air conditioning is an example which becomes inevitable due to our modern architecture which does not allow proper ventilation. Pre-modern architecture provides an interesting comparison in this context. See https://www.curbed.com/2017/5/9/15583550/air-conditioning-architecture-skyscraper-wright-lever-house.

[2] Harari (2017) would use the term 'inter-subjective reality', it is a set of assumptions about how the world works and should work. It comprises of some sacred ideas, beliefs, values, meta-norms, archetypes which provide a lens to a group of people to make sense of the world and their lives and organize themselves to ensure their collective survival. Harari believes that it is uniquely a human ability to create such inter-subjective realities as any other species does not possess such a capacity. It may also be referred to as 'world view' or 'ideology'.

and if the survivors get their hands on to it, they will know how not to repeat the paradigm-formulation mistake while laying the foundation of the new civilization.[3]

This chapter uses the framework proposed by Hollingsworth (2000) to analyze systems. The framework is explained in section two below. The third section would use the Hollingsworth's approach to peel off layers of the modern industrial system of production and consumption to reach to its core, the paradigm and ultimately the axioms constituting the paradigm. A top to bottom approach is taken in the fourth section. The fourth section would reconstruct an alternative system on an Islamic paradigm while using a bottom-up approach. The last section would conclude.

12.2 Methodology

The Hollingsworth's (2000) framework provides a means to systemically evaluate institutions in the light of the broader systems and ideologies they are standing on. Hollingsworth (2000), Schumacher (1973), and many others (Asutay, 2007; de Soto, 2009; Greif, 1994; Mokyr, 2010) argued that systems evolve over their unique ideologies, paradigms, meta-norms, or set of axioms. It begins with the development of a system of thought, followed by a system of communicating ideas, upon which human societies organize themselves on macro and micro levels. This study thus uses the Hollingsworth approach to analyze the modern system of production and consumption; the broader systems it is standing upon, to the very bottom of its ideological construction. The comprehensive picture created as a result of this multi-layer excavation of institutional foundations provides a critical medium to differentiate a system with the alternatives prevailing in different civilizations (Hollingsworth, 2000). If there is no alternative to compare with, the approach can help see the very foundations upon which the system is standing and analyze the impact of any changes in the foundations on the overall system.

The outcome of this approach is the exposition of the ideological or axiomatic foundation of a system or institution. The insight about the foundations of an institution is essential at the time of adopting an institution from one civilization or society to another (Javaid, 2015a). If the foundations are opposed to each other, then the adoption is expected to do more harm than good, or at the best, the results would be disappointing, if not in the short run, then most likely in the long run (Greif, 1994). Furthermore, the analysis also helps in identifying how deep the problem is. A procedural level or policy level problem in the system can be fixed by changing the procedure or the policy. However, if the problem is in the ideological foundation of the institution, or the foundation of the system of which the institution is part of

[3] This may sound very dramatic, however, the more I study how the modern system are structured, the more I realize that it is beyond the capacity of the modern system to fix the problems which it is design to create by default. So, people who survive its collapse are addressed here so that they may not repeat the same mistake.

or the foundation of the civilization of which the system is a part of, then fixing mere procedures or policies cannot solve that problem (Javaid, 2015a).

Effects of a problem with deep roots may disappear temporarily through symptomatic treatment, however, the problems resurface, in other forms and cause harm to a different set of stakeholders (Beck and Ritter, 1992; Javaid, 2015a). Symptomatically addressing a problem is also important, however in the long run, if its roots are not addressed, the problem may aggravate. For that matter, the Hollingsworth framework provides a handy tool, to trace the root of a problem and see how deep it goes, and subsequently what measures could be required to fix the problem permanently in the long run. Without such an analysis, certain deep-rooted problems are seldom addressed, while the problem-solvers remain in an illusion of having solved a problem. And when the problem resurfaces after a while in a different form, often something or someone else gets the blame. Without undermining the significance of firefighting for quick fixes, it is argued here that to fix the problem at the root, analysis of the problems within institutions, systems or societies is needed, the Hollingsworth framework can be used. Hence, long term measures are taken to fix the problems at the root, so old mistakes are not repeated while laying down the foundations of a new system.

12.3 Excavating the Advance Industrial Society

Using the framework of Hollingsworth to analyze the system's foundations, the author was able to dig through multiple layers of the system of production and consumption as used in the advanced industrial societies today to reach to the root of the climate crisis. Following is a brief description of these layers:

- The top layer visible to the ordinary person is a system of production and consumption operating on a global scale which is responsible for much of the environmentally destructive practices.
- The system has been pushed[4] all over the world driven by an insatiable desire of a small elite to maximize profits.
- Other than the elite, the management hired by the elite in multinational firms in particular also participates in the process, who calculates the firm's profit by employing certain accounting techniques and standards.
- The accounting techniques and standards consider the exchange to be happening strictly in a monetary sense, while any non-monetary exchange which happens with stakeholders such a natural environment and society is never accounted for. So, the exchange is seen a linear rather uni-dimensional, and not multidimensional.
- The multidimensionality of the exchange process is also invisible because the exchange is considered as a linear process, not a circular one. It is not visible to the specialists in most fields that the outputs or externalities they create in any

[4] Referring to the famous quote by Polanyi (1944) 'Laissez-faire was planned, planning was not'.

type of exchange process, can complete a full circle, and affect them as well in the long run.

- This invisibility to the circularity of the exchange process is perhaps because of how knowledge is organized in the free-market society and developed in compartmentalized-isolated-domains which typically miss seeing the bigger picture, let alone circularity of the impact they create.
- Finally, the compartmentalization of knowledge in micro specializations is a result of a peculiar meta-physics which defines the epistemology of knowledge and ontology of man in a very narrow and specific manner.

This section will elaborate on each of these layers to explain the root of the problem on an axiomatic level.

12.3.1 The Global System of Production and Consumption

Our contemporary supply chain is global, and we route raw material and labor from every nook of the planet and sell products at every corner. The priority of businesses, particularly Multi-National Corporations (MNCs), is to sell the product to as many global locations as possible. The search for labor, raw materials, product components, and customers is typically done either to minimize the costs or maximize profits (Bakan, 2004). An interesting case in point is the phenomenon of exporting a product to a buyer in another country for higher profits, while the local demand is met by importing similar products from other countries. Pakistan, for example, export and import cotton at the same time.[5] The phenomenon is known as intra-industry trade (Taylor, 2014). Although the volume of intra-industry trade is not significant in comparison, the phenomenon is referred to as economically beneficial, with an encouraging tone, in the relevant literature (Melitz, 2003). Increased variety of products or product differentiation is typically referred to as an advantage of intra-industry trade (Ruffin, 1999). The benefits are exclusively measured in purely economic terms, while the carbon footprint or other forms of the environmental impact generated due to excess transportation (required to ship the products to consumers in a different country while importing the same products for the local consumer) is typically not the focus of concerned literature. The goal is perhaps to perpetually maximize profits (Bakan, 2004; Boltanski and Chiapello, 2007).

12.3.2 Hunger for Profit Maximization

The global system of production and consumption is better for profits than a local one. A global system gives unprecedented opportunities to maximize profits, while the

[5] See https://tradingeconomics.com/pakistan/imports/cotton, accessed on 29th July 2019.

locally organized system of production and consumption only limits the possibility of growth due to a limited number of customers, less variety of labor or skills, and limited number of materials, subsequently limiting the growth of the locally organized enterprise. So it is the idea of perpetual growth which motivates the 'one-dimensional man' (Marcuse, 1991) of modern capitalist society to expand the system of production and consumption to every nook and corner of the planet to keep the growth engine running perpetually. The local consumption and employment needs are typically ignored as production is conveniently shifted to countries which offer cheaper labor, low tax rates, lax environmental laws, little wage control, and where it is easier to bribe officials to look the other way (Jaffe & Quark, 2006). Products are shipped to places where the customers have a higher purchasing power (Sachs, 2010).

Often raw material is sourced from conflict zones, like in Africa, controlled by militant groups with a track record of extreme human rights violations (Pouilly, 2007). Usage of slaves working to dig the minerals from mines brings the cost of extraction down significantly, subsequently lowering the selling price. For example, Coltan a mineral used in electronic circuits is mined in Congo in such conflict zones and sold in the international markets for a lesser price (Ayres, 2012). Oil production in Nigeria is controlled by a corrupt regime supported by oil companies in other countries for the same reason (Cockcroft, 2012). Cockcroft (2012) has identified MNCs as one of the sources of corruption in many third world countries who bribe public representatives or bureaucrats to keep the wages low, evade taxes, loosen capital controls, or look the other way, while MNCs create environmental disasters to ensure their growth.

These are just a few examples, suggesting that while organizing the trade, lower costs and higher profits are perhaps the benchmark for managers of corporations operating on global levels irrespective of externalities on the outside world. A distance of thousands of miles also makes it easier for a company or its managers to ignore the consequences of their decisions on the local population and vice versa (Besser & Jarnagin, 2010). Typically, corporations do not mend their ways unless their practices are exposed in mainstream media. To save their face, they take some corrective measures or hire a PR agency to project an exaggerated image to the public. However, if it is possible to get away with a destructive act if there is no impact on the balance sheet or the income statement, corporations may do that anyway in the interest of shareholder's value (Bakan, 2004).

12.3.3 A Faulty Accounting System

The damage to the environment and communities is typically out of sight of modern business practices unless it turns into a public relations crisis and has its toll on the brand equity or shareholder's value. So the damage has to impact the company's balance sheet negatively directly or indirectly (damage to the brand image) to get noticed by the management (Bakan, 2004). It is out of the question to include the

cost of the damage to the environment, for example, while calculating the company's profit, as the environment itself does not come forward to claim the damages. However, the communities which are affected often come forward to protest when their survival is threatened due to some industrial activity. Protests against Dakota Access pipelines are a recent known example (Fredericks et al., 2018). The damage to the communities in the form of social disintegration is also largely subjective and difficult quickly identify, let alone articulated in terms of monetary value, making it even more convenient for corporations to shy away from taking the responsibility (Jaffe & Quark, 2006). In other words, risks posed by the damages are generally externalized (let someone else handle them) by corporations to evade the cost of responsibility of the damage inflicted on the outside world (Lanier, 2014).

It is costly for a business to act responsibly as it can hurt the income statement and subsequently adversely affect the shareholder's value; therefore, the strategy of evasion or 'letting someone else deal with it' is often adopted, particularly when it is difficult to calculate the cost of an impact in purely monetary terms (Beck and Ritter, 1992). Often the damage is simply ignored, like in case of oil spills if there is no party claiming for damages in a court of law. It is even more convenient to evade if the damage is visible in the long term (greenhouse effect of burning fossil fuels or emergence of drug-resistant bacteria due to overuse of antibiotics) particularly when it is difficult to pinpoint which corporation contributed more toward the damage.

In modern free-market society, the risks externalized by one industry often become a capitalizing opportunity for another industry, which offers products and services to the affected populations, while creating new kinds of risks. Ulrich Beck (1992) referred to modern capitalist society as Risk Society due to the peculiar behavior of continuously producing, externalizing, and capitalizing on the new risks. A vicious circle is created which subsequently affects more and more people over time (Lanier, 2014). Externalization of risks and reluctance to bear the cost of responsibility is also acknowledged as one of the fundamental contributors to the inequality in the modern free-market society (Beck and Ritter, 1992). This is also an epistemological problem, as the calculation of costs is exclusively done in quantitative terms, while any difficult to quantify cost is ignored because of epistemological limitations.

12.3.4 One Dimensional Concept of Exchange

The one dimensional, self-centric, rational, and short-sighted approach of modern man (or a corporation which is also treated as an artificial legal person in a court of law in capitalist societies) blinds them in considering the impact or risk associated with their action. These actions appear to be non-economic, which does not affect them and cannot be quantitatively expressed and will not appear in the short run. The one-dimensional man, a term coined by Marcuse (1991), is the harbinger of the modern Risk Society. The concept of the modern corporation is also built on the image of such a kind of a man, also referred to as homo-economicus (Bakan, 2004).

On the contrary, in traditional societies, we often find people who see themselves associated with others not just economically but also socially and spiritually (Forbes, 2008). They are more collectivist and community-oriented rather than self-centric. They often appreciate the subjective nature of reality and have a long-term perspective while evaluating the outcomes of the individual or collective actions. For such a person exchange just happens not only in economic terms but also in a social and a spiritual sense. Such a person acknowledges the exchange of trust and security in purely social interactions. For example, when a person visits a sick relative, and express his care, a similar reciprocal behavior may occur in the opposite direction (Diamond, 2012). Likewise, taking care of the natural world is done with the same zeal, simply because the natural world provides for our sustenance (Forbes, 2008).

For example, Forbes (2008) suggested that Aboriginal tribes do not consider themselves as dominating the natural world, rather consider themselves as part of the bigger reality of which natural world and human beings are an integral part of, both depending on each other, both linked with the other in a process of mutual exchange, only giving what is beneficial for the other to survive. What we exhale or excrete is inhaled or absorbed by the plants and what is exhaled or produced by the plants is inhaled or consumed by humans. The two-way dependency implies that the natural world which provides us for sustenance must be taken care of, even if there is no immediate benefit.

Exchange with the natural world or the community we live in, therefore, can happen in a variety of ways where its quantitative evaluation is not possible, neither appropriate. Typically, traditional cultures across the globe have a criterion of subjective evaluation of the exchange with the social and natural world, which is taught to the new generation by the previous ones. Modern-one-dimensional-rational-self-interested-short-sighted-man, however, finds it difficult to appreciate the nature of such an exchange. The inability is not just epistemological (only quantitative evaluation accepted) but also an ontological one. One dimensional modern man typically considers himself as a dominant force to exploit the natural world for his advantage, while ignoring his reciprocal role of taking care of the natural world (Harari, 2017; Sachs, 2010). It is a one-way relation for him, which follows a straight line. Reality is perhaps the opposite.

12.3.5 The Linearity of the Exchange Process

It is hard for a one-dimensional-short-sighted-modern-man to see the circularity of the exchange process. 'What goes around comes around' literally happens in the natural world. However, the one-dimensional modern man sees the transaction happening in a very linear fashion. The raw material is taken, transported, processed, distributed, sold, consumed, and discarded (Morgan, 2015). He typically does not see even the economic impact of his transaction beyond his immediate stakeholders, let alone see—what is given back to nature at the very end of a supply chain—is acceptable to nature or not. For the one-dimensional man, the exchange with the

natural world is not even an exchange, after all, as there is no economic transaction happening, the epistemologically-biased-quantitative-focus on short term economic returns coupled with ontological bias against nature as inferior and exploitable does not allow him to see the circular nature of the exchange which prevails in nature. Nature in itself is a closed system; it consumes everything it produces, as hardly anything is wasted. Modern one-dimensional man operating incompatibly with the natural world can only be viewed as an anomaly for nature. If inside a human body, an organ begins to consume other organs or excrete substances that cannot be consumed by other organs; it would be regarded as diseased. Such a diseased organ may be referred to as cancer, whose urgent cure would be sought for; however, ironically, the one-dimensional man finds it difficult to view his exploitative and pollution creating practices as an anomaly (Forbes, 2008).

As a result, he (or she) has eventually created a world where his survival is becoming difficult, depending on his ability to purchase a way out while transferring the risks to others (Beck and Ritter, 1992). The linear supply chains now start from one country and end in another, the journey from raw material to finished goods typically take thousands of miles. Often products contain substances, like plastic and other petrochemical compounds, which cannot be absorbed either by the human body or the natural world. Further, the waste produced at the end of consumption is often shipped to other countries for disposal or recycling (Baldé et al., 2016). The process is anything but circular. The emission of greenhouse gases in this entire process particularly in the transportation system disqualifies the process to be referred as circular even if, hypothetically speaking, the waste at the end of the supply chain is 100% recycled, and the entire extraction, production, and recycling process are powered through renewable sources (Gregson et al., 2015; Hobson & Lynch, 2016). A circular economy, therefore, is conceivable when the supply chain is localized, not globalized. However, that would not make much sense to the one-dimensional profit-hungry modern-man (or corporation). He would rather prefer a global system of production and consumption for the sake of maximizing profits, while externalizing all the risks to others, while evaluating the performance of the supply chain exclusively in economic terms, or at best in the light of the rubrics used within his area of specialization.

12.3.6 Division of Knowledge

The modern world is operated by innumerable specialists specializing in countless domains. The entire corpse of knowledge is divided among a multitude of specializations. The idea of division of knowledge is rooted in an evolutionary paradigm, which suggests that like biological organisms' knowledge also evolves through the process of survival of the fittest, where every individual or group of the individual can generate

new knowledge in response to new challenges or risks created by externalities[6] of solutions derived from earlier specializations (Raffaelli, 2003). If the new specializations beat the competition by attracting more customers in a particular market segment then it would grow (Loasby, 2004). Commercialization of each specialized domain of knowledge creates an incentive for everyone to reap the benefit of the knowledge they are creating. The self-interested approach in a competitive environment with quantitative evaluation of results predominantly in monetary terms would restrict the one-dimensional modern man to take a holistic view of the entire system. He looks only where his interests appear most vividly in the forms of numbers (Marcuse, 1991).

There is no ideal image where this collective evolution of all specializations would reach in the long run. No one can predict, no one can say what kind of risks would be produced in the long run by products or services meant to cater prevalent risks (Beck and Ritter, 1992). New specializations keep emerging reactively in response to risks created in the system but in turn produce new kinds of risks. Bigger the risk, higher the commercialization potential of specialization which deals with that particular risk and higher the possibility of growth of knowledge within specializations with high commercialization potential. The bottom-up approach therefore can go on for infinitum without hindrance, creating its own path. It is even impossible to tell, even unnecessary, how the whole system would look like as long as the individual members can grow materialistically (Loasby, 2004).

There is no big picture in this bottom-up approach let alone anyone is trained to adapt to the broad ideal of a society.[7] There is only a picture of a perfect individual, referred to as Homo Deus by Harari (2017), while each individual is encouraged to achieve that ideal within himself, irrespective of how it affects the world at large. The future of modern civilization is therefore a cumulative outcome of innumerable self-centric, reactionary, and irresponsible modern individuals striving for personal growth in a purely material sense. The near future however can be predicted very well by the risks a modern man has created so far for the world at large (Beck and Ritter, 1992).

The one-dimensional self-interested specialist is rather concerned about the economic value which his specialization generates for himself and his customers. Hayek (1952, 1945) believed that the commercialization potential of any body of knowledge encourages people to work specifically in one area, gaining experience and contributing more toward the specialization. Since the time of Descartes, the emblem of knowledge is the rational mind of the modern man (Cottingham, 1978), and free interaction of many such men (or women) subsequently creates innumerable specializations of knowledge (Hayek, 1945). Hayek (1952, 1945) believed that free interaction between different specializations also leads to unrestricted growth

[6] Pollution is the most known externality. Iatrogenics of modern medicines is another known example. The banking system siphoning wealth toward the rich is another example.

[7] Science fiction novels are an exception, but according to which we should have become an interstellar species, everyone should have flying cars by now while problem of climate change would not exist.

of knowledge, while the free-market system by default encourages or discourages a particular specialization depending upon its commercialization potential. Specializations which are not in demand are left by people while those in demand are opted for, till the supply matches the demand, creating equilibrium (Raffaelli, 2003).

The modern, one-dimensional-specialist is formally qualified to focus only on his area of specialization, while he typically remains unconcerned about the other unrelated areas, areas on which his one-dimensional economic interest is not connected to. It is difficult for him to see or evaluate the impact of his action other than what his specialization trains him to see or evaluate, particularly when the impact has a subjective nature. His sense of responsibility is also restricted by his area of specialization (Beck and Ritter 1992). Every specialist operates in small interdependent silos, where the output of one is an input to the other.[8] Yet no one understands the entire complexity of the system, the effect of each component on the other. Even those trained to take a macro view only focus on a certain aspect, like an economist would only look at the data emerging from the markets while ignoring the socio-emotional or environmental impact of economic activity, particularly when the impact is difficult to quantify.

So eventually this one-dimensional, value-maximizing specialist, focused on his self-interest while measuring his worth purely in quantitative terms, only see a small one-dimensional arc of the circular process, an arc so small that it appears linear. His focus on economic self-interest encourages him to externalizes his risks, his specialization creates the perfect excuse, that is, 'I am not a specialist of this area', so 'let someone else deals with it' (Bakan, 2004). The narrow-self-interested-linear-short-term focus of a specialization allows him to neglect the possibility that his waste ought to be handled by someone else or his waste can become someone else's cost. And if that someone is the environment or any easily exploitable entity, and if the cost of the damage which the waste creates or the benefit of cleanup is unquantifiable, than the waste may be left unaccounted for (Bolt et al., 2005). So those who are responsible have their economic interests attached to the process which creates environmental pollution for example (Klien, 2015). Many of the beneficiaries even resist any change which would reduce environmental destruction simply by refuting the data shown by experts by labeling it as a conspiracy of their competitors in the marketplace.[9]

Resistance to a body of knowledge that threatens the interests of a particular group may not necessarily come from the people in power. Mere bureaucratization of a certain specialization leads to resistance to any necessary but major change (Campagnolo & Vivel, 2012; Phelps, 2006). The emergence of multiple areas of specialization in a market society by self-interested individuals also created the

[8] This even happens in big organizations; Tim O'Rielly (2017) has explained how different teams working inside organizations like Amazon, Facebook or Google are not aware of what others are doing, so eventually no single person in these organizations can actually understand how the entire system works. The same can be extrapolated for the entire modern economy operating on the idea of division of knowledge and labor.

[9] For example, Donald Trump (POTUS at the moment) and his associates in White House these days are a good example in this sense, they neither have the technical competence to understand the problem of climate crisis nor their interests are aligned with the act of understanding the problem.

need for the bureaucratization of knowledge by corporations and state institutions. When a body of knowledge becomes valuable, it becomes an asset, whose protection cannot be just left on some concerned self-interested individuals operating independently. The bureaucratic system of management, therefore, is employed to regulate the dissemination, growth, and protection of the knowledge emerging in a particular specialization. Bureaucratization also defines the boundary conditions to maintain the differentiation of one specialization with another, due to the economic interests involved, particularly of the ones who have invested in the growth of any specialization. State institutions also set regulatory standards to prevent any abuse or misuse of a body of knowledge. Protection through bureaucratization also prevents the rise of any competing body of knowledge, particularly when the state bureaucracies are involved in the protection of a particular specialization. This becomes problematic particularly when risks associated with certain specialization surface and a competing specialization claim to address those risks. Bureaucratization, therefore, ends up resisting alternatives and uses its economic and political influence to subdue any competing specialization which threatens its obsolescence.[10]

12.3.7 In Retrospect

Free market society and ontology of individuals in a market society have been formulated on evolutionary lines subsequently creating a scenario where individuals or organized groups of individuals (corporations) compete with each other for higher profits (Boltanski and Chiapello, 2007; Raffaelli, 2003). The key arsenal of every competing individual or organization is a valuable body of knowledge or specialization. They compete to get the lion's share of customers using the knowledge to offer a better solution to the problems customer seeks in a particular market segment. This pursuit of self-interest in micro areas of specialization only makes the world look linear. On the contrary, all-natural systems including human systems are circular in a holistic sense, where consequences of an action can bounce back and affect the very actor in due time. If I pollute, pollution can harm me as well. However self-centric approach with a motivation for quick quantitative results only leads to accumulation of knowledge where one's contribution and benefit are seen on a very micro-scale, while circularity of the human system typically gets ignored.

Circularity becomes invisible when individuals think more about themselves than the bigger picture, while interaction with the stakeholders becomes only a one-dimensional process of economic exchange due to quantitative evaluation of outcomes. Ontology of the modern self and its position in the order of things (cosmology) therefore makes the circularity of natural or human systems irrelevant, while epistemology of evaluation of outcomes (quantitative) obscures the multi-dimensionality (subjective evaluation of outcomes in a purely social and spiritual

[10] Please see Marcuse (1991), Hayek (1945, 1989), Beck and Ritter (1992), Javaid and Suri (2016), and Kuhn (2012) for details on how bureaucracies resist alternative knowledge structures.

sense for example) of an exchange process. So, the exchange becomes linear and one-dimensional. For example, if a one-dimensional modern man organizes a production system, its socio-emotional, spiritual, and environmental implications are often ignored, let alone how they would impact him or his future generation.

His derive from short-term quantitative results, limited liability, restricted sense of responsibility, based on his focused specialization and a self-centric worldview does not create the need to take into account the long term and subjective outcomes affecting the world outside the range of stakeholders engaged with him in a purely economic sense. His (or that of a corporation's) accounting practice, which provides vital information about his success of failure in the market only records what affects him in purely quantitative (economic) terms in a particular quarter or a year. After all, he is not responsible to bear the cost of emitting greenhouse gases or destroying marine life to make a fortune for himself. Thus, he produces more and more, for an ever-growing customer base, using resources not restricted in a particular geographical region, as growing the length and breadth of the supply chain increases the returns. Hence, from local, the one-dimensional man goes global, while his accountants keep feeding him data about how much wealth he (or the corporation's shareholders) has accumulated, yet none of his direct stakeholders tells him how damaging his influence on the environment and society has become.

12.3.8 The Axiomatic Foundations of the Modern System of Production and Consumption

In retrospect, the problem of climate crisis can be traced back to three fundamental axiomatic ideas. These are as follows:

- ***Ontology of self***: Man (or women) is the being of the highest order, the primary source of knowledge, who is rational, competitive, short-sighted, whose goal is to exploit natural resources for his self-interested ends, he takes the responsibility of his action to the extent the outcomes influence him back in the short term.
- ***Ontology of the world***: The world offers resources which the one-dimensional modern man can exploit to create an alternative world the way he pleases, there is nothing sacrosanct which is to be preserved, so the future image of the world is not known, it would be rather shaped by the collective action of man, outcome of which cannot be predicted in the long run.
- ***Epistemology***: only that which can be quantitatively measured can be known, let alone exist, the whole cannot be measured, only the bits can be measured, so the knowledge that is acquired through measurements is only of the bit, but not of the whole. Like the content each bit of knowledge, its value is also quantitatively measured, which is best done in monetary terms. The monetary value of anything in the market is in flux therefore the value of knowledge of anything is also in flux, and once the value drops, new knowledge of higher value must be acquired. Making a certain body of knowledge sacred and holding on to it can

threaten one's survival if the economic value of that body of knowledge drops in the market. Therefore, knowledge of lower economic value must be replaced with knowledge of higher economic value to ensure survival in the marketplace. Knowledge, therefore, is in constant flux and is valued if its value is quantifiable.

12.4 The Alternative

To address the problem at its very root, three axioms stated above need a makeover. Turning them upside down would perhaps provide us a foundation to erect an alternative system of production and consumption which would appreciate the sanctity of the natural world around us while avoiding problems like climate change. The alternative axioms can be:

- ***Ontology of self***: Man (or a woman) is an integral part of the natural systems, who is first and foremost a spiritual, socio-emotional being also capable of rationalization and can also be farsighted. His inner satisfaction depends on living in harmony with the natural world while fulfilling his needs. He can feel unconditional concern and responsibility for any being, particularly human, or object in the world around him even if the being or object is not associated with him directly. The purpose of man, therefore, is not just to survive, but to seek meaning in transcending beyond his existence, while nourishing all lives around him in the process. It is the very ability to transcend is what differentiates him from other sentinel beings, the absence of transcendence from one's life would equate to the death of his humanness, and therefore of his kind.
- ***Ontology of the world***: The natural world harbors and nurtures life, therefore, taking care of the world becomes a fundamental responsibility of its inhabitants whose life is being supported by the world. If life is sacred, then the natural systems which support life in the world around us are also sacrosanct. The core of the natural system which supports all life, including that of the man, must be preserved so that all lives of all beings which are dependent on the natural system are also preserved.
- ***Epistemology***: Knowledge is a-priori to human existence. It emerges from the natural world, is revealed by Prophets, may be based on the experience of our elders, and is not confined to our five senses. Rather intuition and spiritual experience can often reveal necessary details about the world around us. The worth of knowledge cannot be measured, therefore it cannot be traded. It belongs to the commons, resources available for all to use, which is multiplied with use. To enable more people to use it more, it must be spread unconditionally. Since the natural world is sacred, all life is sacred, therefore, the knowledge that helps in the survival of the natural world and all its constituents must also be sacred. Emerging challenges to the survival of the natural world and all its constituents including a human being, eventually lead to emergences of new knowledge which can help ensure the survival of all. However, the fundamental qualifying criteria

for emerging knowledge would be in its ability to facilitate the survival of all beings and achieve transcendence.

Keeping the three alternative axioms in view, if we retrace our steps from the structure of knowledge to the design of our production system, the path will perhaps take a different route with unique results. To begin with, the alternative structure of knowledge that would emerge from the stated axioms would enable mankind to transcend beyond themselves, while, making sense of the emotional and spiritual experience that emerges in the process of preservation of the world beyond their existence. Both Carl Jung (2006) and Frankl (2007) acknowledged the significance of religious knowledge which provides us a meaning to our complete existence (including spiritual and emotional aspects of our being) along with a framework to transcend beyond our the 'self'. Any piece of data, information, or idea may only be referred to as knowledge if it enables us in achieving the purpose of our ontological self. Axiomatically, any bit of data, information, or idea which allows us to survive in a purely material sense, but not facilitate in the achievement of purpose, may be considered useful only if does not contradicts the purpose of self. Such a bit of information however may not be referred to as knowledge. Knowledge would be referred to as something which enables our spiritual transcendence and give meaning to our actions to benefit others; knowledge is simply that which helps a man (or a woman) to achieve the purpose of the ontological self.[11]

12.4.1 An Alternative Structure of Knowledge

Islam in this sense provides a much suitable and comprehensive guide to transcend beyond our material self while fully engaging our spiritual and emotional faculties in the process. This claim is made due to the breadth and depth of subjects covered in the Quran and the examples which Prophet Muhammad (peace be upon him) set in every facet of his life. Prophet Jesus (peace be upon him) for example, never married, never fought a war, therefore his example provides a lesser degree of guidance in comparison. Buddha also lived a very limited rather monastic life. So, despite many of his worthy teachings, he also cannot be looked upon as a guide for multitudes of challenges a common man faces in his everyday life. Therefore, the teachings of Prophet (peace be upon him) and the Holy Quran can be referred to as more thorough in comparison. The differentiation other than comprehensiveness is the unifying theme that synergistically connects the teachings of Islam about all aspects of our private and collective lives in a way that our actions in every role converge toward achieving the purpose of our creation. The structure of knowledge as presented in the Quran can become the structure for Muslims to synergistically organize their

[11] This abstraction of the concept of knowledge is consistent with the definition taken in the Sect. 3.6 where knowledge enables a person to grow in the marketplace, make more money, which is the purpose of the ontological self in the modern paradigm.

knowledge of different aspects of their lives. Religious texts, like *Ihya-ul-Uloom-ud-Deen* by Imam Ghazali, for example, may also provide us a structure (which is perhaps also derived from the subjects covered in Quran and Sunnah) for that purpose.

12.4.2 The Circularity of Exchange in Islam's Paradigm

The message of Islam connects every aspect of our private and collective lives into a common theme in a way that every action complements the other. For example, the purpose of our business activity is also to fulfill our commitments towards our families, while the emphasis of keeping strong ties with the family often leads to the emergence of a family-oriented business organization, as is witnessed throughout Islamic history (Javaid, 2015b). Many studies on family businesses, even in non-Muslim societies, have shown how family members who share the profit can turn out to be better than paid employees due to their trustworthiness and commitment during difficult times (Arregle et al., 2015; Colli & Rose, 2007; Danes et al., 2009; Hoffman et al., 2006; Tata and Prasad, 2015). Islam's instruction to write all contracts in presence of two witnesses and the belief that economic benefit or *rizq* is from Allah s.w.t, for example, prevents various conflicts from happening between stakeholders in a business, whether family members or outsiders. A conflict-free environment thus keeps one's heart clean from negative emotions which subsequently contributes towards the spiritual growth of a person. Spiritual growth, in turn, leads to better management of our emotions and reinforces a sense of meaningfulness in every aspect of our lives, which can also keep us mentally healthy (Frankl, 2007). This is just a small glimpse of how Islam can connect every aspect of our lives into a single whole.

This synergizing of the multiple facets of our lives is one of the important differentiations of Islam with other belief systems making Islam free of contradictions. In comparison, in the modern way of life, specifically in a free market society, the one-dimensional man often fails to connect different aspects of his life leading to contradictions. While prospering in one aspect, the modern man neglects others, particularly where his focus does not result in an economic benefit. The famous work-life imbalance in modern societies is an example.

The movement of modernism was driven by three ideals, namely: Freedom, Equality, and Progress. In pursuit of freedom (via free-market capitalism), equality is compromised, while in pursuit of equality (socialism), freedom is compromised, yet in pursuit of progress, the health of the natural world has been significantly compromised. The cause of these contradictions lies in the evolution of innumerable domains of knowledge or specializations, which interacts with only a few other specializations while remaining disconnected with the majority. Such a compartmentalized evolution of knowledge can only be expected to create contradictions that have become an inherent part of a modern lifestyle. Each contradiction creates new challenges and risks for others to solve, which are solved only if there is an expected return on

investment. So far saving the natural world from pollution has not made a significant business sense. The progress to fix climate crisis is moving on a pace of a snail, while the time is rapidly running out.

Islam's synergizing nature can train its followers, even non-followers, that how everything is connected and a part of a single whole. Disturbing one aspect of our lives can negatively affect other aspects. The idea of circularity, which was discussed earlier, already exists in Islam's core philosophy. In Islam's worldview, man is a vicegerent of God, a God who takes care of and justly treats everyone. If man, in his capacity as a steward toward other creations, would honor the role given to him by God, he will be rewarded by the system created by God. Quran says:

> And whatsoever good thing ye spend (in God's name), it is for yourselves (i.e., for your good), when you spend it purely in search of Allah's pleasure; and whatsoever good thing ye spend, it will be repaid to you - in full and ye will not be wronged. (2:272)

The idea of circularity is unmistakably present in the above verse. What goes around does comes around, as Allah (swt) does bring it to come around. You do good, good will happen to you, you do a wrong, and you will be punished accordingly. This reciprocity is inherent in the core message of the Quran.[12]

12.4.3 Multidimensionality of the Concept of Exchange

Allah (swt) often uses the metaphor of trade-in Quran to explain the exchange which a believing Muslim does with Allah s.w.t when he obeys the Divine message. He is however not paid in monetary terms; neither there is strictly a quantitative measurement of the reward. Often the description is subjective. The reward may be in the form of mental peace (Quran, 8:11), enhanced *barakah* in the *rizq* (22:58), or qualification for *Jannah* on the Day of Judgment (43:70; 18:107). The exchange, therefore, has a socio-emotional and spiritual dimension as well. Even if a Muslim trader performs an honest exchange in the market place, his returns are not just in the form of monetary profits, but also in the form of spiritual satisfaction particularly when he bears a monetary loss (Al-Ghazali, 2007). Maintaining trust between buyers and sellers while avoiding any possibility of a conflict due to dishonest practices is a social goal sought by the teachings of Islam (Javaid, 2015b). Islam also teaches to value social relations, for example, while emphasizing the rights of neighbors. A hadith[13] clearly instructs to prefer selling a product to one's neighbor in need despite a stranger offering a better price. The emphasis is to make the exchange a means to maintain or strengthen social ties with the neighbors. Therefore, a process of exchange even in a marketplace is not just purely economic but also possesses a spiritual and social dimension in the Islamic worldview, where benefits or losses are unquantifiable.

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[12] Quran, 16:97; 34:39; 24:77; 99:7.

[13] Sahih Bukhari, Volume 1, Book 2, Number 12; source: https://www.sahih-bukhari.com/Pages/Bukhari_1_02.php; accessed on 24th Sep 2017.

The multidimensionality of the exchange in the Islamic worldview, therefore, implies that every action of a Muslim which impacts others is an act of exchanging one's deeds with reward or punishment on the Day of Judgment. There may also be emotional, spiritual, and social benefits to be reaped in the material world. Where for the one-dimensional modern man, the benefit is purely economic, which may also generate some emotions of excitement or pleasure but nothing beyond that.

The multidimensionality of exchange in Islam's paradigm can have implications for a Muslim interacting with the natural world. A Muslim cannot escape the act of destroying the natural world as the modern man can in his paradigm. A Muslim will be punished for disturbing the balance in the natural world as Quran strictly forbids such disturbance (55:7–9). The act of disturbing the natural order particularly becomes graver if it harms human beings who may be dependent on the natural order. The case of Dakota access pipelines would have been decided in favor of the native tribes whose water resources were threatened in the act of installing the pipeline in the light of Islam's teachings. However, protecting the interest of the investor community or to keep the country's GDP growth is perhaps more important in the modern paradigm.

12.4.4 A Dual Accounting System

The idea of recording the transactions is much older than Islam itself. Islam also puts a great emphasis on writing down the contracts. However, for a Muslim, accounting happens in two realms because of the multidimensional nature of the exchange process in the Islamic paradigm. The monetary values of debit and credit are to be recorded on paper. However, the counting of good deeds which every Muslim reaps while obeying the Divine commandments happens inside a Muslim's mind, or heart perhaps. Islamic worldview trains every Muslim to keep in mind how many good deeds he would be carrying with him on the Day of Judgment in case if he dies now. Quran tells a Muslim that his salvation on the Day of Judgment would depend not on how much material wealth he has accumulated in the material world, rather how many good deeds the angels on his shoulders have recorded. The two angels referred to as *Kiraman Katebeen* (82:10–12) are like two accountants, one of them recording the good deeds, while the other records the bad ones. Since we cannot see the angels, the idea that someone else is recording the deeds subsequently pushes a believing Muslim to keep a track of his actions himself and keep seeking forgiveness. As success or failure in the hereafter would eventually depend on the weight of one of the ledgers.

Since success in the eternal life in the hereafter is far more important than the temporary benefit of the material world, therefore, keeping the mind focused on good deeds is fundamentally more important than making sure that how much profit one is earning on a given day, month or quarter. Mental accounting of good deeds, therefore, is to be a stronger motivator for a Muslim mind, instead of his monetary concerns which he has recorded on a piece of paper. A Muslim trader therefore would worry about the social and environmental impact of his business practices, as

the return he is expected to get is not just monetary. A one-dimensional modern man may also worry about his social standing in the market; however, his social standing is perhaps only a means toward his economic gains. Social capital is a term used in this context in the relevant literature, where social relations are referred to as 'capital' because they are considered a means toward economic ends. For a Muslim the ends are not primarily economic, rather they are oriented toward his standing on the Day of Judgment, while for the economic gains, he relays on his Creator's promise to provide sustenance till his last breath.

12.4.5 The Urge to Maximize Rewards on the Day of Judgment

A higher focus on the mental accounting of good or bad deeds would make a Muslim less competitive or self-centric and more concerned about other's wellbeing, as taking care of all types of stakeholders would fill-in the good-deeds-accounting-ledger more. Thus, unlike the one-dimensional modern man, a Muslim's ultimate goal cannot be to maximize material wealth while competing with others. In surah *Takasur,* chapter 102 of the Holy Quran, also specifically warns against competitive pursuit of material wealth, as such indulgence may distract a Muslim from performing good deeds and may lead him into the hellfire on the Day of Judgment. On the other hand, Islam also discourages monasticism. Muslims are encouraged to pray for a material life free of misery also in the Holy Quran.

> Our Lord, give us in this world [that which is] good and in the Hereafter [that which is] good and protect us from the punishment of the Fire. (2:201)

Therefore, a Muslim has to take a balanced approach to ensure enough records in the good-deeds-accounting-ledger, to become successful on the Day of Judgment. Often miseries in the material world make it challenging for a Muslim to keep his spiritual orientation intact. Prophet (peace be upon him) once said that poverty can also lead to apostasy.[14] This is perhaps because of the hopelessness which a poor person can fell into, compared to a person who is not poor. In this context, material wellbeing is to be seen only as a means toward success on the Day of Judgment.

Material wellbeing is also a means to live a life of service to others in an Islamic paradigm, which is difficult for a poor person. A Muslim in all his roles is supposed to take care of every stakeholder to the extent possible. It is an impossibility that an ideal Muslim would even think of exploiting a person or a natural resource for his advantage while leaving them worse off. Any practice which can be socio-emotionally, economically, environmentally (or in any other sense) damaging for others, is out of the question simply because it will reduce the likelihood of a Muslim to find success on the Day of Judgment. The design of life support systems, which include the system

[14] Sunan an-Nasa'i 50:29.

of production and consumption in a Muslim society, therefore must conform to the criteria of ensuring the wellbeing of all stakeholders.

12.4.6 The Design of the System of Production and Consumption

Islamic paradigm, as discussed above, can lead to the creation of a responsible system of production and consumption. The system would be concerned about the wellbeing of the customers, employees, the local environment, and all other stakeholders. The circle of concern extends from the closest to the furthest. A Muslim is concerned first about his family, then his relatives, neighborhood, community, society, the Muslim world, and finally the entire world including all sentinel beings. Therefore, the system of production and consumption would take care of the needs of stakeholders from the closest to the furthest.

History of Islamic bazaars provides a clear picture of the system where a family-based guild is involved in the manufacturing and sale of items for the customers in the neighborhood and the community. The employees in the guild are mostly family members or relatives, while the suppliers are also of local origin. In case if the raw material is not available in the proximity, it is then sourced from distant places. It may be argued that due to the lack of railroad technology and heavy transportation like in modern times, commodities never went too far. This is contrary to the available evidence as there were merchants who would want to export items to faraway places while bringing in stuff from distant lands. However such merchants were typically despised by the local craftsman and traders (Yi, 2004). Production was typically localized, while limited availability of resources in the local natural world, often forced locals to avoid waste, and put all available materials to best possible use (Yi, 2004).

Islam's paradigm, if used as a master template, can be used to design a localized circular economy, where the needs of every individual are taken care of while the wellbeing of the natural world is also ensured. In Islam's paradigm, the subjective cost (outcomes on the Day of Judgment) of unjust exploitation of any resource is simply unaffordable for a Muslim. Wastage of any resource is also a sin (Quran 17:27), so the minimum most quantities of resources are to be used while producing the desired products, while making sure waste, if any, is recycled.

There is also an emphasis on preferring local customers over distant ones. In this context, the emergence of a globalized system of production and consumption would not fit well within the Islamic paradigm. There would be a case of exporting the surplus after all the local demands are fulfilled. The surplus would however be exported, if the means permit, to places where the products are needed the most, as compared to places where the sale would yield the most amount of profits within the Muslim world, and then the world beyond. The returns on the Day of Judgment are far more important than worldly profits. The use of non-renewable resources would

be discouraged to the extent possible, while renewables, recyclables, biodegradables will be preferred. The organization of a localized supply chain would also cut emissions from the transportation of products to distant places, which now comprise of around 7% of total annual emissions in the world.[15] Finally, it is also possible to see the socio-emotional and environmental impact of one's business decisions more directly if all the stakeholders (customers, employees, suppliers, etc.) are local than global, who in case of the global supply chain becomes invisible.

The ideal consumer in an Islamic society would also be inspired by the humble traditions of Prophet (peace be upon him) and his companions (peace be upon them). Quran also clearly instructs to keep away from the life of extravagance (*tabzeer*) and discourage from spending beyond means (*israf*). A culture of conspicuous consumption, therefore, is unthinkable in such a social order were *takasur* is specifically discouraged in the holy Quran. If Muslims pay heed to this advice, a race to maximize consumptions as encouraged by the modern free-market system would perhaps not exist in the Muslim world.

The modern trends of Minimalism or Zero Waste lifestyle would be perhaps naturally compatible with the culture of Muslim society, in fact keeping the consumption standards to a bare minimum to save the environment would also find spiritual motivation as well in Islam's paradigm. To harm the natural world for the sake of unnecessary pleasures (*tabzeer*) would be a greater sin than extravagance which is harmless to the environment. An ideal Muslim consumer would, therefore, prefer a local circular economy in comparison for a global one, if all his needs are met locally.

Figure 12.1 is from the author's previous study. In the Fig. 12.1 Islam's paradigm has been referred to as Meta-economic ideas. The current paper provides a thorougher description of the Islamic paradigm, articulated in the context of one's impact on climate change. Table 12.1 briefly compares the layers of the two systems.

12.5 Conclusion

This study used the Hollingsworth framework to excavate the roots of the modern system at its axiomatic foundations to analyze the depths of the root cause of the contemporary climate crisis. The analysis revealed how the ontological and epistemological disposition of the modern free-market society creates a system where risks are externalized for others to manage. Often the multidimensionality and circularity of these risks become invisible due to the reasons explained in Sect. 3, so it is unlikely for the system to acknowledge let alone effectively improvise to eliminate the risks like climate crisis. In the modern paradigm responsibility of every individual or a corporation has an epistemological limitation which is often legally acknowledged as well. Externalization of risks, particularly when its economic value is difficult to ascertain, is also legal and considered as a standard practice particularly in the

[15] See International Transport Forum (2021). The Carbon Footprint of Global Trade. Retrieved 31 March 2021, from https://www.itf-oecd.org/sites/default/files/docs/cop-pdf-06.pdf.

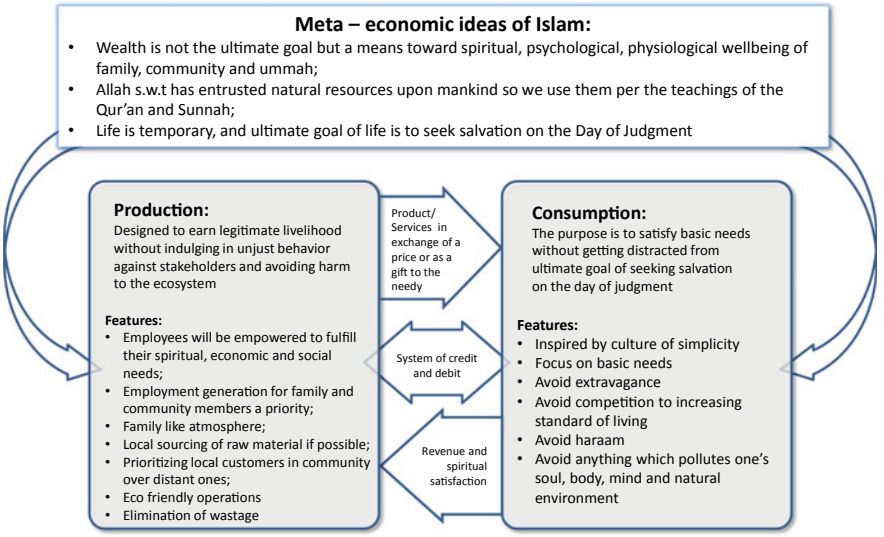

Fig. 12.1 Islamic system of production and consumption. *Source* Adopted from Javaid (2019)

Table 12.1 Table one shows a comparison between the two systems built on two unique paradigms

Layer 1	The global system of production and consumption	Localized-circular system of production and consumption
Layer 2	Maximization of profits which encourages going global	Maximization of rewards on the Day of Judgment by serving the local stakeholders
Layer 3	Accounting of loss or profits purely in quantitative monetary term	Accounting of rewards and sins through subjective evaluation of deeds, while ensuring the financial sustainability of the business
Layer 4 & 5	A linear one-dimensional idea of exchange which hides the losses that cannot be calculated easily or whose effect will not be felt in the short run	A circular and multi-dimensional idea of exchange, as even words, acts of kindness, etc. can result in a return in a variety of ways as promised by Allah s.w.t
Layer 5	Compartmentalization of knowledge in specializations which are seldom connected, but compete more often, does not allow development of a holistic understanding of all aspects of life and the natural world	A unifying source of knowledge that synergizes all aspects of life into a single whole while creating an interdependent relationship between every role a person plays in his life

marketplace. The inability to assume responsibility for the risks produced for society and the natural world is the typical behavior of a one-dimensional modern man or a corporation. This behavior is grounded in the ontological and epistemological disposition of the advanced industrial society.

On the contrary, Islam's ontological and epistemological position does the very opposite, as every person is deemed responsible for the impact he or she creates in the world around them. Islam's paradigm acknowledges the multidimensionality and circularity of risks produced as a result of every action. Islam's paradigm also encourages every individual to assume responsibility for the consequences of every interaction he or she makes with every stakeholder in the system, even if the interaction is non-economic. A system of production and consumption grounded in Islam's paradigm, therefore, pose a better hope to mitigate the climate crisis as compared to its modern counterpart. The crisis cannot be solved by the type of thinking responsible for the crisis itself (adapting Einstein's quote), therefore, a paradigm, which assumes the responsibility of an individual's action on all stakeholder, who are connected in a multidimensional circular relationship, is perhaps the only hope for the humanity.

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Part III
Circular Economy Innovations—Case Studies

Chapter 13
Zero Waste Cities in the Developing World: A Comparative Study

M. Evren Tok, Cristina D'Alessandro, Adenike Akinsemolu, and Bayan Khaled

Abstract Currently, our consumption-driven society contributes to the production of a large quantity of waste every day in urban environments. Low recycling rates pressurize city authorities to handle waste more sustainably. Despite this pressure, waste management systems have paid little attention to the urban planning processes, compared to other sectors like energy or water. Consequently, there are perceptible significant gaps regarding waste management, and therefore, strategic waste management and an overly sustainable consumption model are necessary, particularly in developing countries that are quite vulnerable to the vagaries of climate change. This chapter presents a detailed comparison of waste management and zero waste attempts in Middle Eastern cities, notably Qatar, and in some contexts in sub-Saharan Africa, where interesting case studies may be found. Exploring these examples is instrumental to emphasize the challenges and opportunities in the Middle East and sub-Saharan Africa, thus, to offer insights on the role of zero waste, as part of a circular economy in the achievement of the sustainable development goals in developing countries. This chapter would also contribute to investigate the relationship between localization and zero waste strategies, henceforth how localization plays a key role in circular economy.

13.1 Introduction: Circular Economy and Zero Waste

During the last 150 years, from the advent of the first industrial revolution, a linear industrial model has dominated the economic production and consumption. According to this model, goods are manufactured from raw materials, getting into the

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market, being used and then discarded as waste or incinerated (Geissdoerfer et al., 2017). The global demographic growth and its associated adverse effects (including food, water security and increased pressure on natural resources) have made clear that the idea of a 'business as usual' mentality is no longer tenable for a sustainable future. On the other hand, the circular economy model and theory has been developing since the 1970s, shifting from the current linear to a circular model has increasingly gained attention, not only from scholars, but also from policymakers (Murray et al., 2017). In addition, various benefits have been identified in regards to a circular economy. The increased awareness of a circular economic model made numerous public and private organizations and stakeholders willing to leverage the benefits accrued from this concept as a potential revenue opportunity. Due to the growing interest in the opportunities that a circular economy creates, there has been a surge in the number of governments and companies that use this model in their systems and processes. Thus, understanding these opportunities is critical for Africa and the Middle East that are grappling with waste and unsustainable consumption, while trying to follow the path of sustainable development. The knowledge obtained could be used to predict suitable future trends and develop proactive mechanisms that enable the Middle East, and particularly Qatar, to embrace a zero-waste strategy.

Numerous studies have been conducted on the concept of circular economy. Despite this large literature, there is lack of consensus on a standard definition, unlike the concept of sustainable development that's definition was settled in 1987 by the Brundtland Commission in a report dubbed *Our Common Future*. One of the latest studies conducted by Murray et al. (2017) states that the circular economy is one of the latest attempts to understand how to integrate economic growth and environmental sustainability. Tracing conceptualizations as well as the origin of the concept, the authors established that the concept emphasizes economic process redesign and a material cycling that could lead to a more sustainable model, it also brings about limitations and tensions. They include the lack of a social sphere that is part of sustainable development, thus impeding its ethical dimensions. Consequently, Murray et al. (2017) defines the circular economy as follows: "an economic model wherein planning, resourcing, procurement, production, and reprocessing are designed and managed, as both process and output, to maximize ecosystem functioning and human well-being."

Drawing insights from the above definition, this article defines a circular economy as an alternative to the traditional linear economy that entails generating and managing waste. This concept seeks to minimize waste, recover resources when the life of a product ends, and re-channel it into production, thereby substantially lowering the pressure exerted on the environment and its carrying capacity. Today, a large part of the global economic system is linear (Yuan et al., 2006) because people extract resources, transform them into products using energy, money, and labor and, after using them for a certain time, people throw the products away. Every time a crafted and manufactured product gets to a landfill, we lose its constituent physical resources, the energy and time that has been used to produce it.

Apart from the creation of new growth opportunities, the importance of a circular economy reduces waste produces new competitive opportunities, positions countries

and regions to try to tackle the increasing resource scarcity, contributes to more resource productivity, and minimizes the environmental effects associated with our consumption (Yuan et al., 2006).

The concept of zero waste is closely related in ideological terms to the circular economy concept. The zero-waste approach is a people-centered solution to the waste problem. It is an approach that seeks to guide the use of resources and ensures that there is resource recovery, efficiency as well as protection of the finite natural resources. The circular economy includes innovation in the design and manufacturing of products to direct back to the production process materials that were previously considered as waste as much as possible (Frosch & Gallopoulos, 1989). The zero-waste concept has also increasingly gained traction because of the unsustainability of the linear system that places emphasis on resource extraction, while overlooking the undue pressure exerted on the environment. Henceforth, zero waste could be considered as a useful instrument to achieve a circular economy. As the population increases in Africa, in the Middle East, and more generally in the world and as incomes rise and nations try to alleviate poverty, there will be more demand for services and goods. The linear model makes it challenging to achieve Sustainable Development Goal (SDG) 12. The goal, calling for a responsible production and consumption, requires that societies change the linear model of production. Thus, the circular economy/zero waste concept and practice warrants close attention because of its potential to open up new opportunities for the creation of employment, to mitigate climate change and minimize the cost associated with cleaning and recovering in developing states (which remain quite fragile to climate change vagaries). In this regard, there is a need to explore the underlying principles, concepts/ideas of zero waste cities.

13.2 The Fundamentals of Zero Waste Cities

Zero waste implies the development of new living models to reduce what is trashed in the landfills as well as incinerators to zero. At the most basic level, it involves reducing and ultimately eliminating the number of resources disposed (Zaman & Lehmann, 2011). A large proportion of what is dubbed as waste today can be economically and safely reused, recycled, or composted. Zero waste further involves respecting communities to ensure that pollution and facilities for treating waste are not concentrated in marginalized and vulnerable communities (Song et al., 2015). It revolves around inclusion to enable the many people globally earning a living through the collection and sale of discarded materials to live a dignified life and to increase their number, as business opportunities emerge in this domain. The other fundamental aspect about zero waste is that it entails allocating money to sustainable solutions, providing support to local governments and fighting corruption (Binnemans et al., 2015). It also focuses on democracy, education, community mobilization to enable all citizens to take part in the local resource conservation and management plans in order to distribute the funding in a fair way and for all manufacturers and businesses

to understand as well as fulfill their roles in waste reduction and design of products for cities of the future.

Effective zero waste management programs also involve people from diversified life horizons. People collaborate to come up with these programs, embrace resolutions, and develop innovative plans for reducing injustice and waste. Leaders model sustainability and efficiency through the creation of well-remunerated jobs in industries (Zaman, 2015). Various cities have recognized that our water, soil, and air do not necessarily have to be contaminated or polluted, and there is no need for people to trash natural resources. Nizar et al. (2018) contend that landfill garbage disposal leads to the wastage of finite natural resources.

Despite regional and local differences, at the global scale, cities are spatially and demographically growing and most of the global population lives nowadays in urban areas. Henceforth, it is crucial to tackle the problem of sustainable waste management in urban areas, where the space is limited and the population is concentrated, producing large amount of waste that it is nowadays difficult to handle. Defining zero waste as an idea of waste management in the upstream to reduce the waste that people dump into a landfill, the authors argue that various cities globally have been successful in applying this concept and illustrated that it could be beneficial for saving the finite natural resources. The study provides insights on the most fundamental principles in zero waste cities: waste avoidance and separation, pay as you throw scheme, community recycling, extended producer responsibility, and incentives and disincentives (Nizar et al., 2018).

The extended producer responsibility principle suggests that it is the responsibility of producers to manage all the waste that they generate through a continuous program. Various cities have begun incorporating this policy into their plans and programs to ensure that they reduce the quantity of waste generated through prudent management (Nicol & Thompson, 2007). As such, factories and distributors in cities are charged certain fees. Zero waste cities emphasize the need to assist and encourage local businesses to ensure that they take back products. This financially incentivizes producers to redesign products to make them less toxic as well as easier to recycle and reuse. These cities require that packages and products that cities cannot reuse, recycle, or compost have to be taken back where they were sold (Zaman, 2015). The extended producer's responsibility principle ensures that producers do not export harm to other areas.

The 'pay as you throw' or 'polluter pays' principle was first coined in 1974 by the Organization for Economic Co-operation and Development (OECD). The main idea behind this principle is that a person who takes part in a pollution activity should be held responsible for prevention costs or costs associated with any pollution rather than the same being passed to others. This means that the polluter bears the expenses associated with pollution prevention as well as control measures to ensure that the environment has an acceptable state. It is incorporated in the 1992 Rio Declaration on Environment and Development, which states that national authorities need to strive to foster the globalization of environmental costs and deploy economic instruments, considering that the polluter must bear pollution costs (Lu et al., 2015). For example, in South Africa, the National Environmental Management Act (NEMA), passed in

2009 and revised in 2016, recognizes that related to the remedy of pollution as well as indirect adverse health impacts should be paid by people who cause the harm. The basis for the principle is that people/stakeholders who cause pollution in cities should bear the costs, thus giving them a compensatory or reactive and proactive role (Li et al., 2018). The principle can be pursued to minimize inefficient economic externalities since costs are transferred from the consumer to the producer.

The precautionary principle, applying to every environmental issue and risk, involves the application of preventive measures during scientific uncertainties, whereby an action may harm the environment. Simply put, in case of threats or risks that may cause irreversible damages to the environment, the lack of full scientific information on certainty should call for a precautionary postponement or blockade of processes or experiments for preventing environmental degradation (Franco-García et al., 2019). The principle is based on the need to appreciate the harm that may be irreversible, thus making it more beneficial to avoid instead of handling later remedy. Pauli (2017) contends that this is because a later action could be either too costly or impossible. Therefore, cities should embrace a cautious approach that considers the limits of current information.

In the Rio Declaration, the preventive principle requires preventive measures to be taken to anticipate and avoid environmental damage before it happens. It is beneficial for preventing environmental harm in cities as a viable option to remedying (Pauli, 2017). According to the principle, environmental degradation should be prevented or avoided.

According to the principle of sustainability, the World Commission on Environment and Development of 1987 defines sustainable development as the development that caters for the needs of the present generation without compromising the capacity of future generations to meet their needs (Zaman, 2015). The primary focus of sustainability under this report, for cities, is that they should improve natural resource use beyond the ability of the environment to provide them indefinitely. Thus, sustainability means short-term and long-term equity.

Nevertheless, cities tend to be quite dynamic, and they amalgamate a plethora of complex spheres, activities, and interests. In addition, cities in a given region may differ from others because of different environmental and geographical factors. As such, it is quite challenging to understand the interconnexion and dynamics of factors in city development and to align them with environmental protection standards and sustainable development principles. Additionally, the complexity associated with the design of zero waste cities is also dynamic. Zaman and Lehmann (2011) identified five major aspects that they consider as significant for the transformation of cities to become zero waste cities. The authors believe that the strategies, techniques, or tools developed for waste management in zero waste cities need to be affordable. Also, they believe that all waste aspects need to resonate with the ideals of environmental sustainability. Referring to them as inter-connected principles, Zaman and Lehmann (2011) believed that they should be applied to transform cities into zero waste cities. These principles involve sustainable consumption and change in behavior, extended consumer, and producer responsibility, recycling of all municipal solid waste, zero incineration, and landfills and a 100 percent waste recovery. The study affirms that

these five principles are significant for transforming cities and should be applied to get tangible results. They are developed based on waste hierarchy, including avoidance, minimization, and recovery (Zaman, 2015). Thus, the idea of zero waste cities provides a crucial background for meeting the SDGs and ensuring that the quantity of waste generated is as low as possible.

13.3 The Evolution of Zero Waste Cities

Current waste management systems were conceived before the advent of sustainable development, in the context of the first industrial revolution, within a linear economic development. Over time, various innovations including composting, recycling, landfill along other advanced treatment methods have been rolled out. Zaman and Lehmann (2014) argue that, in this century, zero waste is among the most holistic innovations because of the actualization of sustainable waste management systems. The term 'zero waste' was first used in 1973 for the recovery of resources from chemicals (Palmer, 2004). Despite this first use, the concept became popular only in the late 1990s. Nowadays, various organizations globally embraced the idea of zero waste, thus setting a goal of zero disposal of waste to landfills. The community consultation process held in Australia led to the development of this radical idea. The first bill advocating for 'no waste' was enacted and adopted by the city of Canberra in 1995 (Connett, 2013). In 1997, the enactment of the Zero-Waste New Zealand Trust, providing support to waste minimization, led to the zero-waste movement. According to Tennant-Wood (2003), this trust advocated for the creation of a closed loop materials economy whereby reuse, repair, and recycling of materials would occur to reduce and eventually move away from waste. Three years later, Connett (2013) contends that the State of California developed the first comprehensive plan on zero waste, and its California Integrated Waste Management Board adopted zero waste targets in 2001 as part of its strategic plan. According to Tennant Wood (2003), the Zero Waste New Zealand Trust then developed the definition of zero waste in 2002 as follows:

> a new goal that seeks to redesign the way resources and materials flow through society taking a 'whole system' approach. It is both an 'end of pipe' solution that maximizes recycling and waste minimization and a design principle which ensures that products are made to be reused, repaired, or recycled back into nature or the marketplace. Zero Waste envisions the complete redesign of the industrial system so that we no longer view nature as an endless supply of materials.

The first working conception of zero waste was provided by the Zero Waste International Alliance in 2004, which defined it as an objective that is visionary, economically sound, ethical as well as efficient for guiding people to change their practices and lifestyles to emulate the sustainable natural cycle that is designed in such a way that discarded materials become resources that can be used by others. The report further stated that zero waste implies the design and management of products and processes for systematically avoiding and eliminating the toxicity and volume

of materials and waste, conserve as well as recover all the resources. Other cities that wish to attain holistic zero waste targets have embraced and used the working definition. According to the San Francisco's Department of the Environment, zero waste entails ensuring that nothing gets to the landfill or incinerated. In England, it is defined as a fundamental way of minimizing the environmental effect of waste. Phillips et al. (2011) contend that it is a visionary objective that seeks to deter waste from being generated, protects resources, and facilitates recovery of value from the materials.

Various major innovations have taken place in waste management. The following significant phases can be identified as important for the zero-waste movement. The first phase is open dumping that still exists in various low-income nations, while the second wave was characterized by uncontrolled landfill. The third wave is the one predominantly used in China called waste composting. The fourth wave entails recycling along with the controlled landfill. The fifth wave occurred in the twentieth century and involved technologies like plasma arc, incineration, advanced recycling, and anaerobic digestion. The sixth wave is zero waste and has been heralded as the most holistic to-date for attaining a genuine sense of sustainable waste (Hannon & Zaman, 2018). Today, numerous cities are planned and designed based on the ideal of an eco-city to ensure a high quality of life to residents. Accomplished eco-city projects, including Masdar City in the United Arab Emirates, Vauban in Germany, and China's Tianjin Eco-City are designed to provide a high quality of life.

13.4 Zero Waste Case Studies in Sub-Saharan Africa

In Sub-Saharan Africa, various countries have begun embracing zero waste principles and ideas. Although they may not be as advanced as in some Western states, significant progress has been made in this region that can provide insights for Qatar and the rest of the Middle East. One of the most renowned programs is the one designed by the Green Campus Initiative and called Trash for Education. The program is instrumental for eliminating waste through appropriate collection, sorting, trading, recycling, and reusing. It rewards people with formal education, vocational training, and education materials for trading their valuable wastes or any other unused materials (Green Campus Initiative, 2018). In addition, the program has been instrumental for creating value for the participants via revenues obtained from recycling and reusing. The process entails a chain that starts with the collection and submission of waste by participants, then the utilization of credits for funding the participant's educational needs. Apart from providing education, the initiative seeks to use the platform to create employment as well as train individuals on the management of waste. People can learn about the zero waste objectives through the program since they are motivated to engage in green environmental behaviors, and they can get rid of trash that harms people and the environment. Implemented by the Nigerian Green Institute, this scheme emphasizes the critical role of education, but also the crucial importance

of localized processes in local municipal environments, developing desirable values and benefits for a given local community.

The other case study is the Ondo State Integrated Waste Recycling and Treatment Project that emerged in 2006 (Olanrewaju & Ilemobade, 2009). The project sought to reduce solid waste within Akure and its surroundings, in the Ondo state, in Nigeria. Since it started, it has achieved great success in the transformation of the waste generated within the Ondo State to wealth through the development of an array of beneficial products using basic sustainability concepts including environmental protection, social progression, and technological enhancements. Various techniques are used for transforming the waste into profitable commodities including the use of biogas for production of fertilizer and energy. Learning from this experience indicates that awareness and education on waste and sustainable development is the necessary prerequisite for the success of this initiative and that increasing public awareness and willingness to change waste habits.

In South Africa, the Department of Environmental Affairs and Tourism initiated the idea of the waste hierarchy, including reducing, reusing, recovering, and disposing of as the only way toward sustainable development. The scheme extended into the Polokwane Declaration that identified zero waste as the eventual objective for the country's sustainable waste management system. Integrated waste management has been incorporated in the zero-waste system, thus contributing to waste minimization as well as the at-source separation of recyclables to bring down the quantity of waste that needs to be disposed of. *GezaKapa* (Clean Cape) is among the zero waste case studies in Cape Town, South Africa, seeking to create a green environment. Established in December 2016, the firm aims to encourage recycling in some parts of Cape Town where there are no recycling opportunities provided by the council (Collins, 2017). According to Ashley Epstein, one of the co-founders, the ultimate aim of the project is to foster the creation of similar forms of drop-off centers around the city, and they hope to have at least 10 more depots in the next two years (Collins, 2017). They seek to divert sufficient waste from landfills and prevent planetary degradation. The program claims that it has been able to raise more awareness regarding waste among the populace while creating an impact regarding where the waste goes. From a household point of view, the venture mainly deals with recycling to ensure that organic waste and other inorganic waste can be converted into compost or recycled.

In Mauritius, Nineteen Fifty Design and Print Co Ltd. (1950) is one of the major examples that showcase the prudent management of waste. The company focuses on sustainable one-off printing and has incorporated new environmental initiatives, which upcycle non-renewable PVC materials to minimize advertising waste that finds its way in landfills. This is the basis of the Sakili project, which makes bags from textile and advertising waste. Started in 2017, the brand considers its environmental effects. Typically, after conducting an advertising campaign, the billboard materials are not reused, and since they are made of thick PVC material, they produce waste, as they are non-biodegradable. To avert this, up-cycled bags allow the materials to have another lifecycle and continue being used by consumers in another way. The venture remains focused on ensuring that its operations have the least effect on the

environment, as it believes that environmental protection is a future investment in the country's development.

Finally, the Green Egypt Initiative is one of the most revolutionary zero waste efforts. To provide support to the SDGs, it is stepping up efforts that minimize its carbon footprint. The initiative is in tandem with environmental sustainability efforts as it seeks to ensure that there is a 50% reduction in the utilization of printed-paper, elimination of disposable plastic cups, introduction of recycling in liaison with the local actors, and assessment of environmental sustainability of the new initiatives. It has been quite instrumental for the recycling and reuse of office waste.

Mr. Green Africa is a very innovative initiative founded in Nairobi, Kenya with the idea that the future of waste can be changed alleviating the marginalization of informal waste pickers. This human-centered business model is based on strong relationships with informal waste pickers, giving them access to fair and stable prices for their work. This is made possible only through a localized process, responding to local needs and realities with adapted solutions.

With such initiatives in Sub-Saharan Africa, it is worth noting that countries in the region are making quick steps in the right direction in terms of waste management. Furthermore, the solutions they showcase are different, according to the variety of realities, needs, and scopes of initiatives, but sustainable development through zero waste is the common driver.

13.5 Zero Waste in the Middle East

Due to rapidly growing populations and economic activity, Middle Eastern countries produce ever-growing amount of waste in all different forms such as solid waste, used plastic, etc. (King, 2019). Coupled with the lack of strong regulations or any publicly led initiative, the majority of this waste has been dumped to the landfill, or worse, to rivers and seas, especially in poor Middle Eastern countries. Lack of previous experience in dealing with such high amounts of various waste forms and limited technological expertise only exacerbate the problem (Zafar, 2019). According to World Bank estimates, the Middle East region will record the second highest growth in the total waste generation per year from 2016 to 2050 and only second to sub-Saharan Africa (World Bank, 2019) (Fig. 13.1).

Considering the harmful effects of untreated and poorly managed waste to the air, soil and seas of the Middle East, there is growing awareness in the whole region and especially in relatively wealthy and more waste producing Arabian Gulf regions (Al-Maaded et al., 2012). Coupled with the urgency of climate change and rapid environmental degradation of the Middle East, countries in the region have started to look at waste, first, as a problem then as an economic opportunity (Zafar, 2019).

Zero-waste cities are set in place to eliminate all kinds of waste and increase the environmental quality and living standards as a response to the challenges mentioned above (Zaman & Lehmann, 2013). Starting with the inauguration of Masdar City in 2006 in the United Arab Emirates, there has been a growing interest in the Middle

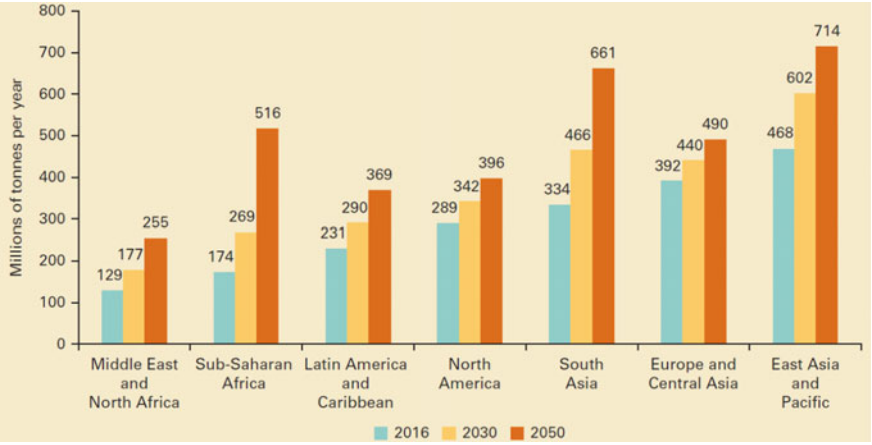

Fig. 13.1 Projected waste generation by region. *Source* Adopted from World Bank (2019)

East in eliminating harmful effects of all kinds of waste (Reiche, 2010). Oil and gas rich Arabian Peninsula states of the Middle East, particularly, are spearheading these kinds of initiatives for two specific reasons. These states are between the highest energy consumer and waste producer per capita in the world, which affect their habitat significantly (Reiche, 2010). They also have access to large capital that is helpful for the initiatives to reduce all kinds of waste and lessen their negative impact on the environment.

For example, Qatar is striving to eliminate waste of all kinds produced in the country by supporting various initiatives financially and logistically (Clarke et al., 2017). Elite Paper Recycling is a company aimed at recycling all the used paper in Qatar by working with numerous stakeholders and collecting used paper with more than 2,500 dumpsters located inside the country and carried by more than 100 trucks to the recycling center. Mesaieed Integrated Domestic Solid Waste Management Centre is located in the largest industrial area of Qatar and recycles all its intakes either into reusable products or into energy. Another waste recycling company is called Al Haya Enviro, which specializes in technological waste recycling (computers, phones, electrical accessories, printers, copiers and ink cartridges), hazardous waste recycling, office waste management, used oil recycling, hydrocarbon recovery, and waste to compost services, marine services and water treatment chemical distribution in Qatar. Other notable companies in the country regarding waste recycling are Averda Qatar, Al Hodaifi Group, Al Suwaidi Paper Recycling Company, Twyla Recycling and Boom Waste Treatment Company.

Among the prime examples of such initiatives, Masdar City has been at the forefront in terms of applying renewable energy for its electricity use, building highly insulated buildings to lessen energy consumption overall, and the use of recycled materials as much as possible (Reiche, 2010). The city also strives to recycle all of its waste such as paper materials, plastics or municipal waste like sewage (Cugurullo,

2013). Another example from the UAE is the Bee'ah initiative by the Municipality of the Sharjah Emirate, where they turn biomass waste into energy, distribute recycling bins throughout the whole city along with continuous research into further utilization of all waste types. Ibn Sarhan United Projects is an Omani waste recycling company specialized in the highest recovery of used plastic, paper, metals, and glass both in Oman and in Saudi Arabia through their subsidiary.

13.6 Lessons from Africa and the Middle East: The Zero Waste Cities Model

The examples and insights presented above emphasize lessons to learn from them, as well as differences and commonalities. They indicate that developing countries may move fast and effectively toward zero waste cities. Rich oil and gas producer states in the Middle Eastern may have financial facilities, but they are also confronted to budget constraints and face other difficulties.

The variety of examples showcase in fact the common *Zero Waste Cities Model* in Fig. 13.2. Although they can focus on different domains, such as education, employment, technological enhancement, renewable energy, etc., they all create social values like awareness, creativity, and commitment to zero waste and they build capacities in relevant domains to zero waste including managerial capacities, recycling capacities, etc. In the end, it is important to notice that zero waste case studies are based on the creation of enterprises that are both, by definition, green and social enterprises. These diverse zero waste companies have a few common goals and results. They all are "localized" initiatives, meaning they respond to and are adapted to specific local needs and aspirations. For instance, valuing and improving the status of informal jobs

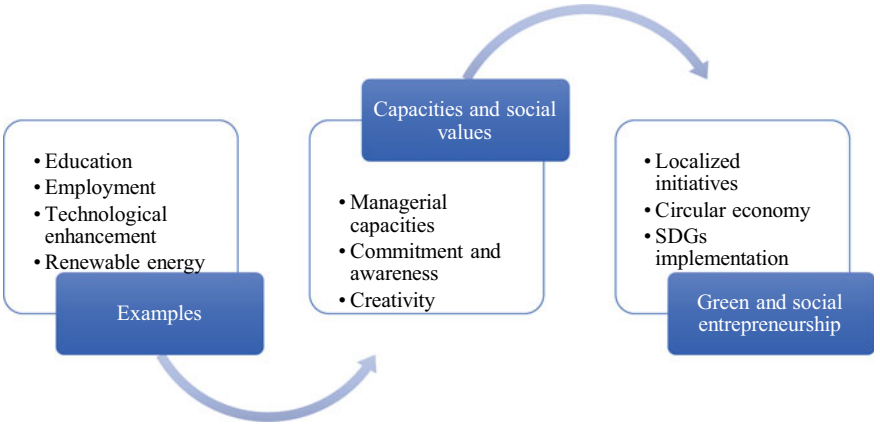

Fig. 13.2 The zero waste cities model

in African contexts. Furthermore, they directly or indirectly contribute to the production of more circular economies in the countries in which they take place. Finally, by improving environmental standards and the quality of life, they contribute to achieving the SDGs and enhancing sustainable development.

In the Middle East, zero waste cities private initiatives may face specific regulatory hurdles like governance problems and limited bureaucratic performance (Heydemann & Leenders, 2014), which may delay or prevent initiatives pursued by private entities. Nevertheless, entrepreneurship is at the core of the zero waste cities model.

To conclude, the circular economy is critical in preserving the environment and achieving the SDGs, as well as creating economic benefits, such as employment, to the society. This is an especially hard-pressing issue in developing countries plagued by environmental catastrophe. It is, nevertheless, a critical issue for Middle Eastern countries confronted to climate change effects and to possible future disruptive consequences related to increasing temperatures and sea level rise, especially in relation to food and water security.

The target of zero waste and its close connection to the circular economy and to sustainable development must bring the issue of the efficient use of resources to the center of attention, along with handling waste in the post-usage stage.

13.7 Challenges and Opportunities in Africa and the Middle East

13.7.1 Challenges

Designing sustainable cities in Africa is quite difficult, as waste management remains one of the most critical challenges for designing sustainable cities. Both international economic growth as well as consumption rates have increased substantially around the world. The trends of waste generation illustrate that the reduction of waste volume is among the major challenges for cities. Whereas other cities have been successful in implementing various policies and methods for collecting 100% of the waste from the generation source, African cities are grappling with various challenges in terms of long-term sustainable resource recovery. Notwithstanding, incineration leads to the depletion of valuable resources like paper, plastic and various materials that may be reused and recycled. In countries with low levels of consumption, the waste volume is rising significantly parallel to the growth of the population. Resource consumption in Africa and the Middle East has been rising significantly during the last few decades, which illustrates rising waste generation rates within the low consuming cities. Thus, considering the context of low consumption among cities, whereby the level of consumption has been increasing, and the landfill acts as the major technology for waste treatment, waste management within cities is also quite difficult to manage sustainably (Hannon & Zaman, 2018). The international waste management, as well as finite resource scenario, will pose further hurdles for the

management when low consuming states attain the same rates of consumption like the high consuming nations.

Cities in the Middle East and Africa are quite dynamic and amalgamate various complex spheres. In addition, cities in the two regions are quite different from others because of environmental and geographical factors. Thus, it is difficult to comprehend the dynamism of factors that are involved in city development in the absence of holistic research approaches. The main issue is that the two regions are full of garbage that needs to be assorted and managed. For example, in Cairo, garbage has piled up on the streets, thus adversely impacting whole families and human health. It is notable that a healthy environment is needed to offer a good living standard to persons and individual governments. Making waste management commercially viable poses a great challenge (Hannon & Zaman, 2018). The main way of managing the challenge is converting garbage into a resource through intelligent ways as witnessed internationally in aluminum's case (a product with the capacity of being recycled 20 times). Today, recycled aluminum is being utilized more globally compared to virgin aluminum.

Solid waste management within the Middle East region is afflicted by waste management deficiencies, particularly issues about poor planning and legislation. Numerous nations do not have the appropriate legislative framework and regulations for dealing with waste. Some of the challenges experienced by countries in Africa and the Middle East in rolling out an integrated waste management are insufficient funds, lack of stakeholder coordination, absence of prudent waste management plans, inadequate operational and technical decision-making, and inadequate skilled manpower. State-owned corporations are the main custodians of waste management and deter private entrepreneurs and companies from participating in waste management initiatives. Despite Islam emphasizing on waste minimization, Arab states are among the highest per capita generators of waste. Because of inadequate garbage collection and waste disposal facilities, waste is dumped in the open spaces, deserts, and water bodies. The other crucial issue is the lack of awareness as well as public apathy toward source segregation, waste management and a waste reduction (Hannon & Zaman, 2018). For a waste management system to be sustainable, there is need for high level participation, sufficient funds, effective legislations as well as modern waste management technologies or practices. The Middle East can enhance waste management through the implementation of source-segregation, promoting private sector participation, using recycling and waste-to-energy systems in addition to coming up with a robust institutional and legislative framework.

The other major challenge is that wealthier nations have dumped a significant part of their electronic waste on the poorer African and Middle Eastern nations instead of appropriately disposing it themselves. Close to 500 shipping containers are dumped in Africa every month and the cumulative waste quantity dumped within Africa is close to about 50 million tons every day. Electronic waste also has high levels of dangerous chemical elements including lead and mercury that is poisonous to people and the environment. Lower rates of recycling in Africa and the Middle East are a common aspect of waste. Everett (2014) contends that Africa has generated more than 108 million metric tons, thus demonstrating that about 98 million tons of waste

found their way into landfills. The other finding was that about 10% of the trash produced in the continent was recycled. Installing a waste disposal system would lead to the loss of more than 100,000 jobs since this is the number of opportunities that have been created in the informal sector (Everett, 2014). The other challenge is that the two regions have some of the most wasteful countries including Morocco, Swaziland, Egypt, Algeria, and Botswana.

13.7.2 Opportunities

In the future, there is likelihood of smart African and Middle Eastern cities to achieve zero waste, improving services to citizens and reducing the operational costs of municipalities because of smarter and more efficient waste collection systems. The international technology revolution is transforming the way African and Middle Eastern countries think about waste management. The higher influx of people into the urban areas and higher consumption of products are some of the aspects that are spearheading the generation of waste across the globe. The high population growth and consumer demands call for a new integrated approach. Also, global shaping of technology implies that waste management systems and practices can be improved for consumers, service providers as well as governments. A vital facet of this revolution is ensuring that the poor and developing states also rely on the trends and changes in technology that are emerging within the waste management industry since population growth within these developing states, and particularly Africa, is the largest globally (Hoornweg et al., 2015). The Internet of Things can enable the Middle East and Africa to offer timeous, integrated, and sustainable solutions. The two regions are moving toward the creation of a circular economy for managing waste using technology. This includes a cradle-to-cradle approach and rethinking the way we can recycle and reuse products, materials, and components to minimize natural resource use.

13.8 Future Trends

In the future, smart cities in the two regions will embed connectivity, communication, and technology to share data that can aid with an array of waste management processes, including the routes followed by garbage disposal vehicles for waste collection and removal, along with automating operations. The data generated by this automated process could transmit information within real time to a control center for guiding drivers on the routes that will be taken, collection points, traffic situations, analytical information, and estimated collection time. After collection of the bins, information on the waste types can be analyzed to ascertain the bins, for instance, making it mandatory to go to the recycling centers or any appropriate disposal sites (Pietzsch et al., 2017). The information may then be utilized for informing clients and

providing customers with invoicing information simultaneously through the cloud. It is notable that this is already being experienced, albeit on smaller scales, in other world parts. African and Middle Eastern countries will follow suit.

Larger organizations will get on board and embrace the zero-waste lifestyle, including the use of zero waste stores and whole shopping centers in major cities of the regions to accommodate the rising trends of zero waste consumption, plastic-free and package-free trends. Also, leading multinational corporations in Africa will begin embracing the international shift toward sustainability. We will witness the emergence of leaders within the circular economy including consumer goods, furniture, and apparel. The other critical trend is that there will be more conversion of waste into energy (Pietzsch et al., 2017). Waste organizations will require business models that can generate profit, and conversion of waste into energy is one of the solutions. Whereas thermal technologies have spearheaded a larger proportion of the current trends in growth, a major breakthrough will be spurred by biological technologies. There will also be a change in public attitudes by 2030. For example, the adoption of smart measuring technology to charge consumers for waste they produce from food could alter public attitudes. Residents will be issued with cards that include a chip, which holds the address and name of the cardholder. They will have the ability to scan their identification card before disposing of their rubbish within smart bins.

13.9 Recommendations

African and Middle Eastern governments need to get into a partnership deal with the business sector, including a commitment by businesses to adhere to and/or promote the waste hierarchy as well as the need to emphasize on waste prevention and resource efficiency while dealing with their waste producer clients. There should also be discussions that look at issues like how to make decisions on the materials and products to target as priorities for preventing waste, mechanisms of extending re-use, repair and lease of business models. Some of the priorities for materials and products for the prevention of waste could be electronics and electrical equipment, food waste, packaging, and construction materials. Governments should develop the required recycling infrastructure and ensure that waste segregation at the source becomes compulsory (Khan & Zaman, 2018). Also, governments in the regions can help in increasing the ability of their population to take part in more green behavior through the promotion of recycling programs or providing incentives for producer of organic and ecological products. If recycling is managed appropriately, implemented correctly, and with stakeholder awareness, it would not remain a burden on recyclers.

Integrated waste management could provide a prudent and proactive solution to the future smart cities that seek to achieve the zero waste targets. To achieve this, these cities should focus on planning, data as well as integrated waste management. Understanding the quantity of waste generated and the places they are generated in could enable the local governments to allocate land and budget, assess the relevant technologies as well as factor in strategic partners for the provision of services

including the non-governmental organizations (NGOs) and private sector. With an emphasis on waste data, providing support to Middle Eastern and African states to make crucial solid waste management decisions important, various solutions could be handy. One of the solutions could be financing the countries that are in dire need, particularly the fastest growing nations, to develop ideal waste management systems, and supporting the major producers of waste to minimize the amount of litter released to marine bodies and plastics consumption through comprehensive recycling and waste reduction programs (Khan & Zaman, 2018). The other solution is reduction of food waste through organics management, consumer education as well as organized food waste management programs. There are numerous solutions available, and the most pertinent issue is urgent action at all societal levels.

13.10 Conclusion

Today, our consumption-driven society plays a detrimental role in the production of a large volume of waste everyday within urban environments. In addition, low rates of recycling impose pressure on cities to manage waste in a more sustainable way. Against this background, this chapter has critically explored the concept of zero waste in sub-Saharan Africa and the Middle East. The study has established that, despite the zero waste city concepts infiltrating the region, there is much that needs to be done to ensure the constituent states benefit from the concept. This will be prudent in the light of the unsustainable ecological footprint that is harming the regions. The various solutions available should be embraced by African and Middle Eastern countries to begin changing the appearance of their cities and the contribution that they have in the match toward future smart cities.

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Chapter 14
Solving the Problem of Water, Sanitation, and Hygiene in Nigeria Using Blended Finance

Mubarak Mohammed Kabir Musa, Jainaba Kolley, and Dalal Aassouli

Abstract This chapter proposes an Islamic blended finance structure for water and sanitation in Nigeria. The rising shortage of water, sanitation, and basic hygiene facilities pose a threat to the development of Nigeria and its people. A large segment of the Nigerian population in both the urban and rural communities lacks access to improved water and sanitation facilities. Open defecation is widespread in many parts of the country. These problems have had resultant social impacts in the form of out-of-school children, reduced productivity, cholera, and other water-borne diseases outbreaks. The government of Nigeria is committed to achieving access to water and sanitation for all by the year 2030 in line with the SDG initiative and the National Water Sector Road Map of 2010. However, a reduction in government revenues occasioned by falling oil prices and competition by other critical infrastructural needs has created a huge funding gap in the water and sanitation sector. The authors concluded that Islamic blended finance could help to bridge the financing gap in the WASH sector in Nigeria to achieve the sustainable development goals, national aspirations, and the higher objectives of Shariah.

14.1 Introduction

Lack of access to water, sanitation, and basic hygiene facilities poses a real threat to the development of Nigeria and its people. A large segment of the Nigerian population in both the urban and rural communities does not have access to improved water facilities. Open defecation is still widespread in many parts of the country, with less

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than a third of the population having improved sanitation facilities. These problems have had resultant social impacts in the form of out-of-school children, wasted man-hours and reduced productivity, cholera and other water-borne diseases outbreaks, frequent clashes between herdsmen and farmers, and so on. Although the government is committed to achieving access to water and sanitation for all by the year 2030 in line with the SDG initiative and the National Water and Sanitation Programme, a reduction in government revenues occasioned by falling oil prices and competition by other critical infrastructural needs has created a huge funding gap. The aim of this work is to analyze the problem and come up with innovative Shariah-compliant ways of addressing them, especially in the form of blended finance.

The study is organized as follows. The next section gives a brief literature review. This is followed by a discussion on the identified problem and the solution/value proposition. The financing structure is discussed in the following section along with the Shariah considerations, the underlying contracts, and legal and regulatory framework. The last section concludes and makes recommendations.

14.2 Background Literature

14.2.1 Water and Sanitation in Nigeria

There has been significant improvement globally in the population using safely managed services from 61% in 2000 to 71% in 2017, and about 435 million people globally rely on unimproved drinking water sources and 144 million still rely on surface water (Organization & Unicef, 2019). With a population of nearly 200 million people, Nigeria is the most populous African country and the seventh most populous in the world (World Population Review, 2019). It is also Africa's largest economy with a GDP of USD 397.27 Billion and a per capita income of USD 2,028.2 in 2018 (The World Bank 2020). Nigeria is a lower middle-income country having a low human development index of 0.34 and a life expectancy of 54 years (World Bank 2020). This is the lowest life expectancy in West Africa.

Nigeria has enough surface and groundwater to meet the total annual demand for water for its entire population. It has Total renewable water resources of 286.2 km^3/year amounting to 1 499 m^3/year per capital (FOA, 2017). Although endowed with abundant human and natural resources, its growth and development have been hampered by severe infrastructural deficit and lack of access to basic amenities. Access to potable water and sanitation facilities is a major challenge for a large section of the Nigerian population. Water-borne diseases are still a major cause of death particularly among infants and children less than five 17 percent of child immortality in Nigeria is caused by diarrhea and other diseases such as guinea worm, cholera and dysentery (Orimoloye et al., 2015). According to UNICEF's 2013 Levels and Trends in Child Mortality Report, infant and under-five mortality rates in Nigeria stood at alarming rates of 77.8 and 123.7 per 1,000 live births. Nigeria had witnessed

a significant improvement in access to water with 69% of the population now having access to improved water sources. Despite the improvement in access to water, the number of people with access to pipe water has regressed over the years. The country has not achieved any improvement in terms of sanitation (World Bank, 2017).

The three tiers of government are responsible for water and sanitation delivery in Nigeria. All the water resources in Nigeria belong to the Federal government, and the responsibility of building water treatment plants befalls on its shoulders (Abubakar, 2019). The Federal government through the Federal Ministry of Water Resources is responsible for formulating water policies and approving development projects (Henley, 2000). The State governments are entrusted with the responsibility of supplying water through state water boards or enterprise organizations or through a partnership with private sectors (Abubakar, 2019). The state water board is responsible for water production, distribution, maintenance, and billing services (Abubakar, 2019). Local governments are responsible for water and sanitation in their area but usually lack the required resources and skill to tackle the problem (Khemani, 2001). Other key stakeholders such as the international donor agencies and NGOs play important roles in water supply services in Nigeria. The Federal and State governments of Nigeria receive direct aids from the international donor agencies, while NGOs often engage in community-based water projects with the State governments (Abubakar, 2019).

Several efforts were made by past governments to address these challenges, but inadequate funding was always an issue. The dilapidated state of water and sanitation in Nigeria led the President of Nigeria Muhammadu Buhari in November 2018 to declare a national emergency on the state of emergency on Nigeria's water supply, sanitation, and hygiene sector. Nigeria aspires to achieve 100 percent coverage in both water and sanitation by 2030 in line with the SDG. The Water, Sanitation and Hygiene (WASH) sector in Nigeria is guided by the National Water Resources Policy, PEWASH Strategy (2016–2030) and the National Open Defecation Free Roadmap. The strategy aims to eliminate open defecation by 2025 and achieve universal access to basic water services and sanitation by 2030. To achieve this, about NGN 959 billion investment will be required to upgrade old water, sanitation, and hygiene (WASH) infrastructure and to build new ones (UNICEF 2016). Operating and maintaining these infrastructures will also come at significant costs. The aim of this work is to devise means by which financing can be raised to meet the water and sanitation needs of Nigeria especially in the face of dwindling revenues from oil and other competing budgetary expenditures. Addressing this problem will not only be meeting the SDG 6 of clean water and sanitation, but it will also indirectly address the issues of good health and well-being (SDG 3) and quality education (SDG 4). The methods of financing will aim to serve the purpose of making water, sanitation, and hygiene facilities available in a manner that is compliant with the Shariah and ensures sustainability.

14.2.2 Financing Water and Sanitation in Nigeria

The Nigerian Government is beginning to take the responsibility of providing adequate Water and Sanitation services more seriously after decades of indifference and negligence. Major Donors and NGOs have reacted to the change of the government's attitude by increasing their presence and contributions toward the WASH sector in the country. For example, WaterAid and the Nigerian Government in 2019 signed a Memorandum of Understanding (MOU) to provide technical assistance and capacity strengthening. Also, the USAID partnered with Nigeria's Taraba state in 2020 to improve the delivery of WASH services in the state.

The main sources of WASH financing in Nigeria consist of domestic public resources, official development assistance (ODA), and other official flows (OOFs) (Water Aid 2019). In 2018, the government and donors only spent around $393 million on WASH in the country. This level of public spending on WASH services is insufficient and is not remotely close to the amount the sector requires. The African Development Bank (AfDB) represents the major contributor to WASH ODA to Nigeria. The latest of these ODA from the AfDB is the $124.2 million loan to finance the Urban Water Sector Reform and Akure Water Supply and Sanitation Project in Nigeria. Other ODA financiers include the World Bank, France, and EU institutions. Concessional loans and grants are the two main modes of financing employed by these institutions. In recent years, we have seen the emergence of the Islamic Development Bank as a key provider of ODA financing to the Nigerian WASH sector. The bank provided the sum of $65 million toward the cost of Ilesa Integrated Water Supply and Sanitation Project using Istisna'a mode of financing (Islamic Development Bank). It also provided the sum of $81 million toward the cost of Zaria Water Supply Expansion Project in Kaduna State, Nigeria (Water Aid 2019).

14.3 Islamic Finance in Nigeria

Nigeria has seen the proliferation of Islamic finance in the country over the past decade. The industry is nascent and small but has a great potential of evolving in the years ahead. The total Islamic finance assets in the country is about USD 0.648 billion only (COMCEC, 2019). The country's Islamic banking sector has been able to maintain its share of total domestic banking assets which stood at 0.3% in 2018 (Islamic Financial Services Board 2019). The Nigerian Islamic Finance industry at the moment currently comprises two full-fledged Islamic banks (Jaiz Bank Plc and TAJ Bank Limited), two Islamic windows of conventional banks (Sterling Bank and Stanbic IBTC Bank), two full-fledged *takaful* companies (Jaiz Takaful, Noor Takaful), several issuances of sovereign Sukuk, and other capital market instruments (Mustapha et al., 2019). Through the Federal and State Government, Nigeria has been able to raise USD 289.33 million by issuing Sukuk which represents 0.56% of the global Sukuk issuance (COMCEC, 2019).

The Central Bank of Nigeria (CBN) has been the driving force behind the expansion and growth of the Islamic finance industry in Nigeria. In 1992, the Central Bank of Nigeria granted the defunct Habib Bank approval to operate an Islamic banking window in the country (Islamic Financial Services Board 2019). The CBN issued a Draft framework for the regulation and supervision of non-interest banks in Nigeria in 2009 as a response to the incessant demand for Islamic banking in Nigeria. Finally, in 2011, the Central Bank of Nigeria (CBN) released a framework for the regulation and supervision of non-interest banks. To further solidify its position as a major hub of Islamic Finance in Africa and enhance Islamic finance, the CBN joined several international Islamic finance and multilateral bodies such as IFSB and played a significant role in the creation of the Islamic Liquidity Management Corporation (IILM) (Bello & Abubakar, 2014).

The *takaful* industry has also witnessed significant growth after the National Insurance Commission, and the regulator of Nigerian insurance issued guidelines for *takaful* institutions in 2013. These guidelines spelt out the responsibilities and disclosure standards of *takaful* operators in the country. According to the guidelines, *takaful* operators can only use three Islamic models to conduct their operations which are *mudarabah*, *wakalah* and *wakalah-mudarabah* (Ismail, 2015). Prior to the issuance of the guidelines, *takaful* activities were very limited in Nigeria (Saleh, 2016). African Alliance Insurance Company Limited, Nigeria's oldest life insurance provider, was the first to introduce *takaful* to the Nigerian Market in 2003 (Yusuf, 2012). Niger Insurance Plc and Cornerstone Insurance Plc, two conventional insurance companies, followed suit by offering *takaful* in the country. All these companies were established conventional insurance providers operating a *takaful* window. They did not have separate offices for *takaful*, and the money of *takaful* was often comingled with that of conventional insurance. This was the case with all the *takaful* providers at the time apart from Cornerstone which had established a separate office for *takaful* and separated *takaful* funds from conventional insurance assets. Currently, there are five *takaful* operators, three *takaful* windows, and two full-fledged (Jaiz Takaful and Noor Takaful) operating in Nigeria (Islamic Financial Services Board 2019). National Insurance Commission (NAICOM) in 2019 authorized the establishment of two new insurance operators Cornerstone Takaful Insurance Company and Salam Takaful Insurance Company to operate in life and non-life insurance in the country (NAICOM, 2019).

The interest in Islamic social finance in the country has been rekindled. Academics and policy makers in Nigeria have expressed their interest in reviving the Islamic social sector to address the several key challenges the country is facing. Historically, Islamic social finance has played a significant role in the life of Muslims especially in the Northern Part of the country. Although Islamic law was practiced during the prominent Islamic empires of Sokoto Caliphate and Kanem Bornu empire but despite that, the law and practice of Waqf was not developed (Abubakar, 2015). However, there are some evidences that claim that the institution of waqf was well established during the time of the defunct Sokoto Caliphate which was founded by Usman bin Dan Fodio but witnessed a great decline with the arrival of the colonialists (Abubakar, 2015; Oseni, 2015). There is no National law or provision that regulates

the management or administration of waqf in Nigeria (Oseni, 2015). Ishola (2019) in his study on the legal basis of waqf in Nigeria postulates that the legality of waqf can be deduced from the constitutional provision, state enactments, and Islamic law and that the 1999 Nigerian constitution recognizes waqf which falls under the jurisdiction of the Shariah Court of Appeal. Therefore, the author believes that there are no legal or constitutional constraints to engaging in waqf activity in Nigeria. The early 2000s saw the revival of Zakat as many states in northern Nigeria re-introduced Shariah law in their states (Muhammad et al., 2018). These northern states enacted state-backed zakat legislations (NSRP 2016). The waqf and zakat institutions in these states have faced several challenges due to the lack of experts in the management and administration of these institutions (Raimi et al., 2015). These challenges have led to gross inefficiency and underperformance of these institutions rendering several of them impotent and useless.

14.3.1 The Nigerian Sukuk Market: An Overview

The introduction of Sukuk to the Nigerian market is very nascent. The Sukuk issuance in Nigeria is governed by several legal frameworks, such as the Investments and Securities Act 2007 and the SEC, rules on the Issuance of Sukuk 2013, and rules of the state organizing the Sukuk issuance. The Osun Sukuk Issuance on the 10th of October 2013 by the Osun state government represents the first issuance of Sukuk in the country. The Nigerian Government issued its first sovereign Sukuk on the N100 billion Sukuk with a tenure of 7 years. This was followed by two subsequent issues of N100 billion and N150 billion in 2018 and 2020, respectively. These three issues represent around N350 billion and were highly over-subscribed. The proceeds from these issues are billed for the revitalization and construction of key roads across the six geographical zones in the country. The Sukuk issuance attracted a wide range of investors including banks, pension funds, ethical funds, insurance companies, and retail investors. Retail investors accounted for about 4 and 17.33% of the subscription of the first and second issues, respectively (Parker, 2020). The third Sukuk issue was over-subscribed by 446% even though the rental payment of 11.2% was significantly lower as highlighted in Table 14.1 than the 15.74,3% of the 2018 issue. This is a sign that the Sukuk market is likely to continue growing due to investors' confidence and the increased awareness among the public on the importance of Sukuk.

Table 14.1 The Three Nigerian Sukuk issues

Issue	Tenor	Rental rate (%)	Issue date	Due date	Issue size	Instrument type
First	7 years	16.47	2017	2023	100.000.000.000	Ijara Sukuk
Second	7 years	15.743	2018	2024	100.000.000.000	Ijara Sukuk
Third	7 years	11.20	2020	2027	150.000.000.000	Ijara Sukuk

14.4 Summary of the Identified Problem

Lack of proper WASH facilities has hindered Nigeria's Ability to manage the COVID-19 outbreak. A great number of the population flouted the lockdown protocol enforced by the government due to a lack of access to WASH facilities in their homes. The continuous growth of the population also represents another key challenge. According to the World Population Review report 2019, Nigeria has a population of about 200 million people at the beginning of 2018, growing at the rate of 2.7% annually. The population is equally split between urban and rural settlement dwellers. Among the urban settlement residents, 81% have access to improved drinking water while only 57% of the rural settlement populace have access to the same. In terms of access to improved sanitation facilities, only 33 and 25% of urban and rural settlement dwellers have access to them, respectively. While access to improved drinking water has marginally improved for both rural and urban dwellers over the last 13 years, access to improved sanitation facilities has decreased over the same period for the two sets. Nigeria ranks as the worst in Africa in terms of open defecation and is on the verge of overtaking India as the world's number one in open defecation (Jurji and Ogunjobi, 2019). Data gathering by Water, Sanitation and Hygiene National Outcome Routine Mapping (WASH NORM) suggests that currently, as many as 47 million Nigerians still practise open defecation, with only 11% having access to complete water, sanitation, and hygiene facilities. Only 13% of all schools have access to water and sanitation facilities. Access to basic water and sanitation services is significantly lower in poorer communities. The people in the lowest wealth quintile are 16 times more likely to defecate in the open compared to those in the richest wealth quintile (Nation Bureau of Statistics et al. 2013). In this regard, Minister of Water Resources of Nigeria Suleiman Adamu stated in 2018 that access of Nigerians to pipe-borne water in Nigeria has dropped from 32% in 1990 to about 7% in 2015 (Olatunji, 2018). Open defecation has left a heavy burden on the economy of the country. According to a World Bank report, Nigeria loses NGN 455 billion or US$ 3 billion annually due to poor sanitation (Maina & Sittoni, 2012).

In 2015, Nigeria achieved a coverage ratio of 69% for water and 29% for sanitation. This was sufficient to meet the Millennium Development Goals (MDG) target for water but not for sanitation (World Bank, 2017). However, the bar was raised with the launch of the Sustainable Development Goals (SDG) and Nigeria will try to achieve 100% coverage for both water and sanitation by 2030. The main challenges are lack of services or poor-quality services for the poor in urban and rural areas, mainly in the sanitation and hygiene subsector. Coverage and quality of services vary across the geopolitical zones. While the North faces more water-related problems, open defecation is the bigger issue in the Southwest.

Nigeria intends to achieve 100% access to basic water and sanitation facilities by 2030 with the focus on rural areas. Achieving this will require substantial investments in building new infrastructure and maintaining existing ones. It is estimated that about USD 2.7 billion of investment is required annually to achieve these targets.

The current financing gap stands at about USD 106 million per annum (The Federal Republic of Nigeria and UNICEF 2016).

14.4.1 Solution/Value Proposition

Having highlighted the importance of water and sanitation facilities in sustainable development and inclusive growth, and bearing in mind the limited access to these facilities in Nigeria due to lack of funds, this work seeks to propose a blended Islamic finance structure that can help in bridging the funding gap in the view of achieving the sustainable development goals, national aspirations, and the higher objectives of Shariah.

14.5 Definitions and Concepts of Blended Finance

The mobilization of private capital flows to emerging and frontier markets using philanthropic funds and development finance is referred to as blended finance (OECD 2018). It is a structuring approach that allows organizations and individuals with different motives to co-invest while achieving their individual motives, be its financial return, social impact, or a blend of both (Convergence, 2018). Blended finance offers a potential solution to the huge funding gap in critical sectors of the developing world, by adjusting the risk-return profile of investments without distorting market functionalities (Samans & Solheim, 2015). Figure 14.1 illustrates blended finance pillars of which (i) Leverage is the use of development finance and philanthropic funds to attract private capital into deals; (ii) Impact is investments that drive social, environmental, and economic progress; and (iii) Returns signify the financial returns

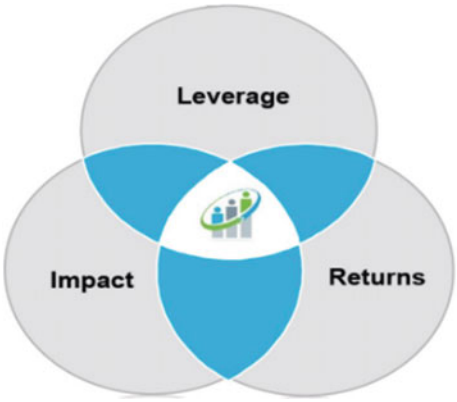

Fig. 14.1 Pillar of blended finance**.** *Sources* (OECD, 2015)

for private investors in line with market expectations, based on real and perceived risks of investment.

Blended finance has gained a foothold in development finance spheres amid the huge funding gap required for the achievement of sustainable development goals. It has the potential of reducing reliance on Order development assistance to a more self-sustaining financing mechanism by mobilizing domestic resources (OECD 2019).

Furthermore, blended finance structures make use of development finance resources to attract additional funds from private and commercial sources. The logic behind this is that the private sectors are constrained by risks and uncertainties of returns associated with investments in development projects. As such, public and philanthropic funds can be strategically used to improve the risk-return profile of investment to attract private investments. Furthermore, blended finance provides governments a framework to help align its development incentives by enabling more national projects to access private capital by structuring financial instruments to address investor concerns regarding the risk-return profile (Deloitte2017). As such, blended finance has the potential to remove the bottleneck that prevents private investment flows into critical sectors using catalytic instruments to deliver the expected development outcome and brings more bankable projects to the market.

14.5.1 Blended Finance for Water and Sanitation

The availability of water and sanitation facilities is critical for sustainable development and inclusive growth. United Nations' sustainable development goal 6 provides an ambitious vision of ensuring the availability and sustainable management of water and sanitation facilities for all by 2030. This goal has a spill-over effect on other SDGs such as food security SDG2, good health and well-being SDG3, clean energy SDG7, and marine and terrestrial ecosystems SDG14, among others (OECD2019). An annual investment of USD114 billion is needed to bridge the investment gap in water, sanitation, and hygiene (WHO 2017).

Governments have aligned their national development aspirations with the SDGs. However, the discrepancies between global aspirations and national realities will make these goals a distance dream for developing economies like Nigeria if effective measures are not put in place giving the government's budget constraint.

Private sector investment in the WASH sector is undermined by mismatches between risk-return profiles coupled with structural issues related to the profitability of water service providers' business models (OECD 2019). Hence, an innovative financing mechanism such as blended finance is needed to crowd in private investments to address the funding gap because governments alone cannot meet this funding gap. Furthermore, private investments improve efficiency in the WASH sector by imposing investment discipline and transparency requirements (Leigland et al, 2016). Table 14.2 illustrates some examples of blended finance deals for Water and Sanitation projects.

Table 14.2 A summary of blended deals for water and sanitation

Case title	Country	Blended parties	Instruments used	Impact
Kigali bulk water supply financing	Rwanda	Africa Development Bank, Emerging Africa Infrastructure Fund, DevCo, Metito and PIDG's Technical Assistance Facility (TAF)	Loans, Technical assistance, and Equity	The project is expected to connect half a million of Rwandans with clean water supply
Facilitating access to finance for household investment in sanitation	Bangladesh	World Bank (WSP), World Bank (GPOBA), Palli Karma Sahayak Foundation (PKSF), Association for Social Advancement (ASA)	Technical Assistance, Grant, Output-Based Subsidy, and Loans	The blended deal is expected to enhance households' ability to afford sanitary facility
Blended finance solutions to expand utilities' services	Indonesia	Water org and KOMIDA Microfinance Institution	Technical Assistance and Loans	The project has benefitted more than 5000 households and enhance the water service providers' access to commercial finance
Facilitation access to finance for domestic water service operators	Cambodia	European Union Agence Francaise De Development (AFD), World Bank, Foreign Trade Bank	Technical Assistance, Partial Credit Guarantee, Loan and Output-Based Aid	The project is expected to provide water services to more than 18,000 household and provide improved water services to 45,000 households
Pooled municipal bond issuance in Tamil Nadu	India	Private Investors (bond holders), Tamil Nadu State Government, and USAID	Bond, Grant, Partial Credit Guarantee, and Equity	The project enhances the Urban Local Bodies access to domestic capital market to finance water and sanitation services in their locality

(continued)

Table 14.2 (continued)

Case title	Country	Blended parties	Instruments used	Impact
Scaling up blended finance for water and sanitation	Kenya	World Bank Global Partnership for Output Base Aid (GPOBA), k-Rep Bank, Community, Water Service Providers, and USAID	Output Base Aid, Loan, Partial Credit Guarantee, and Equity	Blended structure enhances the service providers' access to commercial credit which enables them to provide water and sanitation facilities to over 190,000 people
Water revolving fund	Philippines	Government of Philippines' Department of Finance, Private finance institution, LGU Guarantee Corporation (LGUC), USAID, and Japan Bank for International Cooperation (JBIC)	Sovereign Guarantee, Concessional Debt, Credit line, Credit Risk Guarantee, and Commercial Loan	More than six million people have benefited from this project

14.5.2 Conventional Blended Finance Instruments

There are different conventional financial instruments which can be used in conventional blended finance, and it can be summarized as follows:

- **Grants** are direct monetary injections in a blended fund or project without an expectation of reimbursement. Grants are provided by investors or development funders who seek social and/or environmental impact and to crowd in private investors for the sustainability of the project.
- **Debt** is money lent with an expectation of repayment at a future date either on installments or lump sum. Debt can be in the form of concessional debts which are given on favorable terms or rates compared to the prevailing market rates. As opposed to the market rate debts which are based on prevailing market terms and conditions, Mezzanine debts are subordinated debts in which the providers are paid after the claims of the senior debt holders are met (Samans & Solheim, 2015)
- **Equity** is a share of ownership in a company or a project. Equity holders can range from senior to junior based on their priority claims on the yields of the project or company. Instead of providing debt, impact investors can get into a partnership with commercial investors. As partners, both parties are entitled to the profit and losses of the project. To attract commercial investors, development funders can hold junior equity to serve as a cushion for commercial investors when the project fails to generate profit.

- **Bond** is debt instruments issued by governments, public utilities, and banks to finance their activities.
- **Technical Assistance (TA)** is non-financial assistance provided by local or international experts to augment the capacity of investees and lower transaction costs.[1] Technical assistance and training reduce project uncertainty, operational cost and ensure the execution of projects to meet the required standard (Samans & Solheim, 2015). Technical assistance aims at maximizing the quality of project implementation and impacts by capacity building and other advisory services. TA can help improve the quality of services delivery of utility companies, which can lead to demand generation and improved customer's willingness to pay for their services (Pories et al., 2019; OECD 2019).
- **Guarantee and Insurance** are credit enhancement facilities meant to improve the credit profile of a project or company and to assure investors part of their returns when a project underperforms (Samans & Solheim, 2015). They are unfunded facilities that do not require an initial capital outlay; instead, the providers enter an agreement to pay for the funds owed to the private sector when the project fails to generate enough cash flows to meet their obligation. These instruments are found to be one of the most catalyzing instruments since they don't require initial capital outlay and their materiality depends on a contingent event that rarely occurs if the project is properly implemented. Guarantees account for 58% of the total private finance mobilized for water and sanitation projects using blended finance from 2012 to 2017 (OECD 2019).
- **Results-Based Aid (OBD)** also known as performance-based aids are payment of aid linked to the delivery of specific services or product quality. It helps to enhance the commercial viability of projects by providing fixed pricing for products to attract private investing flows (Samans & Solheim, 2015). It sometimes requires beneficiaries to obtain financing from commercial sources, while the donors commit to paying when an agreed target is met (Gavas, et al., 2014). OBD is part of a broader donor effort to ensure that the aid is well spent and that the benefits go to the poor.

14.6 Islamic Blended Finance

The Islamic institutions of compassion such as zakat, waqf, and *sadaqat* can play a pivotal role in enhancing multidimensional development in Muslim societies. Zakat is one of the five fundamental pillars of Islam; it is an annual levy on wealth above some threshold called *Nisab*, the proceeds of which are to be distributed among specified heads in society (poor, needy, indebted, etc.). Waqf, on the other hand, is a voluntary act of charity. Linguistically, Waqf means to stand still and not to let go

[1] See What is technical assistance? | 2005 Convention | United Nations Educational, Scientific and Cultural Organization. (2021). Retrieved 30 March 2021, from http://www.unesco.org/new/en/culture/themes/cultural-diversity/cultural-expressions/programmes/technical-assistance/what-is-technical-assistance.

(Ahmed, 2004). Technically, it may be defined as holding an asset and preventing its consumption to repeatedly extract its usufruct for an objective representing righteousness and philanthropy (Kahf, 1998). Zakat and Waqf institutions have played a crucial role in enhancing Islamic civilization in the past. They can, therefore, be harnessed innovatively to positively contribute to the socio-economic development of Muslims (Obaidallah and Mohamed-Saleem, 2008). Waqf is more flexible than zakat and its proceeds could be used for an array of purposes. Zakat funds, on the other hand, can only be given to the 8 prescribed categories of people eligible to receive Zakat as mentioned in the Quran. It is, therefore, impermissible to use zakat fund to finance public utilities and services which benefits both the rich and the poor (Shehata, 1994). The reason for this is that spending zakat funds on public services contravenes with the concept *tamlik* in which the zakat funds are supposed to be transferred to the ownership of the beneficiaries. However, some contemporary scholars argue that zakat funds could be used to finance socio-economic activities that benefit the poor and the less privileged. They claim that it is permissible to create a fund which will be responsible for investing zakat funds. This fund could finance SMEs and provide guarantees to the poor to avail small loans (Al-Shubaily, 2019). These scholars also believe that the beneficiaries of this fund must be people who are eligible to receive zakat. With this condition, it can be concluded that zakat funds to both sets of scholars are not suitable for major infrastructural finance. Therefore, the institutions of waqf giving the flexibility in the use of its proceeds can help bridge this funding gap by transforming "social capital into social and public infrastructure" (Shaikh et al., 2017).

14.6.1 Proposed Structure

Conventional blended finance is regarded as a powerful tool for catalyzing commercial funds for SDG financing. However, numerous studies have revealed several shortcomings of the traditional blended finance such as the exclusion of poorest countries (Attridge & Engen, 2019; Leigland et al., 2016), lack of unified framework, and multiplication of financial tools which has led to duplication, fragmentation, and inconsistency in the blended ecosystem (Gavas and Timmis, 2019).

Blended finance can be scaled up in the least developing countries where the majority of Muslim countries lies by strategically using Islamic finance instrument and Islamic social funds as a holistic approach of improving WASH services efficiency. This will enhance inclusive participation, shared prosperity, and risk-sharing to achieve the Sustainable Development Goals. Figure 14.2 depicts the proposed Islamic blended finance structure for WASH projects.

The Islamic finance instruments used and the role and responsibilities of the stakeholder in the proposed structure are as follows:

- **Green Sukuk**: Sukuk are certificates of equal value representing an undivided ownership interest in a specified asset, usufruct, or services (AAOIFI, 2008).

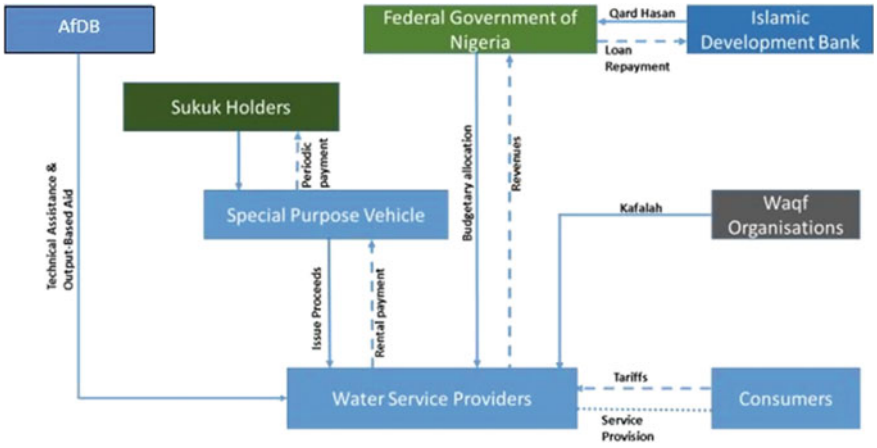

Fig. 14.2 Proposed structure

Sukuk is the second dominant asset class in the Islamic finance industry with a sector share of 24.2%, of the global Islamic finance assets (IFSB, 2019). The sector has witnessed tremendous growth over the past years; it has widely spread in both Muslim majority and minority countries. Green Sukuk is the type of Sukuk for which the funds raised are exclusively allocated to Green eligible Projects (IsDB, 2019). Green Sukuk are intended to encourage sustainability and to support climate-related and environmentally friendly projects. They are used to finance projects that are aimed at pollution prevention, sustainable agriculture, water, and sanitation, among other green eligible projects. Coloring Sukuk green has the potential of targeting both socially responsible investors (SRI) and Islamic investors which will avail the Islamic finance industry a significant market opportunity (Aassouli, et al., 2018). Moreover, issuing green Sukuk will demonstrate the Islamic finance industry's commitment to welfare maximization and creating a common ground with the SRI market (Moghul & Safar-Aly, 2014).

In line with the government of Nigeria's commitment to the Paris Agreement on climate change and green growth and the UN sustainable development goals, the government needs to issue a green Sukuk to finance sustainable investments in its water and sanitation sector. Issuing a green Sukuk in a blended finance structure will enable the government of Nigeria to diversify its funding sources by tapping into the private sector and attracting impact investors. The government of Nigeria will set up a special purpose vehicle (SPV). The SPV will issue a hybrid green Sukuk base on *istisna* and *ijara* contracts. The proceeds of the Sukuk will be a channel to a water service provider who will construct water and sanitation facilities for the communities. In order to generate revenue to pay the periodic payment to the Sukuk holders during the construction phase, the service provider will enter a forward lease contract with the communities and the proceeds of the water tariff will be used to pay the Sukuk holders' periodic profits.

- **Technical assistance and output base aid**: Technical assistances are non-financial assistance provided by local or international experts to augment the capacity of investees and lower transaction costs (UNESCO). Technical assistance and training reduce projects' uncertainty, risk exposure operational cost, and ensure the execution of projects to meet required standards (Samans & Solheim, 2015). The aim of technical assistance is to maximize the quality of project implementation and impact through capacity building. The local water service providers lack the capacity to developed high-quality sanitation facilities. Therefore, there is need for the World Bank to support capacity building for the successful implementation of the project.
- **Out Base Aids**: It also known as performance base aids that are payment of aid linked to the delivery of specific services. They are used in cases where poor people are being excluded from basic services such as electricity grids or water and sanitation systems due to their inability to afford the full cost or user fees.[2] It is part of a broader donor effort to ensure that aid is well spent and that the benefits go to the poor. In our proposed structure, the World Bank provides a result base aid for the extension of services to the underprivileged communities and ensures the achievement of required standards.
- **Kafala**: Guarantees are the most powerful leveraging mechanisms in the blended structure. It facilitates resources mobilization in risky sectors with high commercial viability overtime (OECD, 2018). Guarantees help in assuring bottom-line oriented investors of their returns in case of contingencies. *Kafala* is one of the Islamic institutions of compassion; it is a third-party guaranty intended to provide cushion from various forms of exposure against capital losses for investors. In our proposed structure, the waqf institution will provide a third-party guarantee to the water service providers. It plays the role of a credit enhancement tool, intended to pay for the periodic profits to the Sukuk holders in case the tariffs collected by the water service providers from the end-users are not enough to meet the periodic payments to the Sukuk holders.
- **Qard Hassan**: Benevolent loan is one of Islam's redistributive instruments (Iqbal & Shafiq, 2015). The Islamic Development Bank aims at improving the lives of those it serves by promoting social and economic development in Muslim countries and communities by delivering impact at scale (IsDB, 2019) in line with the banks' aspirations to scale up efforts in achieving sustainable development goals and green growth. The banks provide a benevolent loan to the Federal Government of Nigeria to help augment the country's efforts and provide water and sanitation facilities to its citizens.

[2] See SNV takes part in global Results-Based Financing 2019 forum. (2021). Retrieved 30 March 2021, from https://snv.org/update/snv-takes-part-global-results-based-financing-2019-forum.

14.7 Legal and Regulatory Policy Recommendations

Having highlighted the critical role played by blended finance in realizing the development aspirations of fragile economies, a legal and regulatory framework should be developed to facilitate the effective engagement of blended stakeholders to ensure the sustainability and scalability of blended projects. The following should be implemented at a national level to ensure the proper execution of blended projects.

- Regulator should ensure that appropriate skill sets are developed to work with the private sector and philanthropic organizations across the project development process to facilitate the proper structuring and implementation of projects.
- Fiscal incentives should be created to incentivize private investors. Legal and Regulatory barriers hindering private sector participation should be assessed and modified where appropriate in order to attract private investments in the blended vehicle.
- Different stakeholders in the blended vehicle have different motives and incentives, which need to be understood from inception. An effective strategy should be implemented in creating synergy among the various stakeholder to ensure that the projects are structured to deliver both positive development outcomes being sought by governments and philanthropic institutions and the financial outcomes and risk mitigation sought by the private actors.
- Transparency and proper monitoring standards should be in place to prevent misuse of funds. And appropriate impact metrics need to be set to evaluate the project performance.
- The government of Nigeria needs to issue a green Sukuk to diversify the funding sources for WASH projects in Nigeria.
- Convertibility and exchange risk are among the major deterrents to foreign investment in Nigeria. Therefore, all the Sukuk issuances should be denominated in Nigerian Naira to provide assurance to foreign investors against these risks.
- There needs to be a reform in the tariff structure in a way that people living in abject poverty would pay low and fixed tariffs regardless of their water consumption. State government should use different tariffs systems that look at the capability of each group and set tariffs accordingly.
- State governments need to provide incentives to State water boards to set tariffs at a level which they can recoup their costs and sustain its services.

14.8 Conclusion

Access to potable water and sanitation facilities is a significant challenge for a large section of the Nigerian population. Nigeria aspires to achieve 100 percent coverage in both water and sanitation by 2030 in line with SDG. However, efforts to achieve these goals have been hampered by inadequate funding. Time is at the essence and Nigeria needs innovative solutions to address these challenges in the face of its dwindling

oil revenue. Nigeria with its huge Muslim population could bridge its financing gap in the water and sanitation sector through Islamic finance. One key issue impending the realization of this goal is the problem of cost recovery and affordability. This is where Islamic blended finance could play a significant role. The government of Nigeria will have to collaborate with donors such as the African Development Bank and the Islamic Development Bank to attract development grants and concessional loans which will be geared toward the WASH sector. State waqf and zakat institutions could provide credit enhancement to help attract private investment. Synergy and alignment between different sectors of the economy are required if this goal is to be realized. There needs to be greater transparency on how the resources mobilized with be spent. The issue of mismanagement of resources and corruption could be tackled through output-based aid where the funds are only released after a certain level of services delivery has been achieved.

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Chapter 15
The Role of Islamic Finance in Fostering Circular Business Investments in the Case of Qatar's Tire Industry

Abdul-Jalil Ibrahim, Khalid Al-Ansari, and Nasim Shah Shirazi

Abstract The natural capital manifested in nature's many activities drives human well-being and the foundations of modern society. Natural capital sustainability is threatened with an increasing regeneration deficit due to the growing human population and appetite for high consumption. The linear economy principles if remain the norm of business practices and consumption patterns, the outcome is likely to be shortages of certain materials, growing price volatility, and continued environmental degradation. Tackling this challenge requires a new economic paradigm of the Circular Economy (CE) where material use is decoupled from economic growth. The Islamic finance industry has a role to play in the transition toward the CE. This chapter explores the role of Islamic finance in fostering investments toward the CE to optimize resource use and avoid material waste in the course of economic growth. A focus on how Islamic finance can contribute to building a circular business financing ecosystem is explored. Ways to leverage Islamic finance's unique value proposition and contracts to attract investments for CE with a specific case study of the tire industry in Qatar is presented. The study concludes that Islamic finance profit and loss sharing financing mode can be used to support circular businesses motivated by Shariah objectives. There is also the need for financial regulatory authorities and Islamic financial institutions to consider risks associated with climate change and linear economic activities in asset valuation and pricing. Blended Islamic finance is an essential tool that can foster investments and attract funding for circular businesses. The circular business financing ecosystem can be built in Qatar by combining the profitable and charitable sectors within the context of Impact investing and Shariah objectives. This will mean that Qatar Development Bank, Qatar Charity, Islamic Banks, and Qatar Fund for Development can work together to attract the needed funding for circular businesses within Qatar and also attract entrepreneurial talents to Qatar to support the Circular Economic transition. Circular businesses like the tire industry, plastics recycling, and others need attention from policymakers within the scope of sustainability and achieving Qatar National Vision 2030. The study makes some recommendations, and among them are to invest in research and development

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in the area of Circular Economic growth and to pass a specific Qatar legislation related to CE.

15.1 Introduction

The natural capital manifested in the many activities provided by nature is estimated at US$125 trillion a year which drives human well-being and foundations of the modern society (Barrett et al., 2018). The natural ecosystem regulates natural capital regeneration. For instance, in the case of energy, the climate system plays a pivotal role in the long cycle, with all the energy we use coming from the sun. When the regulatory mechanism for the environment is disrupted through unbridled production, the ecosystem resilience is threatened (De Perthuis & Jouvet, 2015). This feature of the natural capital has shifted the view of it "defined as an aggregation of scarce resources—economists' traditional definition since Malthus—to a perspective in which this capital is a complex whole ensuring the reproduction of resources" (De Perthuis & Jouvet, 2015). The business and finance industries are increasingly becoming concerned with environmental risks and their link to the macroeconomic performance of countries, sectors, and financial markets (Barrett et al., 2018).

To put the unsustainability of the current linear consumption pattern into perspective, it is estimated that it will take 1.75 piles of the earth for humanity to meet resource demand for human well-being sustainably. This is expressed in the "planet's ability to recover from what resources consumed within each year—like regrow the trees we cut down, absorb the carbon dioxide we emit, and replenish the seas with the fish we harvest, to name a few" (Global Footprint Network report for 2019). The report further estimates that the planet exhausts its stock of resources the earth can regenerate in 365 days within 209 days which is 3 days less than the 2018 estimates. The increasing regeneration deficit of natural capital will continue to grow with the increasing human population and appetite for high consumption. Figure 15.1 presents the World Overshoot Days of countries which indicates how the Earth will overshoot if the world population lived like this.

The linear economy emerged from the Industrial Revolution, where the consumption of an ever-increasing variety of goods and services in the world drives economic prosperity (Working Group Finance, 2016). Motivated by the "Hotelling rule" of natural resource extraction with zero extraction cost which implies that at each period the value of the resource in the ground is equal to its extraction value and the space needed for waste disposal were inexhaustible, the linear economic approach birthed the so-called "take, make, dispose of" model (Working Group Finance, 2016; De Perthuis & Jouvet, 2015). The linear economic paradigm leads to high costs and supply risks surrounding non-renewable natural resources with attendant negative externalities associated with their use. Working Group Finance (2016) concludes that the inability to preserve the value inherent in the linear economy is apparent and gives impetus to the potential for an alternative circular approach (one that is regenerative and restorative by design) which is increasingly appealing. The report further

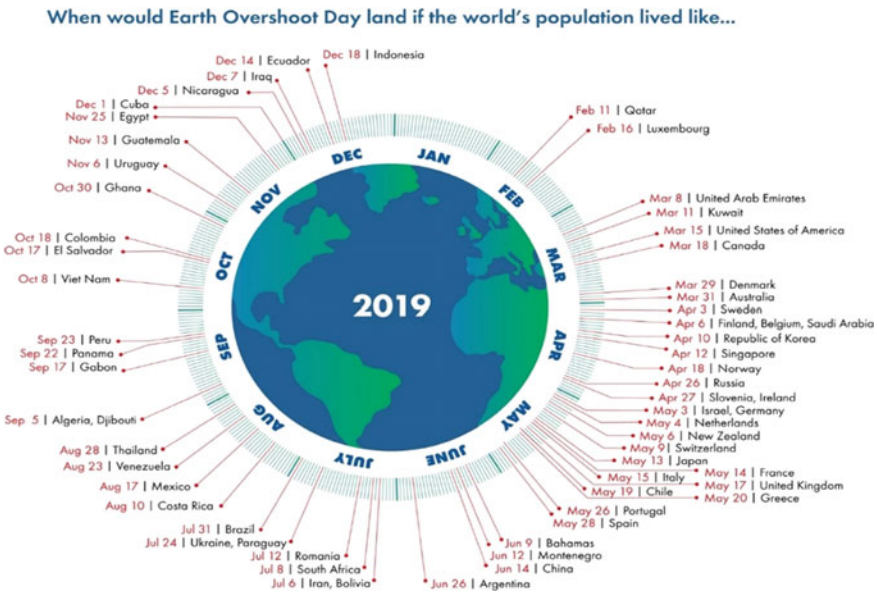

Fig. 15.1 Country overshoot days in 2019. *Source* Global footprint network footprint accounts (2019)

concludes that if linear economic principles remain the norm of business practices and consumption patterns, the outcome is likely to be shortages of certain materials, growing price volatility, and continued environmental degradation. Tackling this challenge requires a new economic paradigm of "reduce, reuse, and recycle", the Circular Economy (CE) concept (Hieminga, 2015). The goal of CE is to combine business progress with environmental and social impacts. It empowers businesses to prosper without compromising on the future generations' ability to meet their needs (Hieminga, 2015).

The transition to a CE economy model will not only deliver climate and other ESG benefits but also provide new growth opportunities in a significant way (Ellen MacArthur Foundation, 2020). Financial institutions can play an essential role in driving the transition to a CE. This is achieved by providing financing directly to circular businesses and by adopting circular business practices (Working Group Finance, 2016). There is a consensus among Islamic financial institutions that sustainable finance aligns with Islamic finance principles, but most Islamic financial institutions are not prioritizing sustainability in their practices (Al Mubarak and Goud, 2018). Khan (2019a) notes that to achieve compressive human development as espoused by the Islamic finance theorists, there is a need for a paradigmatic shift to address the objectives of Shariah (*maqāṣid al-Sharīʿah*) to ensure that the ecological environment is recognized as a resource. In this regard, there is a need to replace the current waste-driven linear economy paradigm with a new zero-waste halal CE

paradigm which is consistent with the Islamic vision of entrepreneurship (Khan, 2019b).

This chapter aims to explore the role of Islamic finance in fostering investments toward the CE to optimize resource use and avoid waste in the course of economic growth, thus decoupling economic growth from resource use. A focus on how Islamic finance can contribute to building a circular business financing ecosystem is explored. The case of Qatar is presented and also ways to leverage Islamic finance's unique value proposition and the structuring of Islamic finance contracts to attract investments and financing of the CE in Qatar. The study presents the case of the tire industry in Qatar. In this study, an attempt will be made to answer the question of what can be done with the used tires in an economically sustainable and environment-friendly manner. The methodology would look at the life cycle of the tire and attempt to put the different products contained within the used tires back into the economy to get another use of them. This is the drive for the circular economy in relation to used tires as will be detailed in the following parts of this chapter.

15.2 Literature Review on Circular Economy

According to Ellen MacArthur Foundation (2013b), a CE is an industrial economy that is restorative by intention and design. One of the main principles of a CE is that "waste is food". This means that all materials and products can be seen as temporary repositories of materials that will subsequently become the inputs for new products. In a CE, the concept of waste is eliminated by carefully designing products and industrial processes in such a way that materials are nutrients in a perpetual flow in either the biological cycle or the technical cycle. The two cycles are separated for the reason that technical nutrients, such as plastics and metals, can be repurposed by human action, whereas biological nutrients serve as inputs for new organic matter, such as crops and forests. The economic benefits of products and materials cycling through the system will not be coupled with the degradation of natural capital since stocks of non-renewable resources are controlled, and renewable resources are used whenever possible. A CE also addresses some of the externalities of the linear approach to production mentioned earlier as it reveals and designs out waste, pollution, and toxic materials. A transition to a CE may also generate positive externalities as it will likely spur innovative technologies and business models. Consequently, a CE aims at decoupling the creation of wealth and jobs from the consumption of non-renewable resources by maximizing resource productivity and minimizing waste generation.

The concept of the CE has been gaining momentum since the late 1970s (Ellen MacArthur Foundation, 2013b). Several authors, like Andersen (2007), Ghisellini et al. (2016), and Su et al. (2013), attribute the introduction of the concept to Pearce and Turner (1989), by describing how natural resources influence the economy by providing inputs for production and consumption as well as serving as a sink for outputs in the form of waste. This is influenced by Boulding's (1966) study, which describes the earth as a closed and circular system with limited assimilative capacity,

and inferred from this is that the economy and the environment should coexist in equilibrium. Some theoretical works influence the contemporary understanding of the CE and its practical applications to economic systems. Some of the most relevant theoretical influences are cradle-to-cradle (McDonough and Braungart, 2002), laws of ecology (Commoner, 2020), looped and performance economy (Stahel, 2010), regenerative design (Lyle, 1996), industrial ecology (Graedel and Allenby, 1996), and the blue economy (Pauli, 2010).

Geng and Doberstein (2008), focusing on the Chinese context of the concept, describe the CE as the "realization of a closed-loop material flow in the whole economic system". Webster (2017) adds that "a CE is one that is restorative by design, and which aims to keep products, components and materials at their highest utility and value, at all times". CE from both policy and business development perspectives is motivated by the view that it can accelerate the achievement of sustainable environmental and economic development (Ellen MacArthur Foundation, 2015, 2012; European Commission, 2015).

Kirchherr et al. (2017) analyzed 114 definitions of CE, and the findings indicate that the CE is conceptually depicted as a combination of reducing, reusing, and recycling activities. The authors argue that the definitions show few explicit linkages of the CE concept to sustainable development, and this conclusion is similar to Geissdoerfer et al. (2017).

The current traditional linear extract–produce–use–dump material and energy flow model of the modern economic system leads to a significant cost to social, economic, and environmental sustainability (Frosch and Gallopoulos, 1989). CE is thus promoted as a model that will spur the economic system with an alternative flow model, one that is cyclical and regenerative (Ellen MacArthur Foundation, 2015, 2013; Geissdoerfer et al., 2017).

According to the 73rd UN General assembly, "the CE holds particular promise for achieving multiple SDGs, including SDGs 8 on economic growth, 6 on clean water, 7 on clean energy, 11 on sustainable cities, 12 on sustainable consumption and production, 13 on climate change, 14 on oceans, and 15 on life on land".

Many countries are formulating policies and strategies to transition their economies toward the CE across the world. The European Union has been in the forefront of the CE transition with the Lisbon Treaty outlining the guiding principles of EU environmental protection policy (Domenech and Bahn-Walkowiak, 2019). The EU also issued the implementation plan of the CE through the CE package in 2015 to support the transition of European states toward a more sustainable economy (European Commission, 2015). The CE package was adopted in July 2014 which was entitled "Towards a CE: a zero-waste program for Europe" establishing a common and coherent EU framework to promote the CE targeting recycling, job creation, new business models eco-design, and industrial symbiosis, and reducing greenhouse emissions.

This policy was withdrawn and replaced by a new one titled "Closing the Loop—An EU Action Plan for the CE" which seemed to put a stronger focus on eco-innovation to cover the whole process from design to disposal and recovery/recycling. This includes provisions for tackling obsolescence equipment, decommissioning

requirements, electronic product reusing and recycling, etc. The legislation sets targets of 65% recycling target for municipal waste by 2030, 75% of recycling of package waste by 2030, and limiting landfill use for waste to 10% (European Commission, 2015).

In the UK, the House of Commons recommended the adoption of the CE through government incentives and catalysts to signal consumers and producers. Some of the interventions put forward included taxation reforms, regulating producers' responsibility by rewarding reuse, and making funds available to organizations that promote recovery of materials (HOUSE 2014). It is essential to mention that the government rejected some of the recommendations and only implemented the recyclability and the producer responsibility schemes in emerging sectors of the economy (Sanderson, 2014).

In Asia, China is providing a leading role in CE transition by enacting a CE Promotion Law of the People's Republic of China. The law provides a legal and policy framework for promoting CE and achieving environmental sustainability (Lacy and Rutqvist, 2015). The CE policy approach in China, similar to the EU's CE Package 1, prioritizes closing the loops of material from within the entire value chain of extraction and production. Zhu (n.d.) outlines some of the activities undertaken by stakeholders in China toward CE adoption including working with some strategic enterprises at the micro-level, the establishment of circular industrial parks at the meso-level, and the selection of some cities and regions to champion the CE transition at the national level. Finally, China has invested hugely in renewable energy as well as the rapid development of digital technologies, and a boom in asset-sharing platforms (Ellen MacArthur Foundation, 2018). Microeconomic factors, market failures, regulatory barriers, and societal customs remain issues to contend with in China's journey toward the CE (Ellen MacArthur Foundation, 2018).

Japan is another country that has pursued policies geared toward the adoption of CE, and this is mostly driven by the resource scarcity in the country as it seeks to optimize the resource use to be competitive (Lacy and Ruqvist, 2014). The government passed the law on the promotion of efficient use of resources in 2000 followed by the law on Fundamental Plan for Establishing a Sound Material-Cycle Society 2013 (Lacy and Ruqvist, 2014). The framework provides for the clarification and blueprint (including roles and responsibilities) for reforming society's lifestyles based on mass production, consumption, and disposal. The country developed an indicator for measuring progress toward a CE by the rate of recycled goods, disposal, and material productivity with policies geared toward raising productivity and recycling and minimizing disposal in the long run (Tanaka, n.d.).

In the GCC, there is no comprehensive policy on CE even though there is enormous potential within the countries in the region. According to a report by the World Government Summit, GCC countries can save almost $138 billion by 2030 if they adopt a circular economic model. This corresponds to almost 1% of the region's cumulative GDP between 2020 and 2030 (Al Soudan, 2019). Despite the lack of CE policies, GCC countries in one way or the other have started to explore sustainable solutions in their development policies. Some of them have captured targets of renewable energy, addressing suitable consumption and reduction and waste management

in their national visions and strategic targets (Al Soudan, 2019). For instance, Qatar National Vision 2030 outlines how the country can achieve sustainable economic and environmental development (QNV2030, 2008). UAE Vision 2021 includes ambitious targets on waste treatment, renewable energy development, and water recycling, and all these are policies that will ultimately lead to transition toward a CE. Saudi Arabia Vision 2030 also captures safeguarding the environment by increasing the efficiency of waste management, establishing comprehensive recycling projects, and pollution reduction of all forms (Al Soudan, 2019).

15.3 The Role of Islamic Finance in the Transition Toward Circular Economy

Banks play an essential role in economic growth through the credit creation process, which leads to the expansion of the money supply in an economy (Bernardo & Campiglio, 2014). Thus, Islamic banks can use credit allocation as a catalyst for adopting circular businesses within the achievement of Shariah objectives. This is done by channeling more credit and investments into circular businesses. The Shariah objectives provide a religious motivation for Islamic banks different from conventional banks. This is because, despite the impact of green investment, these investments have not attracted enough credit from financial institutions (Campiglio, 2016). This is unsurprising, as investors and private banks' profit incentives influence financial decisions. Spencer and Stevenson (2013) assert that green investments (which includes circular businesses) come with additional risks, and this serves as a disincentive for resource allocation in their favor. Also, in the long term, illiquid features of green investment are at odds with the appetite for short-term and liquid investments at the global markets (Spencer & Stevenson, 2013).

The discussion above indicates that climate change is becoming a limiting factor to financial stability and regulatory authorities, and policymakers must act. This calls Islamic financial institutions to consider the impact of climate change in their operations as their long-term sustainability may be threatened and the need for Islamic financial architecture and infrastructure to begin to consider climate change as a global agenda in order to be part of the policy debate at the global stage. This will help avoid reactive policies within the Islamic finance community when stakeholders in the industry are faced with the reality in the future.

The Shariah objectives provide a vital premise that seeks to protect, life, faith, intellect, family, and wealth. According to Chapra (2008), the Shariah objectives framework is aligned with SDGs, and thus, Islamic finance can contribute to achieving the SDGs. In contributing toward SDGs, there is a growing realization that Islamic financial institutions should be concerned with their financing and investment decisions and their outcomes on the planet. Protection of the planet and the environment, climate management, and adaptation, as organizational goals, are clearly in conformity with Shariah objectives as well as with the SDGs (Obaidullah, 2018).

According to Shariah, human beings, as vicegerents of God, have the mission of faithfully observing the values given by their Creator. During their short life in this world, they may utilize the scarce resources of the planet as trustees. They must interact with each other following rules. This would not only ensure the well-being of all humans but also protect the environment, including animals, birds, and insects (Chapra, 2008). This Islamic notion reinforces the scientific concept of a "chain of life", and interdependence among species, maintaining the balance of life on earth. This shows that human activities on the planet should be conscious of keeping the natural ecosystem put in place by the Creator.

Islam thus values maintaining environmental balance and circularity of resources as recognized in the various verses from the Quran (6:38; 6:141; 55:7–8; 67:30). Financing of economic activities that harms the environment needs to curtail or assess with higher risks within the spirit of Shariah objectives. Conversely, businesses and projects that promote circular economic growth should be encouraged and allocated more financing by Islamic financial institutions in order to achieve sustainable development.

Islamic financial service providers, using debt-creating contracts, have witnessed excessive growth, mostly addressing the needs of high-net-worth individuals and corporates. Most of these institutions are perceived to be similar to their conventional counterparts displaying a preference for short-term profit maximization over longer term goals. Islamic economists are particularly concerned that Islamic finance has to contribute a lot more toward addressing development-related issues, and societal concerns (Obaidullah, 2018). This shows that the Islamic financial sector can magnify some of the risks associated with climate change. This has implications for Islamic financial institutions' asset allocations. According to Ibrahim and Shirazi (2020), when an Islamic financial institution deploys capital to finance multiple cars for a client's personal use instead of supporting the circular business model of sharing such as Uber or public transport, the implication is that more cars on the street will lead to higher pollution and this affects climate change. When climate change-induced disasters such as flooding occur, then it may affect their assets directly or indirectly. Thus, the risks associated with *Murabahah* car financing should also consider the implication of the financing on carbon footprint. These risks have to be measured in a way and priced for climate risk-adjusted returns to be assessed. The financial service sector has a huge role to play in supporting the transition toward CE, and Islamic banks may have a more significant role to play with their imbedded social impactful nature. Therefore, there is a need for Islamic bank practitioners and policymakers to assess its role toward CE and put measures at micro-, meso-, and macro-levels to address this. For instance, Islamic banks and non-bank institutions should integrate climate risks into financial risk management. With this, the borrower and deal-level financial analysis should be encouraged to include climate-related impact analysis and prices. If emerging risks are identified and quantified, they need to be reflected in the risk ratings of the borrowers.

Islamic banks may also include climate considerations into limits and sector exclusion policy. These limits can be a form of restrictions on specific sectors such as coal mining to achieve a better climate outcome. These climate-related risks make it

imperative for Islamic financial institutions to disclose to stakeholders the potential risks and measures to mitigate them. This will help to generate new sources of information for market actors and policymakers and influence the allocation of capital to facilitate the transition to a more sustainable and low-carbon economy. Circular economic models can be viewed from both product level or growth stage perspectives (see Tables 15.1 and 15.2).

Conventional and Islamic banks can support the transition to a CE in several channels. According to Hieminga (2015), this begins by familiarizing with CE business models. This creates an opportunity for them to assess how CE can contribute to the sustainability of their businesses as well as supporting their clients for innovative value-creation that ensures maximizing resource use. Achieving this will require both ethical considerations and incentives for banks to channel credit toward the CE. Financial institutions will have to incorporate "circular value" of resources in the financial business case assessment by emphasizing cash flow of these models.

Table 15.2 presents the growth stage dimension of circular business models. The main aim of circular businesses is to keep control over resources and at the same time preserve value added (Working Group Finance, 2016). This is expressed in three business model categories, each of which focuses on a different growth phase:

Table 15.1 Circular business models viewed from the product dimension. *Source* ING, 2015

Model	Explanation
Circular supplies	This business model is based on supplying fully renewable, recyclable, or biodegradable resource inputs that underpin circular production and consumption systems. Through it, companies replace linear resource approaches and phase out the use of scarce resources while cutting waste and removing inefficiencies
Resource recovery	This business model recovers embedded value at the end of a product life cycle to feed into another one. This business model promotes return flows and transforms waste into value through innovative recycling and upcycling services
Product life extension	This business model allows companies to extend the lifecycle of products and assets. Values that would usually be lost at the end of the life cycle are maintained or improved by repairing, upgrading, remanufacturing, or by remarketing products. Moreover, additional revenue is generated as a result of extended usage
Sharing platforms	This business model promotes a platform for collaboration among product users, either individuals or organizations. These facilitate the sharing of overcapacity or underutilization, increasing productivity and user value
Product as a service	This business model provides an alternative to the traditional model of "buy and own." Products are used by one or many customers through a lease or pay-for-use arrangement. With a "product as a service" business model product longevity, reusability and sharing are no longer seen as cannibalization risks, but instead drivers of revenues and costs reduction

Table 15.2 The growth dimension of circular business models. *Source* Working Group Finance, 2016

Model	Explanation
Circular innovation model	These business models focus on the development phase of a business. Products are designed to last longer and be easy to maintain, repair, upgrade, refurbish, remanufacture, or recycle. Also, innovative processes are developed within the context of this model to increase the reuse of potential and recyclability of industrial and other products, by-products, and waste streams
Circular use model	These business models focus on the use phase by optimally using the product and maintaining added value. These business models make it possible to retain ownership of the product (e.g., by servicing a product rather than selling it) and/or take responsibility for the product throughout its useful life (e.g., through maintenance services, or add-ons to extend the life of a product). Product-to-service models entail a (partial or total) conversion from manufacturing (and selling) a product to offering the product in the form of a service contract
Circular output models	These business models focus on the output and added value of a product's after-use phase. In these. business models' revenue is generated by transforming after-use products into new products or use resources in order to add value, reduce costs, or reduce waste. The development of reverse logistics is essential for this model

designing and sourcing products (CIM), the use phase (CUM), and treating effects after use (COM).

For the circular use model to work, some financial issues must be addressed. The change from selling assets to providing them as a service has consequences for a company's balance sheet, working capital, and cash flows (Working Group Finance, 2016). Also, concerns of uncertainties regarding the residual value of the assets, uncertain consumer demand, the absence of legal structures, and the risks of the product as a service model are currently high for bankers. Pricing of these risks poses a problem to financial institutions which either leads to high-interest rates or non-financing of them. The challenges facing circular businesses are not as peculiar as any innovation geared toward solving society's problem always comes with skepticism and its attendant risks (Working Group Finance, 2016). These challenges present an opportunity for Islamic banks to use equity financing modes with appropriate incentives and investment protection mechanisms to structure investments into circular businesses.

15.3.1 Green Sukuk

According to Malaysia's Security Commission, green Sukuk are Shariah-compliant investment vehicles that fund environmentally friendly projects such as solar parks,

biogas plants, and wind farms. The main objective behind the development of green Sukuk is to address Shariah concerns for protecting the environment. For Shariah-compliant investors, notably in South East Asia and the Gulf Cooperation Council regions, green Sukuk represents an ideal investment that benefits the environment and promotes CSR (Alam et al., 2016). Malaysia issued green Sukuk guidelines which cover a broad range of eligible projects which include projects that aim to (a) preserve and protect the environment and natural resources; (b) conserve the use of energy; (c) promote the use of renewable energy; (d) reduce greenhouse gas emission; and (e) improve the quality of life for the society (Malaysia's Security Commission, 2017). Existing projects under several categories are deemed to be eligible to be categorized as an SRI project. This includes community and economic development projects relating to (i) public hospital/medical services; (ii) public educational services; (iii) community services; (iv) urban revitalization; (v) sustainable building projects; and (vi) affordable housing. Islamic trust and endowment (waqf) assets or any projects that undertake the development of waqf assets are also deemed eligible to be categorized under SRI. These principles are in line with the IFC green bond initiatives which addressed areas including resource efficiency, greenhouse gases, water consumption, and wastes.

Contemporary Islamic finance, in general, can use or adapt the available frameworks of the Climate Bond Initiative (CBI), the Green Bond (GB) Principles, and the Equator Principles as mechanisms to support projects seeking to fulfill Islam's environmental ethics and laws (Moghul & Safar-Aly, 2014). The CBI framework provides for a means of verification, audit, certification, and redress of stakeholder grievances. The GB Principles establish a broad and flexible set of guidelines for institutions seeking to support "green" projects. The Equator Principles urge participating financial institutions and projects toward a common goal requiring diligence, reporting, and independent review and assessment. Analysis of the scope of various green bonds and green Sukuk reveals that they are in sync with Shariah objectives, especially with a social and human emphasis.

The green Sukuk holds a vital promise that can be leveraged to achieve the QNV2030 vision. Three of the four pillars of the QNV2030 relate directly with the objectives of green Sukuk, including environmental, human, and social development. Green Sukuk can be used to support Qatar's transition toward a CE by closing the loops toward renewable energy, and this can be achieved through renewable energy investments using the green Sukuk to mobilize the investments. Green Sukuk can also be used to raise funds for investment in the waste management sector in Qatar. Achieving this will require a deliberate government policy such as a comprehensive regulatory framework for green Sukuk with incentives to attract investments into this area.

15.3.2 Blended Islamic Finance

Islamic blended finance involves blending Islamic institutions of compassion with the motive of earning Halal profits by undertaking responsible business that serves the society. This provides an opportunity to utilize Islamic social finance to promote responsible businesses or projects that are inclusive of human development, service to society, and preservation of the ecological environment and other species (Khan, 2019b).

Khan (2019b) proposes an Islamic blended finance structure to solve the waste problem facing many Muslim societies and accelerate the transition toward a CE by using a Waqf structured venture. In this regard, the study asserts that there is a need for (i) changing the businesses paradigm from linear to circular; (ii) an incorporated institutional framework for the Venture Waqf; (iii) purpose of the Waqf to make impactful small businesses successful; and (iv) designing a financial contract to loan in favor of responsible businesses that convert to equity stake for the waqf in case of default (equity-at-default) replacing collateral and foreclosure requirements. The study tackles the consciousness of businesses regarding corporate social responsibility and the design of contracts. The study argues that there are many contracts in Islamic economics which are initially compassionate such as *Kafala* (sponsorship), *Wakala* (delegated authority), *Dhaman* (guarantee), *Takaful* (mutual protection), *Tawaruq* (compassionate lending by mutual sale and purchase), *Hawala al Dayin* (transfer of debt), *Qard* (compassionate interest-free loan for Forbearance), and *Wa'd* (promise). However, given practical urgencies, these have been commercialized. It means that a social institution like Waqf has a potentially important role in harnessing the social power of these listed institutions of compassion into effective utilization. Waqf can be used purposefully for an impactful small and micro business through a venture waqf, which is proposed as an institution for the specific purpose of making the Shariah-compliant impactful small and micro businesses successful. The existing Waqf institutions collect their financial resources as waqf contributions. The paper further argues that the waqf institution established to make impactful businesses successful could blend its resources in a way that can help achieve a more significant impact. The sources of funds and other resources of the venture Waqf could be (i) interest-free loans; (ii) charitable grants; (iii) Waqf contributions; (iv) investments; (v) structured and blended financing with philanthropic organizations; (vi) voluntary service and advise; (vii) compassionate guarantees; and (viii) any other legitimate contributions.

The blending of compassion and profit motive has an unlimited scope, especially if the third element of the blending, namely the facilitating role of the government or regulator, also exists. For example, if the purpose is green energy, charitable motivation can be blended with green Sukuk. Equity at Default (EaD) is a new financing structure proposed by Khan (2019b). EaD is an interest-free loan (or any other Islamic debt creating a contract) that converts to declining equity at the trigger of a default event and hence replaces collateral requirements and foreclosure conditions. The EaD is a potentially suitable contract for the venture Waqf because the motivation

of the waqf is the success of the high-impact, socially responsible enterprise. The general trend of rising compassion can be extended to commercial banks. Current accounts are a source of significant funds in commercial banks. For example, about 85% of the total funds of some banks in Saudi Arabia come from current accounts. In the spirit of the rising global trend of compassion, and with proper regulatory oversight, part of these funds can be utilized, by banks in a venture Waqf type of activities for extending interest-free loans to needy small enterprises based on the EaD. The venture Waqf offers a blended finance modality in which fund providers and other contributors have different motivations. Some charitable funds can be used to subsidize the cost of funds in a *Murabahah* transaction for impactful businesses which are cash trapped to benefit from the interest-free loan. This allows blended Islamic finance to be used as a catalyst for achieving greater impact by combining compassionate contracts with profitable ones in a win–win situation.

15.4 The Case of the Tire Industry in Qatar

Ordinary people tend to take for granted the accumulation of used tires in a landfill, not noticing the problems that it may cause if they accidentally or deliberately catch fire. The result would be a large amount of thick dark cloud resulting from burning rubber tires with a large amount of heat, smoke, and flame. Environmentalists see those used tires sitting in landfills as an environmental time-bomb waiting to burn dangerously if it catches fire, and hence the mandate to dispose of stored and used tires in an environmentally safe and sustainable manner. Economists see the wasted tires as a possible new source of income if they can be recycled or reused for another purpose other than being a tire.

In the first section of the paper, an attempt will be made to answer the question of what can be done with the used tires in an economically sustainable and environment-friendly manner. The methodology would look at the life cycle of the tire and attempt to put the different components contained within the used tires back into the economy to extract another use of them. This is the drive for the circular economy concerning used tires as will be detailed in the following parts of this section.

The second part of this section would present the typical life cycle of a tire in a few parts of the world and will evaluate the four (4) phases of a tire from creation to disposal. The third part of this section will present best practices (i.e., shredding, retreading) and then looks at how the United Kingdom (UK) and Canada took the matter further to encourage the reuse of used tire products (new life of the tire after its end of life is reached). It will also present what the practice of the Government of Qatar in combating the tire accumulation problem is. The fourth part of this section will give the recommendations for the State of Qatar regarding the used tires' presented challenges.

15.4.1 Evaluating the Problem to Find a Solution

Current Life cycle of A Tire

Tires start with usually three (3) components which are rubber, steel wires, and filling materials. Once all those components are put together, the tire is created. The tire is placed for sale or on a new car or equipment and then used for an average period of 3–4 years, after which it is worn out due to weather conditions as well as the wear and tear factors. The usual life cycle ends when the tires are sent to remote landfills where they are stacked in piles and stored. This is what is called in economics as "Linear Economics" which is "create–use–dispose" (Fig. 15.2).

The New Life Cycle of a Tire in Circular Economy

In advanced societies, the concern for environmental impact had taken high priority over daily activities. A more focused look was made at all types of waste material that may be reused for different products other than the original one. As a result of this focus, landfills were classified into two categories.

The first category is called Municipal Waste landfill (i.e., Non-hazardous landfill) which has all that households produce as waste. This included food particles as well as other household items such as paper, metal, and glass containers. The amount of recyclable material was proven to be cost-efficient and was economically viable. Therefore, many industries by the private sector were created to make use of recycling glass, paper, and different grades and types of metals. The average user supported these industries as they reuse some of the wasted materials. A primary motive was the reduction of utilization of earth resources to save it for the future generation.

The second category of the landfill is called Industrial Landfill (i.e., Hazardous landfill) to differentiate it from the first type, as the second category is catered mainly for industrial and commercial waste products and has unique lining material to prevent hazardous material from seeping into the groundwater below the landfill. Generally, municipal authorities prepare a dump to receive and store the used tires which are segregated from the Municipal Waste landfill as there are not any apparent dangers from the tires to the groundwater.

In the new life cycle of a tire, the used tires are shredded into their main three components. Those components are used in other industries which makes the material movement circular as in create–use–reuse and hence the name circular economy (Fig. 15.3).

Fig. 15.2 Current life cycle of a tire. *Source* Authors own

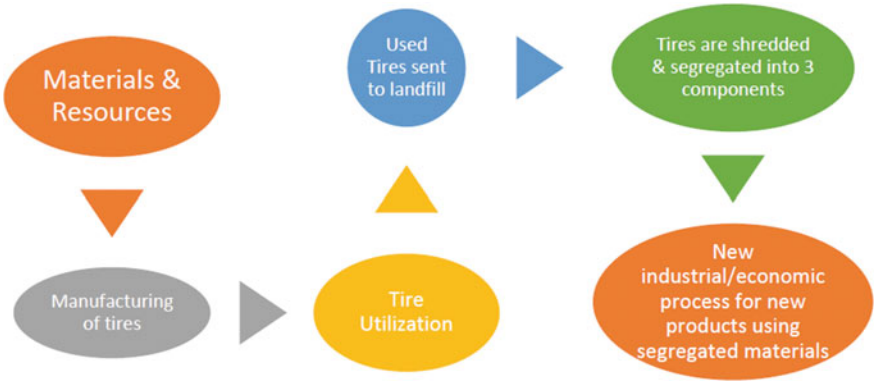

Fig. 15.3 New circular economy for tires. *Source* Authors own

15.4.2 Evaluating the Life Cycle of Rubber Tire

In evaluating the life cycle of rubber tire, it is necessary to get familiar with the materials that constitute the tire, the manufacturing process, the merchandising and importing of the product, its use once it is bought, and its final disposal scheme once the tire had been used and either got worn out or damaged. As such, we will evaluate four (4) subsections below to highlight each part of the tire life cycle.

Rubber Tire Materials

Rubber tires are composed of mainly two parts. The first is the rubber compounds, which are related to the subject of this study, and the second is reinforcement materials.

As per the report entitled The Pneumatic Tire (National Highway Traffic Safety Administration, 2006), the rubber compounds are divided into five (5) main components, which constitute the majority of the rubber tires produced for transportation. The report (2006) presents that the main component here is the polymers consisting mainly of natural or synthetic rubber, with fillers such as carbon black or silica to strengthen the rubber compounds. The report (2006) further presents the softeners such as petroleum oils, pine tar, and resins which are added to the mix with antidegradants such as waxes, antioxidants, and antiozonants to help protect tires against deterioration by ozone, oxygen, and heat. The report (2006) shows that the final ingredient is the curative such as sulfur and other accelerators and activator material to create the final strong and elastic material.

Airplanes tires used in the landing gear assembly have a different composition which makes them not only more durable but also extremely expensive. However, after using those tires, they are generally sent for the special process, where a new tire is created from part of the old tires. Thus, these types of tires would be the exception to the usual case of tires made for cars and equipment.

Manufacturing Tires

Once tires are manufactured, they are placed in the economy cycle as goods. Research by Workman (2018) had shown that global sales from new rubber tire exports by the country amounted to US$ 74.7 billion in 2017.

According to Workman (2018), Rubber & Plastic News publishes an annual ranking of the world's top tire makers, and the top ten (10) rubber tire manufacturing companies, which were responsible for two-thirds (67%) of global tire sales, are

- Bridgestone Corp (Japan),
- Michelin (France),
- Goodyear Tire and Rubber Company (United States),
- Continental AG (Germany),
- Pirelli & C. SpA (Italy),
- Sumitomo Rubber Industries, Ltd (Japan),
- Hankook Tire Group (South Korea),
- Yokohama Rubber Company, Ltd (Japan),
- Cheng Shin Rubber Industry Co Ltd (Taiwan), and
- Hangzhou Zhongce Rubber Co, Ltd (China).

Merchandising, Exporting, and Importing Tires

Almost every country in the world imports certain quantities of tires for the replacement of used tires for cars, buses, agricultural cranes, and other equipment that have tires as a means of mobility. Quantum Engineering (2018) article entitled "Tyer recycling in Qatar" reported that in Qatar, the Statistics Authority (QSA) on average imports roughly 913,000 tires a year, and that some 488,000 vehicles were registered in the country in 2009. The QSA said its tire import figures were based on the assumption that two tires were brought into the country per registered vehicle. The article (2018) stated that in 2010, over a million tires were imported and more than 70% of them were for automobile cars.

Tire Use and its Final Disposal

Tires are bought to be installed on new cars, buses, and equipment. Tires are also bought to replace the existing tires on cars, buses, and equipment once they are worn out or damaged. The old tires are normally sent to a landfill. This raises the question of how many tires are replaced per year and if it is economically viable to start a recycling industry for old tires. According to the article (2018), from a QSA source, at least 1.9 million used-up tires are discarded in Qatar as scrap every 2–4 years, with the virtual age of a tire being about 3 years.

15.4.3 Analysis of Viable Solutions for Tire Accumulation Problem

As tires have the stored capacity of producing intensive dark polluting smoke as well as radiant heat in case it catches fire, the solutions to the accumulation problem of old tires should be both economically viable and environmentally friendly for it to be placed in the cycle of the circular economy. This part will evaluate the best practices in the developed countries and then focus on soft and hard laws in the UK and Province of Ontario, respectively. It will conclude with an evaluation at what stage the State of Qatar is and give recommendations based on best practices.

Best Practice—Shredding

One of the best practices around the world is to shred the tire in a special shredder machine (see photo 1) which extracts the steel and fibers from the tire and then shreds the tire into powder-like material called "rubber crumb" (refer to photo 2). The rubber crumb is used in new products such as in the rubbery coating on the running asphalt layers in sports clubs (refer to photo 3 and in particular the orange layer on top of the asphalt panel). The rubber crumb is also used to produce the rubber brick tiles (see the greenish brick tile in photo 3 and the tiles in photo 4). This type of rubber brick is gaining popularity now through its use for children's playgrounds to reduce the harm to children when they fall.

Photo 1

Photo 2

Photo 3

Photo 4

Shredding rubber tires means that a surplus of fibers and steel wires that are included originally in the tire must be extracted before the shredding process takes place. The fibers can be reused in the production of new tires, but the steel wires can be used in another industry because it is not viable to use them again in the tire manufacturing process.

Best Practice—Retreading

Another best practice that is widely used in industrialized nations is the retreading option for massive duty tires (i.e., heavy trucks and aircraft). As per the research conducted by the tire manufacturer Michelin (2018), retreading involves giving a lease of new life to a worn tire to minimize the use of raw materials without compromising safety. The Michelin research (2018) explains that once truck and aircraft tires come to the end of their life cycle, their casing structure is retained and their tread—the part of the tire in contact with the ground—is replaced (see photo 5). The research specifies that a truck tire designed for retreading can be retreaded twice which means it can be used to cover 660,000 km whereas its initial lifespan would only cover 220,000 km according to an independent study drawn up by EY (2016).

As the research explains that the environmental benefits of retreading are substantial and when compared to an entry-level tire that it cannot be retreaded, for example, a retreaded tire makes it possible to save 24% CO_2 emissions and 70% natural resource extraction because the steel casing is reused! A retreaded tire also means less waste to recycle.

The research stated that from a socio-economic perspective, the retreading industry supports 32,000 jobs in Europe, including 4,000 in France. The research further says that at equivalent use, a retreaded tire generates 4.3 times more jobs than a tire that cannot be retreaded, since, in addition to the actual retreading operations, associated maintenance and logistics services are also provided (collection, inspection, maintenance, and distribution). The research states finally that a tire which lasts two and sometimes even three times longer and costs 40% less per kilometer than a new tire enables customers to make significant savings.

The option of retreading is a viable option for countries that have the manufacturing industries of tires or have heavy consumption of tires that are geared for aircraft or trucks.

Canada Best Practice

Although Canada has the practice of shredding, and retreading, the Province of Ontario in Canada had gone one extra step. The Province had introduced new legislation entitled the Resource Recovery and Circular Economy Act (RRCEA) (2016). This act made headlines as it made the Province of Ontario the pioneer in governing tire recycling.

The reasons for this legislation are stated in Article (2) Provisional Interest which states:

> It is in the provincial interest that Ontario have a system of resource recovery and waste reduction that aims to:
>
> (a) protect the natural environment and human health;
> (b) foster the continued growth and development of the circular economy;
> (c) minimize greenhouse gas emissions resulting from resource recovery activities and waste reduction activities;
> (d) minimize the generation of waste, including waste from products and packaging;
> (e) increase the durability, reusability and recyclability of products and packaging;
> (f) hold persons responsible for the design of products and packaging on how to handle the products and packaging at the end of thier life
> (g) decrease hazardous and toxic substances in products and packaging;
> (h) minimize the need for waste disposal;

(i) minimize the environmental impacts that result from resource recovery activities and waste reduction activities, including from waste disposal;

(j) provide efficient, effective, convenient and reliable services related to resource recovery and waste reduction, including waste management services;

(k) increase the reuse and recycling of waste across all sectors of the economy;

(l) increase opportunities and markets for recovered resources;

(m) promote public education and awareness with respect to resource recovery and waste reduction;

(n) promote cooperation and coordination among various persons and entities involved in resource recovery activities and waste reduction activities;

(o) promote competition in the provision of resource recovery services and waste reduction services;

(p) foster fairness for consumers;

(q) do any other related thing that may be prescribed.

We can appreciate the concerns behind this legislation as paras (a), (c), (d), (e), (g), (h), (i), (j), and (k) give a clear mandate of the environmental concerns as the reason behind the Province of Ontario's main interest.

Under the new legislation (RRCEA, 2016), obligated companies will be accountable for ensuring that their share of used tires is recovered and recycled according to standards set by the government, and failure to comply may result in significant fines. RRCEA (2016) established a new regulatory agency called the Resource Productivity and Recovery Authority to enforce the new legislation.

As reported by eTRACKS website (2018) explaining the Canada Used Tire Program, effective January 1, 2019, the new producer responsibility model under the RRCEA will begin and under the new individual producer responsibility framework put in place by the Tires Regulation, used tires will have to be collected, hauled, and then reused, retreaded, or processed for recycling. eTRACKS (2018) in the explaining of the program presented key changes under the new framework which include the following:

- Tire collection and management systems will have to be established by each producer.
- Each producer will have to either make their own arrangements to collect and manage tires to meet their mandatory targets or retain the services of one or more Producer Responsibility Organizations (PROs) to act on their behalf.
- There will be compliance consequences for the failure to meet collection and resource recovery targets.

The enforcement of this legislation (RRCEA, 2018) came with hefty fines in case an offence was committed, as we can see penalty applies in Part V (Enforcement) Article 98 (Offences), Clause 7 which addresses the Penalty for an individual:

An individual who is guilty of an offence under this section is liable, on conviction,

(a) in the case of a first conviction, to a fine of not more than $50,000 for each day or part of a day on which the offence occurs or continues; and

(b) in the case of a subsequent conviction, to a fine of not more than $100,000 for each day or part of a day on which the offence occurs or continues.

For the corporation, Part V (Enforcement), Article 98 (Offences), Clause (8) addressed the Penalty for the corporation which states that:

A corporation that is guilty of an offence under this section is liable, on conviction,

(a) in the case of a first conviction, to a fine of not more than $250,000 for each day or part of a day on which the offence occurs or continues; and

(b) in the case of a subsequent conviction, to a fine of not more than $500,000 for each day or part of a day on which the offence occurs or continues.

The above shows clearly the motivation and the mechanism of enforcement of the new legislation which is not only environmentally friendly but also hinges on the circular economy process to develop more sustainable economic activities.

This type of legislation is unique to the Province of Ontario, and some may argue that such legislation may drive away businesses, but three counter arguments can be presented. The first is that established manufacturers may find it difficult to relocate the business outside Ontario due to all the established logistical and distribution networks. The second argument is that manufacturers that do succeed in moving their establishments outside the Province of Ontario will have a negative picture for the public due to a lack of social responsibility to the environment protection. The third argument is that the new legislation is going to create an opportunity for the creation of new service companies that will serve to aid the big established manufacturers to carry out their obligations.

United Kingdom Best Practice

In the United Kingdom (UK), the Tire Recovery Association (TRA, 2014) considered UK restricted by EU regulations and directives, as the UK being a member of the European Union (EU). As such, it is confusing when it comes to the meaning of Article 3(1) of EU directives which set out the EU Waste Framework Directive (2008/98/EC) regarding the point at which waste has been fully recovered and ceases to be waste within the meaning of the Article.

The TRA (2014) presented the interpretation of EU legislation ultimately becoming a matter for the Courts and based on the case that was developed on the interpretation of the definition of waste, the UK came up with a quality protocol (PAS 107 QP) which sets out the end of waste criteria for the production and use of a product from a specific waste type. The TRA (2014) further stated that the quality protocol indicates how compliance may be demonstrated and points to good practice for the storage, handling, application, and use of the fully recovered product.

TRA (2014) stated that PAS 107 QP confers end of waste status when the material ceases to become waste and becomes a product, therefore no longer falling under waste regulations and is designated applications below, where final end uses of used tires can be implemented in the following twelve (12) sectors:

(a) Construction

- Noise insulation/acoustic barrier material;
- Thermal insulation;
- Composite boards and sheets; or
- Rubberized adhesives and mastics.

(b) Civil engineering (unbound applications)

- Replacement aggregate in the construction of road infrastructure, as roadbed stabilizer, slope stabilizer, bridge abutments, and as an additive for rubberized asphalt; or
- Low-weight soil replacement for embankments over compressive terrain.

(c) Loose (unbound) material in the surfacing of footpaths, nature trails, cycle paths, bridleways, roads, and railways as ballast Civil engineering (bound applications)

- Replacement aggregate in the construction and building industry, e.g., use in block fabrication;
- Bound material in the surfacing of footpaths, nature trails, cycle paths, bridleways, roads, and railways as ballast;
- Rubber replacement aggregate in concrete for architectural applications;
- Compressible rubber sheet for the alleviation of subterranean ground movement alongside buried structures;
- Bound rubberized product, e.g., wall and floor boarding, street furniture (e.g., seating and signposts); or
- Marine reefs.

(d) Landfill engineering

- As a replacement aggregate in the construction of landfill sites (e.g., drainage layer).

(e) Landscaping

- Walkways; or
- Turf/ground reinforcement.

(f) Equestrian

- Bedding/floors; or
- Ménage and gallops.

(g) Play surfaces

- Unbound material in sports surfacing, e.g., rubber playground mulch;

- Unbound material in recreation and safety surfacing, e.g., playground surfaces; or
- As bound material in safety surface matting.

(h) Sports surfaces

- Unbound material in sports surfacing, e.g., artificial turf, racecourses, equestrian surfaces, and running tracks;
- Unbound material in recreation and safety surfacing, e.g., nature trails, bridleways, and cycle trails; or
- Bound material in anti-vibration matting and impact protection barriers.

(i) Home Products

- Footwear;
- Carpet underlay; or
- Mouse mats.

(j) Automotive

- Vehicle bumpers, floor mats, insulation, vehicle components; or
- New tire raw material.

(k) Industrial

- Safety surfacing;
- Belting, matting, membranes, air-conditioning mats;
- Sealants; or
- Adhesives and mastics.

(l) Transport/traffic

The British quality protocol opens the door for various utilization methods of the used tires in the UK when it comes to shredding, retreading, or other reuses. This guide can be used by many countries if they have the technology to convert tires from end of life (of normal use) to another new life.

Qatar Practice.

For many years, used tires in Qatar were sent to the Umm Al Afai landfill. It is estimated that the Umm Al Afai landfill area contains well over 8 million pieces of old tires, which means a large catastrophic event if one of those tires' piles caught fire.


Photo 6 – Umm Al Afai Landfill

In addition to the accumulated used tires in Umm Al Afai, Qatar is a user-state of tires (and not manufacturer-state of tires), and it imports all of its annual needs of tires from abroad. The below table (Table 15.3) had been extracted and is a summary of the report by State of Qatar Development & Statistics Authority, which outlines the quantities of tire imports to Qatar.

To mitigate the environmental risks from the accumulated tires, the choice was made to encourage the sustainable solution of shredding the tires to produce rubber crumbs which can be used in industries. By shredding used tires, the balance of the accumulated tires will reduce, and the more the tires are shredded, the less is the environmental risk. As stated earlier, the rubber crumb is the necessary ingredients for commercial flooring, sports activities top surfaces, and playground tile bricks (refer to photos 1, 2, 3, and 4). Most of the rubber crumb produced in Qatar is shipped overseas for large industrial manufacturers.

As a consequence of the mitigating policy, recycling industries were encouraged by offering free plots' lease for such recycling industries. The offered plots were to be established through coordination between ministries of environment and municipal affairs (now both ministries had been merged into one ministry). The space area dedicated for those industries was in the same area of Umm Al Afai landfill to

Table 15.3 Total Imported Quantities of Tires in Qatar.

	2015	2016	2017	2018 (September)
Total Imported Quantity (Mil)	1.7	1.9	2.0	1.7

Source Al-Ansari (2019)

reduce the transportation logistics and to make use of the large surplus of old tires which can be converted into a useful product or by-product and thus can be recycled back into the economy.


Photo 7 – One of the Tire Shredding Industries in Umm Al Afai

In 2010, two industries in Umm Al Afai operated in the shredding business and selling of the rubber crumbs to many clients overseas. The next plan of the Government was to increase the number of the industries in this business to seven (7) industries and accordingly, the appropriate land plots were assigned and reserved for those industries in the same area (Umm Al Afai). However, despite the vast international interest, the five additional industries did not materialize after one round of government bidding.

Currently, the Umm Al Afai landfill had been closed since 2013, and the used tires along with other domestic landfill materials had been diverted to another new landfill "Rawdat Rashid".

15.4.4 Recommendations for the Government of Qatar

The following two recommendations are based on the findings of what was discussed in the previous sections (in order not to reinvent the wheel). The Government of State of Qatar (the Government) can make use of international best practices to position itself in a truly circular economy position when it comes to used tires.

First Recommendations

To continue on the path of the circular economy (i.e., the true circular economy), the Government should invest in the research and development of reusing all the waste of the tire-shredding process (i.e., fibers and steel wires—see photo 8). At this time, only the rubber crumbs that are resulting from the shredding process of the used tires are used on a small-scale private commercial basis. The shredding process had been encouraged to remove mainly the environmental threat of having a large number of used tires piled in a landfill, which can be subject to a catastrophic fire incident.

Now that the threat had been reduced, it is time to think about how to invest this fortune of fiber and steel wires in an existing or new industry which can be researched through universities and research centers. The steel wires should be evaluated for economic feasibility if they can be sent to tire manufacturers.

Similar to UK guide PAS 107 QP, the Government should instruct its local research centers to evaluate the possibility of the use of rubber crumbs in the 12 sectors specified by the guide (playgrounds, sports ground, landfill drainage layer…etc.). This will be the foundation for a new Qatari Code on the use of old tires to exchange the threat of used tires into an opportunity following circular economy processes for each component that is extracted from the old tires. It is also recommended for the Government to follow the path of Canada and introduce legislation to oblige the tire distributors here in Qatar, to be responsible for the used tires that they distribute or sell. For example, the Goodyear tires distributor would be responsible for all the used tires from that brand. Similarly, the Michelin tires (and other brands) distributor would be responsible for all the used tires from that brand. The distributor can manage the used tires himself or use one of the industries that reuses the tires by converting the tires to different products (such as shredding for small tires or retreading when it comes to heavy machinery tires).

Photo 8 – Fibers and steel wires

This would be the ideal methodology along with the shredding process for industries to remove the surplus of the accumulated tires in the landfills. As we have seen, shredding and utilization of the rubber crumbs are ongoing in the State of Qatar (at the time of writing the article).

The responsibility of the tire distributors does not end when the used tire is converted to rubber crumbs. Still, it stops when that particular quantity of rubber crumbs had been utilized or exported, and documented evidence of the same had been authenticated and produced to the responsible department in the Government.

Second Recommendation—New Law for Circular Economy for the State of Qatar

Stated below (Table 15.4) is a draft of a new law for the Government of the State of Qatar to consider implementing and to build upon to position the State in a truly circular economy when it comes to the utilization of tires and reducing pollution. It may also open the door for new industries and services that will add to the life cycle of a standard tire, and at the same time have a positive impact on the local economy.

Table 15.4 Proposal draft new law for tire recovery and circular economy

Proposal Draft New Law for Tire Recovery and Circular Economy
We Tamim Bin Hamad Bin Khalifa Al- Thani, Emir of the State of Qatar
Having considered the Constitution of the State of Qatar
Decree- Law No. 8 of 1974 on Public Hygiene and amending laws thereof
Law No. 3 of 1975 on the Commercial, Industrial and Public Premises, and amending laws thereof
Decree -Law No. 4 of 1977 on the Conservation of Petroleum Resources
Law No. 10 of 1987 on the Public and Private Property and amending laws thereof
Law No. 19 of 1995 on the Organization of Industry
Law No. 13 of 1997 on the Civil Defense
Decree No. 51 of 1988 ratifying the accession of the State of Qatar to the International
Oil Pollution Compensation Funds (IOPC Funds), Brussels 1971
Decree No. 52 of 1988 ratifying the accession of the State of Qatar to the International
Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties
Brussels 1969 and its annexes
Decree No. 53 of 1988 ratifying the accession of the State of Qatar to the International
Convention on Civil Liability for Oil Pollution Damage, Brussels, 1969 as amended by the
Protocol of 1976
Decree No. 55 of 1992 on the Protocol of Marine Environment Protection from Land-
Based Sources
Decree No. 15 of 1996 ratifying the accession of the State of Qatar to Basel Convention
on the Control of Transboundary Movements of Hazardous Wastes and their Disposal
Decree No. 47 of 1996 ratifying the accession of the State of Qatar to the Protocol on
the UN Framework Convention on Climate Change
Decree No. 90 of 1996 ratifying the accession of the State of Qatar to the Convention on
Biodiversity of 1992
Decree No. 23 of 1999 ratifying the accession of the State of Qatar to the Vienna
Convention on the Protection of the Ozone Layer (1985) and the Montreal Protocol on

(continued)

Table 15.4 (continued)

Proposal Draft New Law for Tire Recovery and Circular Economy
Substances that Deplete the Ozone Layer 1987 and its amendments for the years 1990 and 1992
Decree No. 29 of 1999 ratifying the accession of the State of Qatar to the UN
Convention to Combat Desertification in those Countries Experiencing Serious Drought/
Desertification, particularly in Africa;
The Council of Ministers Resolution No. 17 of 1998 establishing the Permanent
Contingency Committee and amendments thereof
Law No. 30 of 2002, promulgating the law of the environment protection
Hereby promulgate the following Law:
Article 1 Introduction
The provision of the Law on the Obligation of Tire Distributors in Qatar attached herein shall come into force
Article 2 Introduction
The Establishments present at the time the present Law comes into force shall conciliate their situations according to the provisions of the present Law within one year from the date the provision of the Executive Directive thereof came into force
Article 3 Introduction
Any provision not complying with the provisions of the annexed law shall be repealed
Article 4 Introduction
All competent authorities, each within its jurisdiction, shall implement the provisions of this Law, which shall come into force one year from the date of publication in the Official Gazette
Article Definitions
Ministry Ministry of Municipality & Environment
Entity corporation or company, limited or unlimited (registered in the State of Qatar)
The "*Land-Based Sources*" means the fixed and mobile municipal, industrial, agricultural sources on land and on which drainage is Discharged in the Marine Environment
"*Environment Pollution*" means any changes in the Environment characteristics, which may lead directly or indirectly to upsetting living organisms damaging structures or affecting the practicing of natural life by humankind
"*Pollution Standard ('PS')*" means the annual average of the maximum limit of pollutant concentration allowed in different habitats. Without prejudicing the annual average value, the maximum limit shall not be exceeded within one continuous hour time
"*Degradation of the Environment*" means the effect on the Environment that reduces the value, or distorts the habitats, or exhausts the resources, or damages both the living and non-living resources thereof
The "*Environmental Disaster*" means an accident caused by natural or man-made factors, which results in great damage to the Environment
"*Environment Protection*" means the conservation of the environmental habitats; upgrading, preventing degradation or pollution thereof; or alleviating pollution severity. The habitats include the atmosphere, seas, and inland waters, including the groundwater, natural habitats and reserves, and other natural resources

(continued)

Table 15.4 (continued)

Proposal Draft New Law for Tire Recovery and Circular Economy
Article 6 Purpose and State interest
It is in the primary interest of the State of Qatar to have a system of resource recovery and waste reduction that aims to
(a) protect the natural environment and human health
(b) foster the continued growth and development of the circular economy
(c) minimize greenhouse gas emissions resulting from resource recovery activities and waste reduction activities;
(d) minimize the generation of waste, including waste from products and packaging
(e) increase the durability, reusability, and recyclability of products and packaging
(f) hold persons who are most responsible for the design of products and packaging responsible for the products and packaging at the end of life
(g) decrease hazardous and toxic substances in products and packaging
(h) minimize the need for waste disposal
(i) minimize the environmental impacts that result from resource recovery activities and waste reduction activities, including from waste disposal
(j) provide efficient, effective, convenient, and reliable services related to resource recovery and waste reduction, including waste management services
(k) increase the reuse and recycling of waste across all sectors of the economy
(l) increase opportunities and markets for recovered resources
(m) promote public education and awareness with respect to resource recovery and waste reduction
(n) promote cooperation and coordination among various persons and entities involved in resource recovery activities and waste reduction activities
(o) promote competition in the provision of resource recovery services and waste reduction services
(p) foster fairness for consumers
(q) do any other related thing that may be prescribed
Article 7 Provisions
(a) All the tire distributors or manufacturers in the State of Qatar must register with the Ministry
(b) All the tire distributors or manufacturers must report to the Ministry on the annual basis of the amount, quantities of tires imported and sold in every calendar year commencing from 2019
(c) All the tire distributors or manufacturers are responsible for the collection system of used tires for the tire brand(s) they distribute
(d) All the tire distributors or manufacturers are responsible to either make their own arrangements to collect and manage tires to meet their mandatory targets or retain the services of one or more Producer Responsibility Organizations to act on their behalf
(e) All the tire distributors or manufacturers are responsible to get a certificate from the recycling industries in Qatar, or through a third party, that the quantities of tires collected on an annual basis had been fully reused

(continued)

Table 15.4 (continued)

Proposal Draft New Law for Tire Recovery and Circular Economy
(f) All the tire distributors or manufacturers are responsible for establishing and operating a collection system for distributed or produced materials in a designated class in accordance with the prescribed requirements
Article 8 Penalties
Individual: Without prejudice to any other law carrying a more severe penalty, it is punishable by a fine not in excess of one-hundred thousand (100,000) Riyals, for anyone who violates any of the provisions of this law. The penalty for a recurring infraction is a fine of no less than two hundred thousand (200,000) Riyals
Entity: Without prejudice to any other law carrying a more severe penalty, it is punishable by a fine not in excess of three hundred thousand (300,000) Riyals, for any entity who violates any of the provisions of this law. The penalty for a recurring infraction of any entity is a fine of no less than six hundred thousand (600,000) Riyals

Source Authors own

15.5 Aligning Islamic Finance Practice to Support Circular Economic Growth in Qatar

The tire industry is one of the many areas where opportunities exist for circular economic growth. Circular economic growth is even more important in the case of Qatar, looking at the unique challenges faced by the country when it comes to the environment. Brook et al. (2006) report that Qatar is characterized by high temperature, low rainfall, strong winds, and low nutrient availability of the soil. This means that the recovery of the terrestrial ecosystems from disturbance is prolonged. The country is seen as one of the most hostile and fragile environments on earth (Richer, 2009). The environmental fragility has been worsened by the rapid industrialization and high population growth that has occurred in Qatar in the past few decades. (Luomi, 2012). As the vast energy producer in the world, Qatar's carbon footprint has been high, which is reported at 13.09 global hectares per person (GHP) in 2016 compared to world's 1.6 GHP. Figure 15.4 shows that while the average carbon footprint in the world is 1.6 GHP, most developed countries' carbon footprint is higher with Germany, the United Kingdom, and Sweden estimated at 2.79, 3.19, and 3.28, respectively. Although Saudi Arabia also produces much energy, its carbon footprint stood at 5.11, owing to its relatively high population. In terms of overall ecological footprint which captures carbon footprint, fishing ground, cropland, forestry, grazing land, and built-up, Qatar is ranked highest of close to 15 GHP. Thus, it is more than twice the score of 6.23 GHP of Saudi Arabia and far higher than the world average of 2.75 GHP. Qatar has taken steps to tackle the increased carbon emissions by reducing flaring by registering Qatar Petroleum for the first United Nations Clean Development Mechanism (CDM) project under the Kyoto protocol in the Gulf region (CDM, 2007). Also, water availability has been one of the critical issues of increasing industrialization, and the concomitant population increase is limiting the availability of water. Qatar is well below the World Bank's "water poverty line" of 1000 cubic

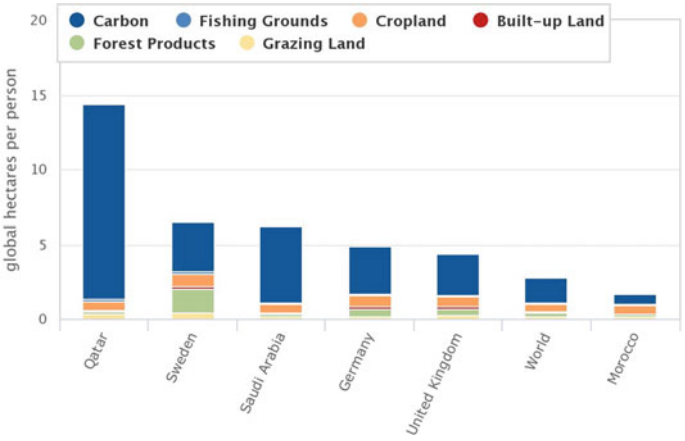

Fig. 15.4 Ecological footprint of some countries for the year 2016. *Source* Adopted from global foot network (2019)

meters per person per year, with only an average of 91 cubic meters available per person per year (El-Sayed Selim, 2004). The annual per capita water from rainfall and groundwater is 71 m^3, while the average demand for life sustenance is around 1000 m^3 per annum (Darwish & Mohtar, 2013). The situation in Qatar is critical as the rainfall water source is below the average in the Arab region of 850 and 7000 m^3 of the world (Sadik, 2013). Almost 75% of Qatar's municipal water supply is being produced by desalination, which comes with high energy consumption, and this creates a huge environmental burden (Mannan et al., 2019).

In 2012, Qatar was ranked as the country with the world's highest ecological footprint (Barrett et al., 2018). The biannual report investigates biodiversity and ecosystems, as well as the demands on natural resources, and what this means for humans and wildlife. According to it, if all the people on the planet had the per capita ecological footprint of the average resident of Qatar, 4.8 planets would be needed to sustain the total population. Marine biodiversity is threatened by population and urban growth, construction activities, industrialization, international shipping, overfishing, overgrazing, and climate change. According to the Global Footprint Network report for 2019, the ecological reserve in Qatar vanished after 1981 due to increases in its ecological footprint driven largely by increased resource consumption. This trend has been followed by a decreasing biocapacity over the years, leading to a yawning ecological deficit over the years (see Figs. 15.4 and 15.5). This means that if the trend continues, Qatar will increasingly depend on other nations to meet its economic needs as domestic resources cannot support the country, and this raises substantial sustainability concerns and the need to maximize resource use by adopting measures including circular businesses toward a zero-waste economy.

The environmental vulnerabilities of Qatar call for an urgent need to balance its natural resource use with the local environment and ecosystem limits to ensure prosperity for its people and the environment far into the future.

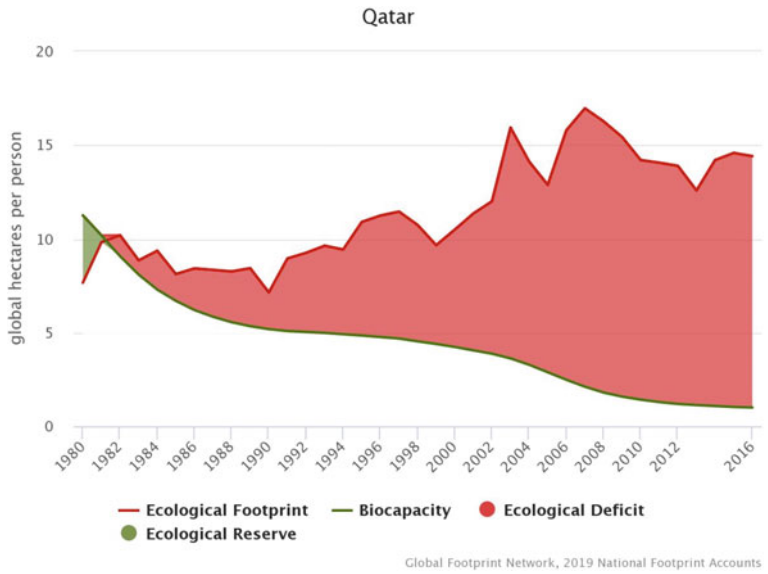

Fig. 15.5 Ecological footprint and biocapacity. *Source* Adopted from Global Foot Network (2019)

The National Development Strategy (NDS) outlines the environmental challenges facing Qatar and the strategies for addressing these challenges. The NDS defines waste management as a critical challenge: 7,000 tones of solid waste are created daily in Qatar (4.1 kg/per capita), of which 30% is domestic waste, and only 8% is recycled.

While all sources of water (desalinated, recycled, and groundwater) suffer from inefficiencies, desalination is regarded as the most challenging: by 2020, demand is expected to rise by 5–7% per year, driven by population growth, distribution losses, and higher household use.

The NDS recognizes that, despite Qatar's robust domestic energy security situation, the opportunity cost of domestic power production is high. It also notes that certainty of supply and lower greenhouse gas emissions are additional gains from increased energy efficiency. The strategy stresses that the current wasteful consumption patterns of energy and water need to be "better managed" for the sake of intergenerational justice.

Circular businesses like the tire industry, plastics recycling, and others need attention from policymakers within the scope of impacting positively on the Qatari economy by ensuring that economic growth can be decoupled from resource use. The impactful business is geared at achieving the dual purpose of economic diversification in Qatar through circular business and promoting human well-being through sustainable economic growth by leveraging Islamic blended finance to attract both public and private investments in the circular business sector.

A careful analysis of the Qatar National Vision 2030 reveals that the tenets of impact investing, which can be used to attract investment into CE businesses, are captured in the document. The preamble of the QNV2030 is couched "The National Vision aims at transforming Qatar into an advanced country by 2030, capable of sustaining its development and providing for a high standard of living for all of its people for generations to come". The QNV2030 vision is anchored in four core pillars of human development, social development, economic development, and environmental development. Transitioning to a CE within the QNV2030 will achieve accelerated growth with minimal resource use as CE unleashes growth within. Sequel to this, it is estimated that circular economic growth can benefit Europe by €1.8 trillion by 2030, twice the benefit of the current development path, and CO_2 emission reduction by 48% by 2030 (Shulze, 2016). This shows the vast potential that underlies circular economic growth pursuit.

Diversifying Qatar's economy requires exploring markets beyond Qatar to benefit from economies of scale as Qatar's market is relatively small. To achieve this will require promoting start-ups and SMEs in Qatar with a global mindset. Various circular businesses within the various models can be developed as business propositions. It is essential to recognize that attracting entrepreneurs into this sector will go beyond Qatar if the right ecosystem prevails in Qatar. This will require a massive amount of financing at the initial stages to develop the market. In this regard, there needs to be a strategy to finance and attract investments in this sector. Public financing alone will not be sufficient and needs private funding. This affords Qatar Development Bank (QDB) and Qatar Fund for Development (QFD) to play a role in catalyzing the market take-off by working with their mandates to develop both the domestic and international markets, respectively.

There must be a strategy to attract and develop a secular economy ecosystem in Qatar and outside Qatar, and Fig. 15.6 presents the ecosystem matrix. The development of impactful business with a focus on economic diversification through CE will create opportunities for the various stakeholders including Qatar Development Bank, Qatar Fund for Development, Islamic banks, conventional banks, government, investors, students, Qatar Charity, and so on to collaborate to offer to finance the circular business. The various stakeholders in the industry are presented in Fig. 15.7.

Qatar Development Bank can play the role of providing some financial guarantees for investors by working with Qatar Charity in this regard. Third-party guarantees will help attract funding from Islamic banks such that the compassionate Islamic finance contract will be used to help build businesses and grow SMEs that are pursuing circular business missions. They can also provide subsidies for the cost of funds through a blended *Murabaha* arrangement with banks that may want to advance financing to start-ups and SMEs. There can be various innovative financing arrangements such as *Qard* with profit such that the SMEs' shares of profit with the Islamic bank or any bank in case of profit is declared but pays only the principal when there is no profit. This may be controversial to some Shariah scholars, but it will also be an opportunity for Islamic banks to blend compassion with profitability.

Supporting the market development will require a mentorship, business advisory, and general incubation services, and these can be provided through Qatar Incubation

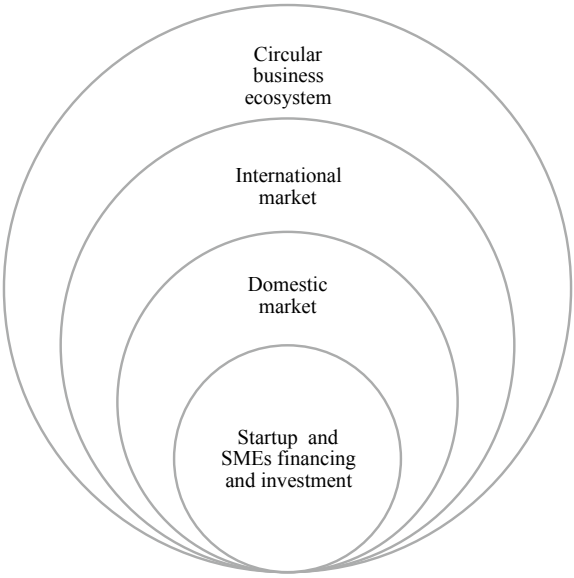

Fig. 15.6 Circular business ecosystem. *Source* Adopted from Ibrahim and Shirazi (2020)

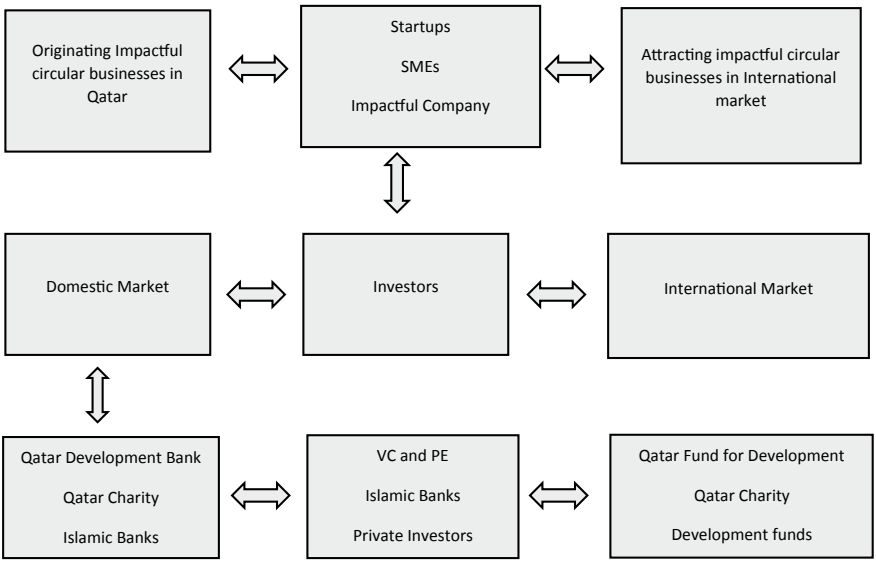

Fig. 15.7 Structure and Stakeholders in the Circular Business Ecosystem. *Source* Adopted from Ibrahim and Shirazi (2020)

Center, Qatar Science and Technology Park, and the like with partnership with QDB. At the international level, Qatar has to be attractive for attracting top-notch talents and start-ups to start businesses, including circular businesses. Likewise, the domestic companies that can build their business competencies will be ready to go global. There is a potential to develop circular businesses in the international market, especially waste management. Qatar entrepreneurs can even export waste to other countries or launch a waste exchange where waste is traded. What QFD can do is to have an interest in catalyzing private investments into developed and developing countries by funding joint feasibility and scientific inquiry in collaboration with Qatar-based researchers and innovators. Figure 15.6 presents the circular business ecosystem which has domestic and international dimensions, which both are converging toward building start-ups and SMEs' sector. Innovative Start-ups and SMEs will originate circular businesses at both domestic and international arenas. Investors must fund this business as an impactful business; government-backed institutions can play a role. Domestic funding can be raised from QDB, QC, and Islamic banks. QFD, QC, and other development funds can play a role in fostering international circular business in Qatar, including VC, PE, private investors, and IB.

15.6 Conclusion

The linear economy principles if remain the norm of business practices and consumption patterns, the outcome is likely to be shortages of certain materials, growing price volatility, and continued environmental degradation. Tackling this challenge requires a new economic paradigm of the CE, and Islamic finance has a role to play in the transition toward the CE. The study explores ways Islamic finance can support circular businesses and more specifically, how it can be used to help Qatar transition to a CE.

The QNV2030 dedicates one of its four pillars to environmental development owing to the resource constraints and the biocapacity deficit experienced in Qatar over the years. When it comes to real-life example, we have seen in this study that at the end of life of a particular product, a tire can be converted to a new life that can then enter the cycle of economy for further use instead of going to waste or in a landfill. The best practices surveyed in the UK showed various utilizations of the used tires which will render the tire to an economic item with a value, which is one of the methods to have a circular economy. We have also seen that the best practice in Ontario Province in Canada is that the Government had elected to impose a new obligation and responsibility on the tire producer or manufacturer, which oblige them to pursue each tire being produced at the end of the life cycle of that tire. There are options now for massive machinery tires was the retreading which promises to reduce the accumulation of used tires through the removal of the old used treads of the tire and install new one fused to the tire structure and casing.

One of the easiest to implement soft law in Qatar is by introducing a guide to encourage the utilization of rubber crumbs similar to the route taken by the UK who produced a guideline, which enables the use of used tires in the 12 sectors specified.

It is also recommended for the Government of Qatar to follow the path of Canada and introduce legislation to obligate the tire distributors (or manufacturers in the future) here in Qatar, to be responsible for the used tires that they distribute or sell. The responsibility of the tire distributors does not end when the used tire is converted to rubber crumbs. Still, it stops when that particular quantity of rubber crumbs had been utilized or exported, and documented evidence of the same had been authenticated and produced to the responsible department in the Government.

The study concludes that Islamic finance can use equity-like and risk-sharing financing modes to support circular businesses motivated by the holistic Shariah objectives. There is also the need for financial regulatory authorities and Islamic financial institutions to consider risks associated with climate change and linear economic activities in terms of asset valuation and pricing. Blended finance in Islamic finance is an essential tool that can be used to foster investments and attract funding for circular businesses. The circular business financing ecosystem can be built in Qatar by combining the profitable and charitable sectors within the context of impacting the economy and driving CE growth. This will mean that QDB, QC, IBs, and QFD can work together to attract the needed funding for circular businesses within Qatar and attracting entrepreneurial talents to Qatar to support CE transition. The study recommends the following for policymakers and relevant stakeholders:

- To develop a comprehensive CE policy masterplan to serve as a comprehensive reference for CE policy and strategy in Qatar as done by Singapore recently.
- To embark on public awareness on the environmental constraints faced by Qatar and the need for a change of attitudes toward ecological preservation.
- To engage with Islamic finance practitioners, academics, and regulators to develop a roadmap for financing circular businesses and the roles they can play.
- To make the CE an essential public policy target in achieving the SDGs in Qatar.
- To dedicate funding for research into the CE for both academic and industrial studies.

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Chapter 16
Electronic and Electrical Waste Management: Malaysia and Sweden Experiences

Eiman I. Hassan and Nasim Shah Shirazi

Abstract The production and consumption of electrical devices are rapidly growing and generating social, economic, cultural, and scientific benefits globally. In addition, this rapid growth leads to an increase in the amounts of disposal, obsolete, defected, or broken devices, which calls for strategic action in e-waste management. On this regard, nine out of the 17 Sustainable Development Goals (SDGs) are with targets relatively linked to e-waste management. This chapter compares the implementation of the SDGs that are related to e-waste between Malaysia, which has large electric and electronic equipment manufacturing industry, and Sweden, which is considered the leader of implementing SDGs as of 2018. Content analysis of related UN reports and annual reports from Basel Convention (BC) for controlling transboundary movements of hazardous wastes and their disposal, including e-waste, is conducted. The analysis revealed that Malaysia is experienced in e-waste management since 2005. However, further efforts are still needed by different stakeholders in the country, especially in the management of the household's e-waste. On the other hand, Sweden's success is mainly due to the implementation of the "Extended Producer Responsibility" and the cooperation of the different stakeholders. Other countries may learn from the experience and practice of Sweden and achieve the targets set in the SDGs and consequently attain the circular vision of e-waste.

16.1 Introduction

16.1.1 E-Waste Definition

The World Economic Forum (2019) defines e-waste as anything with batteries, plug, or electrical cord that reached the end of its lifetime. It is also called Waste Electrical and Electronic Equipment (WEEE). E-Waste is generated from different sources: households, businesses, and governments. It includes precious and rare materials

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Table 16.1 E-Waste categories and volumes (MT) as of 2016

E-waste Type	Temp. exchange equipment	Screens and monitors	Lamps	Small equipment	Small telecom & IT	Large equipment	Total (MT)
Volumes (MT)	7.6	6.6	0.7	16.8	3.9	9.1	44.7
Percentage (%)	17	14.77	1.57	37.58	8.72	20.36	100

Source Adopted from (Baldé et al., 2017)

that can be reused in manufacturing new products if it is adequately recycled (Zhao et al., 2019). Another definition divides e-waste into six categories: (i) temperature exchange devices, e.g., refrigerators and air conditioners; (ii) screens and monitors, laptops, notebooks, and televisions; (iii) lamps, fluorescent lamps and LED lamps; (iv) large equipment, includes washing machines, electric stoves, and large printing machines; (v) small equipment, like microwaves, video cameras, electric toys; and (vi) small telecommunication and IT equipment, such as mobile phones, routers, personal computers. The percentages of these categories in 2016 are summarized in Table (1) below (Baldé, Forti, Gray, Kuehr, & Stegmann, 2017).

From Table 16.1 above, small equipment represented the highest percentage of e-waste at 37.58%, and lamps represented the lowest at 1.57%.

16.1.2 E-Waste Problem

According to Baldé et al. (2017), the total volume of e-waste generated globally in 2016 was 44.7 million tones (MT), 40 MT of this amount (almost 89.5%) is typically discarded in landfills, burned, or illegally traded. Only 10.5% of e-waste is considered adequately managed and documented to be collected and recycled. On the other hand, the volume of e-waste generated globally in 2018 is estimated to be 50 MT (Drayton, 2007). The distribution of e-waste by region is shown in Table (2) below:

Table 16.2 shows that the lowest e-waste is generated in Oceania (0.7MT), which is 1.6% of the e-waste generated globally, and the highest is generated in Asia (18.2 MT), which is 40.7% of the total e-waste worldwide. However, the collection and recycling rate of e-waste by region is highest in Europe (4.3 MT), which is 35% and the lowest in Africa with an almost negligible collection rate.

The forecast for e-waste volumes for the years 2021 and 2050 based on the assumption of the increased population growth and the justifiable increase of the consumption of electronic/electrical devices are 52 MT and 120 MT, respectively, which is almost triple the volume. This increasing level of e-waste is also forecasted to increase the total carbon emission from electronic devices by 14% (Baldé et al., 2017).

Table 16.2 Regional E-Waste status—2016.

Region	Amount of e-waste generated (MT)	% of e-waste generated	A country with highest e-waste generation	E-waste amount by top country (MT)	Amount of e-waste collected/recycled (MT)	E-waste collection rate
Africa	2.2	5%	Egypt	0.5	0.004	0%
The Americas	11.3	25.3%	USA	6.3	1.9	17%
Asia	18.2	40.7%	China	7.2	2.7	15%
Europe	12.3	27.5%	Germany	1.9	4.3	35%
Oceania	0.7	1.6%	Australia	0.57	0.04	6%

Source Adopted from (Baldé et al., 2017)

Although e-waste contains valuable metals such as gold, copper, and nickel. It also contains very toxic materials such as lead, mercury, and brominated flame retardants. Hence, BC considered e-waste as hazardous waste. BC documented that e-waste was shipped to developing countries and was not appropriately treated in these countries, which caused severe human health and environmental issues. Hence, e-waste is causing severe risks to human health and the environment, in addition to presenting several challenges to achieving sustainable development goals by 2030 (Drayton, 2007).

16.1.3 E-Waste Management Opportunities

Electric and Electronic Equipment (EEE) contains different materials such as gold, silver, platinum, copper, and more. For example, the gold that is found in a ton of smartphones is 100 times more than the gold found in gold ore. According to the latest forecast, e-waste is worth about $62.5 billion annually, which is more than the GDP of many countries. The value of only recycled raw materials could value up to $11.5 billion (Zhao, et al., 2019).

The recovery of the precious resources from e-waste yields economic benefits. E-waste entrepreneurs and cooperatives are practicing new business models for managing e-waste, which results in expanding the business and creating thousands of safe jobs.

16.1.4 Zero E-Waste Circular Economy

The 2019 report by World Economic Forum emphasizes the importance of implementing different business models to achieve a circular economy where waste

is designed out of the system. The business models suggested are Product as a service (e.g., Fairphone circular mobile phone company in the Netherlands launched, Fairphone-as-a-service and Dell company in the US has PC as a service), life extension, sharing of assets, and recycling models. The following aspects need to be reexamined to accomplish the circular economy for EEE:

- Product design should be durable, reusable, and safe recycling.
- Incentivized consumers financially and guaranteeing secure handling of their data in the old equipment to encourage buyback or return policy.
- Governments and companies work together to enhance EEE collection and recycling processes by creating a system for close loop production in which all EEEW is collected, and the materials are reused in the manufacturing of new products.

All countries need to invest heavily in technology that assists in extracting metals and minerals from e-waste. Furthermore, they need to develop e-waste legislation, such as extended producer responsibility and build recycling industry formally, and this will create opportunities for economic growth and more jobs as well (Zhao et al., 2019).

16.1.5 E-Waste and SDGs

The United Nations 2030 agenda adopted 17 Sustainable Development Goals (SDGs) with specified goals/targets and some indicators.[1] Below is a summary of some SDGs' goals/targets that are relatively linked to e-waste:

- SDG 1.5 is concerned about the exposure of the poor and vulnerable to climate-related extreme events and other economic and environmental issues; the target is to build the resilience of the poor.
- SDG 2.1 is concerned about ending hunger by providing safe, nutritious, and sufficient food to all people, especially poor people in a vulnerable situation, including infants.
- SDG 3.9 aims at reducing the number of deaths and illnesses as a result of hazardous chemicals and water, air, and soil contamination and pollution.
- SDG 6.1 refers to achieving universal and equitable access to safe and affordable drinking water. SDG 6.3 targets water quality by reducing pollution and eliminating/minimizing the dumping of hazardous chemicals and materials.
- SDG 8.8: Promoting a safe and secure working place for all workers.
- SDG 11.6: Concerned with air quality and waste management of cities to minimize the per capita environmental impact of cities.
- SDG 12.4: International frameworks to achieve environmental management of chemicals and all waste during their life cycle to minimize their adverse impact on

[1] See #Envision2030 Goal 14: Life Below Water | United Nations Enable. (2016). Retrieved 31 March 2021, from https://www.un.org/development/desa/disabilities/envision2030-goal14.html.

human health and the environment. SDG 12.5: Minimize waste generation significantly via the prevention, reduction, recycling, and reuse. SDG 12.9: Concerned with sustainable consumption and production by encouraging the scientific and technological capacity of countries.

- SDG 13.3: Aims at improving human and institutional capacity on climate change mitigation, reduction and adaptation, and early warning via better education and awareness.
- SDG 14.1: Refers to the prevention and reduction of all kinds of marine pollution, especially that caused by marine debris and nutrient pollution.

16.1.6 Basel Convention

On the discovery of toxic waste imported from abroad and dumped in Africa and some parts of the developing countries in the 1980s, the Basel Convention (BC) for controlling of transboundary movement of hazardous wastes and their disposal was adopted in 1989 in Basel, Switzerland, which entered into force in 1992.

The main objective of BC is the protection of human health and the environment from hazardous wastes. BC categorized e-waste as hazardous waste since it contains toxic materials such as mercury and brominated flame retardants, among other precious and heavy metals that can be recovered, recycled, and used as a secondary source of raw materials. BC started to address e-waste issues in 2002 with the primary objective of environmental management, prevention of illegal traffic to developing countries, and global capacity building of better e-waste management. It initiated several e-waste working plans, such as The Mobile Phone Partnership Initiative (MPPI), to achieve better supervision of the product and increase the consumer's awareness of environmental problems generated from mobile phones waste after the end of their lifetime and initiate reuse, recycle, and disposable alternatives. The other initiative is the Nairobi Declaration on environmentally sound management of e-waste.[2]

16.2 Malaysia E-Waste Management Experience

16.2.1 The E-waste Situation in Malaysia

United Nations University (UNU) estimated that Malaysia generates approximately 250,000 tones of e-waste per year or 7.7 Kgs per person. Due to the exponential growth of the adoption of mobile phones, the consumption of electronic and electrical products has increased steadily.

[2] See Basel Convention Home Page. (2021). Retrieved 31 March 2021, from http://www.basel.int/Home/tabid/2202/Default.aspx.

i. Malaysia Industrial and Households E-waste.

Malaysia generated about 688,000 metric tons of e-waste in 2008 and is forecasted to generate 1.11 million metric tons in 2020. There is a management system in place for industrial e-waste where there are full and partial recovery facilities operated by private companies that pay the industries or the e-waste generators for supplying them with the e-waste (Awang, 2010). However, for households, there is still no complete system in place for e-waste management. Consequently, it is ended up in an informal facility by different channels of collections, like, nongovernmental organizations (NGOs), charity organizations, door-to-door collectors or other recyclable buyer, and junkshops. These informal facilities have created various problems, including risk to human health when dismantling e-waste items without wearing protective devices and danger to the environment when the unwanted parts which contain toxic and hazardous components are illegally dumped or illegally burned.

According to 2008 Guidelines for the classification of used electrical and electronic equipment in Malaysia, e-waste is categorized by 2005 Environmental Quality Regulation as scheduled waste with the code SW 110, which is defined by the Department of Environment (DOE) as:

> Wastes from the electrical and electronic assemblies containing components such as accumulators, mercury-switches, glass from cathode-ray tubes and other activated glass or polychlorinated biphenyl-capacitors, or contaminated with cadmium, mercury, lead, nickel, chromium, copper, lithium, silver, manganese or polychlorinated by phenyls.

The purpose of the guidelines is to assist all waste stakeholders (generators, transporters, importers, exporters, and any authority related to waste management) in identifying the used electrical or electronic equipment as e-waste (see the guidelines for detailed information).[3]

Malaysia, as a member of the Basel Convention, is controlling the transboundary movements of hazardous waste and their disposals, which list e-waste as code A1180 and code 2010. As a party to the convention, Malaysia needs to abide by its rules and follow the procedures for importing and exporting such wastes. It is mandatory to obtain prior written approval from the Department of Environment for any importing or exporting of any waste. If any person breaches this mandate, he/she shall be punished with imprisonment and liable for fine (see to Table 16.3).

16.2.2 Government's Initiatives

The minister of Natural Resources and Environment, Malaysia launched in 2013 "E-waste Alam Alliance Malaysia" to effectively collect, segregate, and transport e-waste by developing a centralized system; increase the awareness of the public,

[3] See Hazardous Substances Division | Department of Environment. (2008). Guidelines for the Classification ff Used Electrical and Electronic Equipment in Malaysia, Retrieved 31 March 2021, from http://www.env.go.jp/en/recycle/asian_net/Annual_Workshops/2008_PDF/Handout/14_Malaysia-guideline.pdf.

Table 16.3 Malaysia and Sweden experience with Basel convention

Country	Focal point	Hazardous waste (HW) legislations	Punishments of HW illegal trafficking	Available guideline	Available statistics on HW (Yes/No)	BC Unpaid pledges (USD) for 2018 & prior yrs. As at 31 December 2018	BC pledges for 2019 (USD)
Malaysia	Ministry of natural resources and environment	Yes	Fine/prison	• National strategies/policies • Legislation, regulations, and guidelines	No	0	19,433
Sweden	Ministry of the environment and energy	Yes	Fine/prison/environmental sanctions	• National strategies/policies • Legislation, regulations, and guidelines	Yes	0	57,697

Source Basel Convention Countries Annual Reports (2018)

producer, seller, and distributor of e-waste management; encourage voluntarily collection of e-waste by manufacturers, vendors, and distributors; and to create a stakeholders cooperation network.[4]

16.3 Sweden E-Waste Management Experience

Sweden ranked as the leader in the overall implementation of the SDGs in 2018 (Sachs, 2018). As far as waste management is concerned, its collection level is one of the highest in Europe. A report by the Swedish Environmental Protection Agency, pointed out that the strongest point in Swedish waste management's system success refers to the cooperation between municipalities, producers, recycling centers, and the high awareness of the Swedish people of the importance of waste sorting (EPA, 2009).

The Swedish Environmental Protection Agency (EPA) and the municipalities were assigned the responsibility of enforcement authority on producer responsibility on electrical and electronic equipment (EEE) under the Ordinance (2014:1075) and Ordinance (2008: 834) for batteries (refer to Appendix I for EEE legislation in Sweden). EPA defines EEE producers as anyone who places EEE in the Swedish market. The producer's responsibility is an obligation to accept the wasted EEE when they are returned and covers its management and all the accompanying financial responsibilities. The scope of producer responsibility was changed in 2018 to include more equipment categories. Below is a list of the legislations related to EEE/WEEE (EPA, 2009).

16.3.1 Report Produced EEE

The producer of EEE and batteries must submit an annual report on the 31st of March to report the quantities produced and all the components, equipment parts, and consumables according to Ordinance (2014:1075) to Swedish EPA. The report has to include also the quantity of EEE/batteries that had been provided to the market the previous year, failure to report on time may lead to receiving an environmental sanction charge as per the Ordinance (2012:259). The reports must be submitted via the European Environmental Bureau (EEB) register. EPA will compile all the reports and make sure the producer's compliance with the producer's responsibility provision (Swedish Environmental Protection Agency, 2021).

[4] See Household E-Waste | Department of Environment Malaysia. (2021). Retrieved 31 March 2021, from http://www.doe.gov.my/hhew/

16.3.2 Report Collected and Treated WEEE

Each producer and distributor of EEE is responsible for the equipment produced when they become waste and shall take any financial and organizational responsibility to take back or treat WEEE in an environmentally acceptable form. The producer responsible for household EEE is obliged to join an EPA-permitted collective scheme only. These permitted collective schemes, and the municipalities are the only entities that may collect household WEEE. El-Kresten AB and Receipo Ekonomisk förening are the single permitted collective schemes in Sweden. For the WEEE other than households WEEE, the rules of waste management, in general, apply, however, no need to join a collective scheme. The producers of EEE other than EEE for households shall report how much waste from other EEE has been collected and treated after receiving the information from the recycler. The same is expected for batteries collected and processed. EPA has set an annual fee of 1,000 SEK (Swedish Krona) for each producer responsibility and 2,000 SEK for producers of both EEE and batteries to cover administration costs, managing the EEB register, and any other expenses that assist in enforcing compliance (Swedish Environmental Protection Agenc, 2021).

16.4 E-Waste and *Sustainable Development Goals (SDGs)*

The United Nations 2030 agenda adopted 17 Sustainable Development Goals (SDGs) with specified goals/targets and some indicators. Below is a summary of some SDGs' goals/targets that are relatively linked to e-waste (Sustainable Development Goals, 2021):

- SDG 1.5 is concerned about the exposure of the poor and vulnerable to climate-related extreme events and other economic and environmental issues; the target is to build the resilience of the poor.
- SDG 2.1 is concerned about ending hunger by providing safe, nutritious, and sufficient food to all people, especially poor people in a vulnerable situation, including infants.
- SDG 3.9 aims at reducing the number of deaths and illnesses as a result of hazardous chemicals and water, air, and soil contamination and pollution.
- SDG 6.1 refers to achieving universal and equitable access to safe and affordable drinking water. SDG 6.3 targets water quality by reducing pollution and eliminating/minimizing the dumping of hazardous chemicals and materials.
- SDG 8.8: Promoting a safe and secure working place for all workers.
- SDG 11.6: Concerned with air quality and waste management of cities to minimize the per capita environmental impact of cities.
- SDG 12.4: International frameworks to achieve environmental management of chemicals and all waste during their life cycle to minimize their adverse impact on

human health and the environment. SDG 12.5: Minimize waste generation significantly via the prevention, reduction, recycling, and reuse. SDG 12.9: Concerned with sustainable consumption and production by encouraging the scientific and technological capacity of countries.

- SDG 13.3: Aims at improving human and institutional capacity on climate change mitigation, reduction and adaptation, and early warning via better education and awareness.
- SDG14.1: Refers to the prevention and reduction of all kinds of marine pollution, especially that caused by marine debris and nutrient pollution.

16.4.1 Malaysia and Sweden Implementation of SDGs

Table 16.4 was constructed based on the above-mentioned SDGs' targets linked to e-waste and the UN records of implementation as of 2018 for each country. It shows the experiences of Malaysia and Sweden.

Table 16.4 shows that nothing was accomplished for both Malaysia and Sweden regarding the implementation of the "Sendai Framework" for Disaster Risk Reduction adopted in 2015. However, Sweden performed much better than Malaysia in the remaining SDGs. Nonetheless, the three years assessment indicates that both countries are on right track to achieve all the goals by 2030.

16.5 Conclusion

As mentioned above, the importance of e-waste management is not only for the minimization of its negative environmental impact; it also has valuable social and economic contribution if it is well managed. There is a great need for a collaborative work of all concerned stakeholders, from consumers to producers, government, businesses, entrepreneurs, and society, to transfer the electric and electronic industry from an industry generating waste to a circular one. New business models and ideas need to be innovated and implemented. However, new policy framework needs to be initiated to develop a robust e-waste infrastructure.

This chapter focused on the experience of Malaysia and Sweden. Malaysia is on track and working to achieve the SDG goals related to E-waste. However, Sweden's success and high achievement in e-waste management have to be highlighted as a benchmark for other countries.

Appendix I: EEE Legislations in Sweden.

Ordinance (2014: 1075) on producer responsibility for electrical and electronic equipment to:

1. Promote measures to reduce the amount of electrical equipment which becomes waste;

Table 16.4 Malaysia and Sweden implementation of SDGs linked to E-Waste

	Malaysia	Sweden	UN SDGs target
SDG 1 (No Poverty)	The score of adoption and implementation of national disaster and risk reduction strategies (Sendai Framework) was approximately 0% in 2018	The score of adoption and implementation of national disaster and risk reduction strategies (Sendai Framework) was approximately 0% in 2017	By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social, and environmental shocks and disasters
SDG 2 (Zero Hunger)	The proportion of the population suffering from hunger was 2.9% in 2016	The ratio of the people suffering from hunger was less than 2.5% in 2016	By 2030, end hunger and ensure access by all people, in particular, the poor and people in vulnerable situations, including infants, to safe, nutritious, and sufficient food all year round
SDG 3 (Good Health & Wellbeing)	– The maternal mortality ratio decreased from **79** per 100,000 live births in **1990** to **40** per 100,000 live births in **2015** – The mortality rate of children under five years of age fell from **10.2** per 1,000 live births in **2000** to **7.9 per 1,000 live births** in **2017**	– The maternal mortality ratio decreased from **8** per 100,000 live births in **1990** to **4** per 100,000 live births in **2015** – The mortality rate of children under five years of age fell from **4.1** per 1,000 live births in **2000** to **2.8 per 1,000 live births** in **2017**	– **By 2030**, reduce the global maternal mortality ratio to less than **70/**100,000 – **By 2030**, reduce under-5 years age mortality to at least as low as **25/1,000** live births

(continued)

Table 16.4 (continued)

	Malaysia	Sweden	UN SDGs target
SDG 6 (Clean Water & Sanitation)	– In **2017**, **93.33**% of the population used a "safely managed" drinking water service—an improved source located on-premises, available when needed and free from contamination – In **2017**, **88.63**% of the population used a "safely managed" sanitation service—a basic facility that safely disposes of human waste	– In **2017**, **99.94**% of the population used a "safely managed" drinking water service—an improved source located on-premises, available when needed and free from contamination – In **2017**, **93.38**% of the population used a "safely managed" sanitation service—a basic facility that safely disposes of human waste	– **By 2030,** achieve universal and equitable access to safe and affordable drinking water for all – By 2030, improve water quality by reducing pollution, eliminating dumping, and minimizing the release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally
SDG 8 (Decent Work & Economic Growth)	– The annual growth rate of real gross domestic product (GDP) per capita declined from **6.37**% in **2000** to **4.43%** in **2017** – Domestic material consumption was approximately **16.37** metric tons per capita in **2017** – The total unemployment rate increased from **3.0**% in **2000** to **3.4%** in **2017**	– The annual growth rate of real gross domestic product (GDP) per capita declined from **4.64**% in **2000** to **1.35%** in **2017** – Domestic material consumption was approximately **16.91** metric tons per capita in **2017** – The total unemployment rate increased from **5.5**% in **2000** to **6.7%** in **2017** 0	– At least 7% GDP growth per annum in the least developed countries – Improve progressively, through 2030 – By 2030, achieve full and productive employment

(continued)

Table 16.4 (continued)

	Malaysia	Sweden	UN SDGs target
SDG 11 (Sustainable Cities & Communities)	– In **2016**, the annual population-weighted average mean concentration of fine suspended particles of less than 2.5 microns in diameter (PM2.5) was about **16.04** μg per cubic meter. This is above the maximum level for safety set by the WHO of 10 μg per cubic meter – The score of adoption and implementation of national disaster and risk reduction strategies was approximately **0**% in **2018**	– The proportion of the urban population living in slums was **0.0**% in **2016** – In **2016**, the annual population-weighted average mean concentration of fine suspended particles of less than 2.5 microns in diameter (PM2.5) was about **5.89** μg per cubic meter. This is below the maximum level for safety set by the WHO of 10 μg per cubic meter – The score of adoption and implementation of national disaster and risk reduction strategies was approximately **0**% in **2017**	– By 2030, ensure access for all to adequate, safe and affordable housing, and basic services, and upgrade slums – The maximum level for safety set by the WHO of **10** μg per cubic meter – Holistic disaster risk management at all levels
SDG 12 (Responsible Consumption & Production)	Domestic material consumption was approximately **16.37** metric tons per capita in **2017**	Domestic material consumption was approximately **16.91** metric tons per capita in **2017**	By 2030, achieve the sustainable management and efficient use of natural resources
SDG 13 (Climate Action)	The score of adoption and implementation of national disaster and risk reduction strategies was approximately **0**% in **2018**	The score of adoption and implementation of national disaster and risk reduction strategies was approximately **0**% in **2017**	Holistic disaster risk management at all levels
SDG 14 (Life below Water)	In **2018**, **1.04**% of the marine environment under national jurisdiction (up to 200 nautical miles from shore) was under protection	In **2018**, **15.15**% of the marine environment under national jurisdiction (up to 200 nautical miles from shore) was under protection	By **2020**, conserve at least **10**% of coastal and marine areas, consistent with national and international law and based on the best available scientific information

2. Reduce the problems for human health and the environment electronic waste;
3. Producers shall take responsibility for the problems of electronic waste provides and to give them incentives to take waste prevention measures;
4. Easier for holders of electronic waste to leave the waste;
5. All electrical equipment which, despite waste prevention measures, become waste must be collected and otherwise handled at the way that gives the best results for human health and the environment taking into account that the waste should be prepared for reuse, recycled, otherwise or disposed of in the order of priority listed now; and
6. Promote resource efficiency and to reach the targets for recycling.

- Ordinance (2008: 834) on producer responsibility for batteries
- The WEEE-directive of the European Parliament and the Council 2012/19/EU
- Ordinance (2011: 927) on waste
- Regulation (NFS 2018: 11) by the Swedish EPA on pretreatment of WEEE
- Ordinance (2000: 208) on producer responsibility for filament bulbs and certain lighting equipment
- Ordinance (2012: 861) on hazardous substances in electrical and electronic equipment
- European Parliament and of the Council 2011/65/EU
- Ordinance (2012: 259) on environmental sanction charges
- Law (1985:206) on fines
- Ordinance (2011: 13) on environmental enforcement
- Ordinance (1998: 940) on fees for permit matters and enforcement according to the Environmental

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