Testing the Effects of Agile and Flexible Supply Chain on the Firm Performance Through SEM

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Abstract High competition, continuous, and rapid changing in consumer demands push companies finding differentiation ways to gain competitive advantage. Supply chain and logistics practices have been seen as the core strategic tools to survive for companies. In this research, the impacts of agile and flexible supply chain practices on the customer satisfaction, service quality, sales performance, and profitability are examined. As a research area, fast fashion industry was chosen. To the aim, a theoretical model was developed and tested through structural equation modeling (SEM). The results reveal that companies performing agile and flexible supply chains can reap the benefits in terms of service quality and customer satisfaction, and at the end can reap the resulting financial benefits in terms of increased sales and profits.

Keywords Supply chain management · SEM · Fast fashion · Firm performance

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1 Introduction

It is a well-known fact that supply chain management affects a firm's performance positively. In their research, Bayraktar et al. [1] indicated a positive correlation between a firm's performance and supply chain practices. Lenny Koh et al. [2] researched the effects of SCM practices on firm performance and indicated a meaningful and positive effect of SCM practices on firm performance. An effective and productive supply chain management includes many factors such as agility, simplicity, flexibility, proper use of information technologies, reliability, and information sharing. Fast fashion industry aims to offer more diversity to customers with the addition of interim seasons in between the existing seasons. To realize this aim, the concept of agility in supply chain management is inevitable in order to increase the frequency of new product entries, enhance customer service levels, and reduce the response time to changing market requirements. Also, the importance of a flexible supply chain management cannot be ignored due to its capability of adjusting to un-anticipated, long-term customer demands in fast fashion industry caused by high seasonality and changing order amounts, delivery times, delivery schedules, and production capacities based on market conditions. Consequently, in this study, flexibility factors, as the means to respond to the issues that can be encountered during agility and speed phases of the supply chain, are measured with their effects on firm performances in fast fashion industry.

1.1 Agile Supply Chain Management

For the firms that compete in an ever changing, dynamic supply chains, the motto has changed as "**I**t's not the big that eats the small… it's the fast that eat the slow" [3]. Agility in a supply chain includes elements such as firm's new product frequency, the ability to reduce product development cycle time, production time reduction, customer service enhancement, and response time to changing market requirements [4]. We can consider agility in a supply chain as rearranging with haste. In literature, it is emphasized that the main element of agility is the ability to respond to changing market conditions and customer demands [5–8].

In previous researches, positive effects of agility on firms' performance were shown [9]. Chan et al. [48] empirically investigated the impact of supply chain agility on firm performance and found a positive and direct relationship. Yusuf et al. [10] indicated that an agile supply chain performance increases a firm's competitive advantage performance. Swafford et al. [4] in their experimental studies had found a positive correlation between compatibilities of information technologies, supply chain flexibility, supply chain agility, and competitive work performance. Gligor and Holcomb [11], as a result of their literature research, had found that the most important outcome of agility is the increasing sales in accordance with increasing customer ratio. In addition, several other authors had highlighted the close

relationships between agility and fulfillment and satisfaction of customer demands [12–14]. Swafford et al. [4] only used financial performance elements while he was researching the effects of agile supply chain on a firm's performance and found a positive and direct correlation between them. On the other hand, Gligor et al. [12] emphasized the correlation but it is not direct.

1.2 Flexible Supply Chain Management

Flexibility in supply chain gives firms the ability to respond meaningfully to environmental changes, uncertainties, and contributes to its development of high-quality products and services [15, 16, 49]. Uncertainties may occur in many elements such as demand, supply, and cost, and flexibility in supply chain is must to respond to these uncertainties and changes effectively [17]. Flexibility in supply chain includes elements such as order amounts, delivery times, and ability to change production schedules [18]. Sanchez and Perez [18] had found a positive correlation between firm performance and flexible supply chain. Swafford et al. [4] in their experimental studies had found a positive correlation between compatibilities of information technologies, supply chain flexibility, supply chain agility, and competitive work performance. Supply chain flexibility concept has derived from flexible production literature; therefore, its dimension is usually related to production [19]. In this study, "ability to change production amount" is discussed as a dimension of flexibility. In addition, supply chain flexibility has a process-based perspective and consequently, it includes main processes such as purchasing/order placement and distribution/logistics [20, 21]. In accordance with the said processes, in this study, "the ability to change delivery schedule" and "the ability to change order amount" were discussed as two other dimensions.

1.3 Firm Performance Measures

As there is no agreement on specific firm performance measurement metrics in literature [22], it would cause no harm if the researchers were to use their own free will to determine performance measures. For example, Tan et al. [23] used market share, investment return, sales, active profitability, cost of production, customer service, product quality, and competitive advantage elements to measure the correlation between supplier and firm performances. Operation strategy and firm performance, gathered their performance elements into four groups: market, product, financial, and employee performance [24]. Some researchers [25–27] used service quality, customer satisfaction, productive internal processes, effective resource usage, fast service, growth rate, profitability, and productivity as their performance measures. Walker et al. [28] used profitability, productivity, growth, competitive advantage, customer satisfaction, job quit rates, investor relations, and

environmental impact measures to measure firm performance. In order to measure a firm's performance, customer satisfaction focus is essential; otherwise, all supply chain efforts will be in vain and costly [29, 30]. Consequently, in this study, fast fashion supply chain's end customers' satisfaction is used for measurement. In addition, utilizing the researches mentioned above, profitability and sales numbers are used as financial performance indicators while service quality is used as a quality performance indicator.

2 Conceptual Development

The first two relationships we offer in this study are about the relationship between agile and flexible supply chain issues and customer satisfaction. As Gunasekaran et al. [30] indicated, flexibility and delivery performance to meet customer needs increase customer satisfaction. Inspired by Gunasekaran et al [30], we postulate that the speed of new product offering, the speed of customer services, and the speed of response to the changes and dynamics, also the abilities to change production amount, delivery schedule, and order amount effect satisfaction. Accordingly, we hypothesize:

Hypothesis 1: Agile supply chains have a positive effect on customer satisfaction.
Hypothesis 2: Flexible supply chains have a positive effect on customer satisfaction.

Service quality refers to ability of satisfying customer needs and wants. In highly competitive, turbulent, and volatile markets, the needs of customers have been changed so quickly and suddenly, so the agility and flexibility have become a must to meet the service quality requirements [17, 31]. Thus, we formulate the following hypotheses:

Hypothesis 3: Agile supply chains have a positive effect on service quality.
Hypothesis 4: Flexible supply chains have a positive effect on service quality.

In line with several authors and academic [32–35], we postulate the following hypothesis:

Hypothesis 5: Service quality has a positive effect on customer satisfaction.

Another relationship between constructs we offered exists between the customer satisfaction and sales performance and profitability. To support this idea, there have been several studies in the literature [36, 37]. How customer satisfactions increase company sales and profitability? it can be achieved through the reduced price elasticity of satisfied customers. Also, Reichheld and Sasser [38] indicated the tendency of satisfied customers to pay more for the products or services. Sales of the company increase in parallel with satisfied customers because satisfaction leads to loyalty and

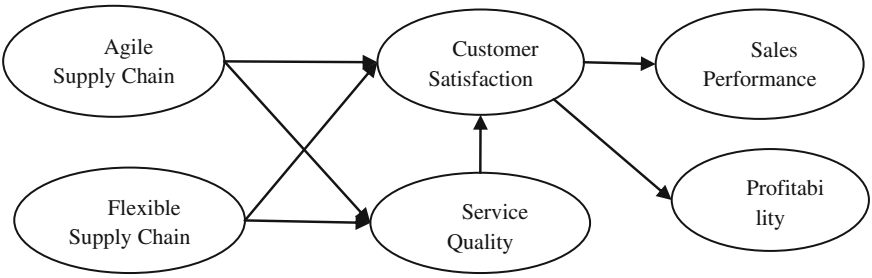

Fig. 1 Theoretical model of the research

for a firm, loyal customers mean more customers will purchase in the future [38]. The sixth and seventh hypotheses of the model can be stated as follows (Fig. 1):

Hypothesis 6: Customer satisfaction has a positive effect on sales.
Hypothesis 7: Customer satisfaction has a positive effect on profitability.

3 Methodology

Fast fashion also challenges existing traditional supply chain management techniques with its solutions for rapid changes in demand and high product diversity. This industry is well known with its characteristics of uncertainties and unstable environment [47]. In this study, instead of the traditional elements, the relationships between more flexible and agiler supply chain elements and firm performances of the brands operating in the textile industry are analyzed. There are 894 firms from 17th Occupation Group (Apparel Retail Commerce Group) registered to Izmir Chamber of Commerce to be included in the research. These firms include boutiques with one branch, private fashion houses, baby and kids clothing retailers, sports shops, readymade underwear, wedding dress shops, etc. Out of all officially registered 894 firms, firms that are eligible, operating in the fast fashion industry, have many branches, and thought be practicing supply chain management are selected. A total of 46 fast fashion brand brands are selected and due to the eligibility of access to the population, a sample is not created and the whole population is included in the research. Some of the firms that participate in this study, due to their firm policies, do not want their names to be revealed. Some of the firms included in our sample are Zara, Bershka, Mango, Pull and Bear, Loft, Mavi, Koton, Benetton, Stradivarius, and LC Waikiki. In this research, survey method is used for data collection. For hypothesis testing, five-point Likert scale is used. Due to the firms having difficulties with providing numeric values, subjective measures are utilized for performance questions. For the performance questions, "1 = too low" and "5 = too high" statements are used for the firms to compare themselves with their competitors. The answers for supply chain flexibility- and agility-related

questions include consist of "1 = I absolutely agree" and "5 = I absolutely disagree" statements. As this survey was going to be conducted with the mid- and top-level managers of fast fashion brands located in Izmir, Istanbul, and Ankara, the possible difficulties that they would have in answering the questions regarding internal processes, cost of production, supplier performance, investment return, and active profitability were taken into consideration and instead the performance measures were handled as sales numbers, customer satisfaction, service quality, and profitability with the utilization of literature. The surveys were conducted in July 2015–November 2016 period with all chosen firms' mid- and top-level managers in Izmir, Istanbul, and Ankara. 35% of the surveys were conducted face to face, while 62% of them were conducted via e-mail.

4 Analysis and Results

The LISREL 8.51 package was used to test the proposed research model. The two-stage testing process suggested by Anderson and Gerbing [39] was performed to apply structural equation modeling (SEM). In the first stage, the measurement model's reliability and validity were tested. In the second stage, structural model was tested in terms of examining the hypothesized paths among the constructs.

4.1 Measurement Model

Calculating standardized loadings in CFA, average variance extracted (AVE) values and composite reliabilities (CR) are the common measurement ways of validity [40, 41]. For CFA, LISREL 8.51 package was used. Both the CR and AVE cannot be computed by LISREL, and therefore CR and AVE are computed manually in spreadsheet software Microsoft.

Hair et al. [41] suggest that all standardized loadings which are above the cut-off point of 0.70 are adequate for validity. Bagozzi and Yi [42] state that standardized loadings greater than 0.60 are adequate. For the measurement model, the standardized loadings are between 0.77 and 0.88, providing adequate evidence of validity (Table 1). Table shows that all latent variables show high composite reliabilities (CR) (between 0.71 and 0.88), well above the accepted 0.60 value [40]. Also as can be seen that all the latent variables' AVE scores are well above 0.50 (between 0.55 and 0.69). So, according to the scores of CFA, CR, and AVE, it can be said that the measurement model validity is achieved. Finally, the overall fitness between the collected data and the measurement model was examined.

Table 2 lists the main fit indices outputted from LISREL and their acceptance thresholds. As the fit indices, normalized $\chi^2 = 1.870$, RMSEA = 0.054, GFI = 0.952, AGFI = 0.890, CFI = 0.960, and NFI = 0.980, all meet suggested acceptable range. So, we can conclude that the fit of measurement model is acceptable [43–46].

Table 1 CFA factor loadings, composite reliability, and AVE

Measures	CFA, standardized loadings (*T*-values)	Composite reliability	AVE
Agile supply chain		0.80	0.59
ASC 1	0.67 (6.88)		
ASC 2	0.75 (9.73)		
ASC 3	0.94 (13.26)		
Flexible supply chain		0.86	0.67
FSC 1	0.79 (10.67)		
FSC 2	0.88 (12.64)		
FSC 3	0.79 (10.65)		
Customer satisfaction		0.75	0.60
CS 1	0.73 (9.32)		
CS 2	0.82 (10.81)		
Product/service quality		0.71	0.55
SQ 1	0.81 (10.21)		
SQ 2	0.68 (8.38)		
Sales performance		0.82	0.69
SP 1	0.79 (10.39)		
SP 2	0.88 (12.00)		
Profitability performance		0.88	0.57
PP 1	0.84 (11.65)		
PP 2	0.80 (10.83)		

4.2 Structural Model

First, the overall fitness between the sample data and the structural model was tested using the six goodness-of-fit indices as the same used in the measurement model. As can be seen from Table 3, a sound fit of the data to the structural model was obtained. All six GOF indices achieve their acceptance thresholds ($\chi^2 = 1.894$, RMSEA = 0.048, GFI = 0.939, AGFI = 0.910, CFI = 0.961, and NFI = 0.978).

Table 4 contains the detailed results related to the structural model. All the hypotheses are accepted with positive directions. The expected relationships from agile and flexible supply chains to customer satisfaction and service quality were supported. We found strong relationship from service quality to customer satisfaction and from customer satisfaction to sales performance and profitability. Although agile and flexible supply chain plus service quality totally explain customer satisfaction 53%, the highest contribution is made by service quality. This result proves the mediator role of service quality. Also, agile supply chain affects customer satisfaction substantially more than flexible supply chain. The results

Table 2 Goodness-of-fit measures of the measurement model

Goodness-of-fit measure	Recommended value	Value of this study
χ^2/df	≤ 2.00 (good fit) ≤ 3.00 (acceptable fit)	1.870
Root means square error of approximation (RMSEA)	≤ 0.05 (good fit) 0.05–0.08 (acceptable fit) 0.08–0.10 (mediocre fit)	0.054
Goodness-of-fit index (GFI)	>0.95 (good fit) >0.90 (acceptable fit)	0.952
Adjusted goodness-of-fit index (AGFI)	>0.90 (good fit) >0.85 (acceptable fit)	0.890
Comparative fit index (CFI)	>0.97 (good fit) 0.95–0.97 (acceptable fit)	0.960
Normed fit index (NFI)	>0.95 (good fit) 0.90–0.95 (acceptable fit)	0.980

Table 3 Goodness-of-fit measures of the structural model

Goodness-of-fit measure	Recommended value	Value of this study
χ^2/df	≤ 2.00 (good fit) ≤ 3.00 (acceptable fit)	1.894
Root means square error of approximation (RMSEA)	≤ 0.05 (good fit) 0.05–0.08 (acceptable fit) 0.08–0.10 (mediocre fit)	0.048
Goodness-of-fit index (GFI)	>0.95 (Good fit) >0.90 (Acceptable fit)	0.939
Adjusted goodness-of-fit index (AGFI)	>0.90 (good fit) >0.85 (acceptable fit)	0.910
Comparative fit index (CFI)	>0.97 (good fit) 0.95–0.97 (acceptable fit)	0.961
Normed fit index (NFI)	>0.95 (good fit) 0.90–0.95 (acceptable fit)	0.978

Table 4 Results of the hypothesized model

Hypothesized path	Hypothesis	Standardized path coefficient	*T*-value
Effects of agile supply chain			
Agile supply chain → customer satisfaction	H1(+)	0.57	7.93
Agile supply chain → service quality	H3(+)	0.55	7.72
Effects of flexible supply chain			
Flexible supply chain → customer satisfaction	H2(+)	0.15	1.98
Flexible supply chain → service quality	H4(+)	0.48	6.51
Effects of service quality			
Service quality → customer satisfaction	H5(+)	0.77	10.51
Effects of customer satisfaction			
Customer satisfaction → sales performance	H6(+)	0.35	3.53
Customer satisfaction → profitability	H7(+)	0.23	3.73
Structural relationships	R^2		
Satisfaction = 0.57 * agility + 0.15 * flexibility + 0.77 * service quality	0.53		
Service quality = 0.55 * agility + 0.48 * flexibility	0.46		
Sales = 0.35 * satisfaction	0.31		
Profitability = 0.37 * satisfaction	0.36		

convincingly supported that satisfied customers with agile and flexible supply chain operations so, with service quality, effects positively the sales and profitability performance of the company.

5 Conclusion

The agile and flexible supply chain operations that stem from the rapidly changing needs of customers center on the supply chain management of companies especially in business-to-customer (B2C) markets. The main idea of this research is to reveal if agile and flexible supply chain operations do really pay off in terms of company financial performance. The main conceptual model comprising six constructs was proposed to examine the relations among agile, flexible supply chain, service quality, customer satisfaction, sales performance, and profitability. With the typical techniques and procedures of SEM, all proposed hypotheses were validated. Our study suggests that companies performing agile and flexible supply chains can reap the benefits in terms of service quality and customer satisfaction, and at the end can reap the resulting financial benefits in terms of increased sales and profits. In this study, it is demonstrated that both the agile and flexible supply chain benefits have a differential impact on the service quality and customer satisfaction. Even though the roles of the agile supply chain on customer satisfaction and service quality almost equally, flexible supply chain affects customer satisfaction statistically significant but much lower than it affects service quality. Also, according to the result of path analysis, the impact of service quality as a mediator has more effect on customer satisfaction than the direct effects of agile and flexible supply chain operations. Finally, the results convincingly supported that satisfied customers with agile and flexible supply chain operations so with service quality, impact positively the sales and profitability performance of the company.

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