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The Impact of E-commerce on Supply Chain Management in Jordanian Manufacturing Firms

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***Abstract*: This study investigates the impact of e-commerce on supply chain management within Jordanian manufacturing firms, employing a descriptive analytical approach. The study population includes employees from three manufacturing firms, with data collected through a statistical questionnaire. Demographic analysis reveals a predominantly male, postgraduate-educated group with extensive work experience. The questionnaire's reliability analysis yields a high and statistically acceptable result of 60%. Analyzing e-commerce and supply chain management dimensions indicates a positive perception, particularly in reducing business costs. Managing relationships with customers and suppliers also exhibits a highly positive impact. Statistical tests, including regression analysis, support the main hypothesis, revealing a significant impact of e-commerce on supply chain management. Sub-hypotheses related to managing relationships with customers and suppliers are likewise supported, underscoring e-commerce's influence on these specific dimensions. The findings suggest a crucial role for e-commerce in enhancing supply chain management in Jordanian manufacturing firms. Practical implications include aligning e-commerce strategies with broader business objectives, emphasizing potential benefits such as cost reduction and improved relationships. This study contributes insights for practitioners and policymakers, highlighting the strategic importance of e-commerce in optimizing supply chain dynamics.**

***Keywords*: E-commerce, Supply Chain Management, Jordanian Manufacturing Firms.**

1. Introduction

The intersection of e-commerce and supply chain management has become a critical area of study in the manufacturing sector, especially in the context of Jordanian firms. This research delves into this intersection, aiming to understand the extent to which e-commerce adoption influences supply chain practices in these firms, with a focus on integration, efficiency, responsiveness, technological investment, and competitive advantage. The integration of e-commerce is hypothesized to enhance supply chain management, particularly in managing relationships with customers and suppliers (Ferrantino & Koten, 2019).

A thorough examination of global e-commerce trends in the manufacturing sector forms the backdrop of this study. Manufacturing firms worldwide are increasingly embracing e-commerce, a shift that necessitates a corresponding transformation in their supply chain management strategies.

This global trend provides valuable insights into the challenges and opportunities faced by Jordanian manufacturers in adopting e-commerce (Ferrantino & Koten, 2019).

The concept of Supply Chain Digital Transformation is particularly relevant to this study. This transformation, driven by the adoption of digital technologies such as the Internet of Things (IoT), artificial intelligence (AI), and blockchain, is reshaping how supply chains are managed in the digital age. This global perspective is crucial to understand the specific impact on Jordanian manufacturing firms (Butt, 2020).

In Jordan, the growth of e-commerce in the industrial sector is driven by increased internet and mobile device use, along with improvements in electronic payment systems. This local context is essential to understanding how e-commerce is being integrated into the supply chains of Jordanian manufacturing firms and the unique challenges and opportunities this presents (Hussein et al., 2019; Malkawi, 2017).

2. Literature Review

A. E-commerce Adoption Trends in Manufacturing

E-commerce is becoming an integral part of the manufacturing sector worldwide, reshaping how manufacturers engage with customers, manage supply chains, and deliver products. Globally, there's a clear trend of manufacturers incorporating e-commerce as part of a broader digital transformation, with direct-to-consumer sales, customization, and supply chain transparency being key factors. In regions like North America and Europe, adoption is driven by technological advancement and regulatory environments, while in Asia-Pacific, mobile commerce and cross-border transactions are particularly prominent. Latin America and Africa are catching up at different paces, influenced by local market dynamics and infrastructural capabilities. Specific industries such as automotive, electronics, and textiles are at varying stages of e-commerce integration, each facing unique challenges. Across the board, issues like cybersecurity, workforce training, and system interoperability are central to the conversation, as is imperative to address the sustainability of e-commerce practices. As manufacturers globally navigate the complexities of digital sales and operations (Ferrantino & Koten, 2019).

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B. Supply Chain Digital Transformation

Supply Chain Digital Transformation is a comprehensive overhaul that integrates digital technology into every facet of a supply chain. This change is not just about replacing outdated systems with modern solutions but also involves harnessing the power of data, analytics, and innovative technologies to make supply chain operations more predictive and adaptable to the ever-changing market and customer needs (Butt, 2020).

At the heart of this transformation is the goal to enhance the efficiency, transparency, and resilience of supply chains. The Internet of Things (IoT), for example, revolutionizes the tracking and monitoring of products throughout their lifecycle, providing real-time data that's invaluable for managing perishable goods or high-value items. Meanwhile, the cloud offers a flexible and scalable environment for managing this data and running sophisticated analytics (Butt, 2020).

Artificial intelligence takes this a step further by not only analyzing vast datasets to uncover patterns but also automating decision-making processes, improving demand forecasting, and even managing inventory. Blockchain technology supports these efforts by adding a layer of security and transparency, making it possible to trace products from origin to consumer with confidence and accuracy (Butt, 2020).

Robotics and automation are reshaping warehouses and production lines, making operations safer and more productive, while advanced technologies like 3D printing are pushing the boundaries of manufacturing, allowing for on-demand production that reduces inventory needs and speeds up the time-to-market (Butt, 2020).

But it's not just about technology. A successful digital transformation also hinges on the human element cultivating a digital culture, ensuring that staff are trained, and processes are redesigned to mesh with new technologies. Data quality and integration are critical; systems must communicate seamlessly to leverage the full potential of digital tools. Moreover, forming strategic partnerships and focusing on scalability ensures that the supply chain can evolve as technology does (Butt, 2020).

C. E-commerce Practices in Jordanian Industry

E-commerce in the Jordanian industry has expanded considerably, catalyzed by enhanced internet and mobile device use along with better electronic payment systems. The landscape includes a burgeoning array of local online retail platforms offering a multitude of products. While cash on delivery remains popular, there's a discernible shift towards digital transactions, reflecting a younger, more tech-embracing demographic. Mobile commerce is on the rise, with businesses optimizing for smartphones to cater to the on-the-go consumer. Social media plays a pivotal role in the e-commerce ecosystem, doubling as a marketing and sales platform, especially for burgeoning enterprises. The demand for swift and reliable delivery services has escalated, prompting investment in logistics (Hussein et al., 2019).

Jordanian consumers are not just shopping locally; cross-border purchases are common, supported by services easing the complexities of international shipping and customs. Recognizing the potential of e-commerce, the Jordanian government has been actively improving the regulatory framework and pushing for greater digital infrastructure and ICT adoption among businesses. With the growth of e-commerce, cybersecurity is a growing priority, and businesses are stepping up measures to secure transactions and protect data. The focus on customer service is sharpening, understanding its critical role in fostering trust and loyalty. Moreover, to resonate with the local populace, e-commerce platforms are localizing content and aligning with regional shopping habits (Malkawi, 2017).

Marketplaces are also a significant element of the e-commerce scene in Jordan, providing smaller sellers with a platform to reach broader markets. Lastly, there is a push towards education and training to ensure a workforce proficient in digital skills, necessary to sustain and amplify e-commerce growth. The trajectory suggests that e-commerce is set to play a central role in Jordan's economic narrative moving forward (Hussein et al., 2019).

D. Efficiency and Responsiveness of E-commerce Enhanced Supply Chains

1) Impact on Supply Chain Efficiency

The advent of e-commerce has significantly transformed supply chains, making them more efficient by leveraging technological advancements and data analytics. In an e-commerce-driven market, supply chains have become adept at managing inventories with greater precision, using real-time tracking to maintain just enough stock to meet demand without overstocking, thereby cutting down on storage costs and losses from unsold goods. Automation in warehouses, driven by the e-commerce boom, has streamlined the process of order fulfillment. Robotics and automated systems quicken the pace of picking, packing, and shipping items, leading to more efficient operations that are less prone to error and can function continuously, enhancing throughput (Yu et al., 2016).

One of the most significant impacts of e-commerce on supply chain efficiency is the improvement in demand forecasting. The data collected from online transactions is rich and voluminous, enabling businesses to deploy predictive analytics to anticipate customer demand with far greater accuracy. This foresight allows for a more strategic stock replenishment and production planning, helping to mitigate the risk of over or understocking. Furthermore, e-commerce has led to the optimization of distribution networks. By situating warehouses and fulfillment centers strategically closer to customer clusters, companies are not only able to reduce delivery times but also lower the cost associated with long-distance transportation (Kawa & Maryniak, 2019).

Dynamic pricing models in e-commerce influence supply chain efficiency as well. Prices can be adjusted automatically in response to various factors such as changes in demand or supply conditions, competitor pricing, and inventory levels. This ability ensures that revenue is maximized, and the excess stock is minimized, contributing to a more responsive and efficient supply chain. Transport logistics have also become more sophisticated with e-commerce. The use of advanced systems for route optimization and shipment consolidation has resulted

in cost savings and a lesser environmental footprint by reducing the number of vehicles required and miles traveled (Chornous & Horbunova, 2020).

2) Responsiveness to Market Demands

E-commerce has markedly increased the responsiveness of supply chains to market demands. By harnessing digital platforms, businesses can quickly detect changes in consumer preferences and market trends, enabling them to respond in real time. The direct line of communication with customers through online channels provides immediate feedback and data, which companies use to adjust their offerings, stock levels, and marketing strategies. The ability to swiftly update product listings and launch promotions in response to market shifts allows for a nimble market presence. Similarly, the deployment of flexible manufacturing techniques, like 3D printing, and the use of drop shipping models, where products are made to order and shipped directly from the manufacturer to the customer, reduce lead times and enhance responsiveness (Ferrantino & Koten, 2019).

E-commerce also supports a dynamic supply chain that can scale operations up or down as needed, without the constraints of physical retail spaces. With the global reach of online platforms, businesses can test new markets with minimal risk and adapt their supply chains to cater to regional demand patterns. The enhanced responsiveness brought by e-commerce not only improves customer satisfaction through better service and product availability but also drives competitive advantage in an increasingly fast-paced and consumer-driven market (Xiao et al., 2021).

E. Strategic Implications of E-commerce on Supply Chain Management

1) Technological Investments in E-commerce

The strategic landscape of supply chain management has been reshaped by the proliferation of e-commerce, compelling companies to make critical technological investments. A robust IT infrastructure becomes indispensable to support the surge in data and transaction volumes, while advanced data analytics tools are essential for extracting actionable insights from customer behavior and market trends. Seamless integration of supply chain processes is achieved through sophisticated software solutions, enhancing coordination from procurement to distribution (Ajah et al., 2019).

Automation in the form of robotics and AI in warehouses is vital to meet the demands of e-commerce speed, alongside machine learning applications that refine everything from demand forecasting to customer interactions. Investments in blockchain technology provide unparalleled transparency and efficiency, especially in tracking and authenticating products. As e-commerce relies on swift deliveries, upgraded transportation technologies can optimize logistics and reduce costs. Enhancing customer experience is equally crucial, with investments in AR/VR and chatbots that enrich the online shopping experience and strengthen brand loyalty. Furthermore, as mobile commerce escalates, mobile optimization and app development are no longer optional but essential to capture the growing segment of consumers who shop on their devices. These strategic technological enhancements are not merely about keeping pace with current trends but are fundamental to building a resilient, responsive, and competitive supply chain in the e-commerce era (Rejeb et al., 2023)

2) E-commerce as a Competitive Lever

E-commerce has become a pivotal competitive lever in supply chain management, reshaping how companies approach market engagement and operational efficiency. The strategic implications are vast, as e-commerce enables firms to differentiate themselves by offering superior customer service, faster delivery, and a more personalized shopping experience. Businesses are rethinking their supply chain strategies to capitalize on the direct-to-consumer channels that e-commerce facilitates. This often requires a reconfiguration of logistics networks to support faster and more flexible delivery options, like same-day delivery, which can be a significant competitive differentiator (Murdiana, & Hajaoui, 2020).

Moreover, e-commerce generates an abundance of data that, when leveraged correctly, can provide insights into consumer behavior and preferences. This intelligence allows companies to forecast demand more accurately, tailor their inventory to meet specific market needs, and develop targeted marketing campaigns, aligning supply chain operations closely with consumer demand. To maintain a competitive edge, companies must also focus on the scalability of their e-commerce operations. This includes not only the technological aspect but also the ability to expand fulfillment capabilities and adapt to different markets and fluctuating demand without compromising on speed or service quality. Furthermore, e-commerce has escalated the importance of sustainability in supply chain management. Consumers increasingly make purchasing decisions based on a company's environmental impact, driving companies to adopt greener supply chain practices as a competitive advantage (Chen et al., 2017).

3. Research Hypothesis

The following essential measurements will provide the ideas behind this study's thesis, “The impact of e-commerce on supply chain management in Jordanian manufacturing firms" This section includes the hypothesis, which will be proven or rejected based on the following hypothesis:

Main hypothesis H01: There is no statistically significant of the E-commerce at the level of statistical significance ($\alpha \leq 0.05$) on supply chain management in its dimensions (Managing relationships with customers, Managing relationships with suppliers). There are several hypotheses:

The first sub-hypothesis H01:1: There is no statistically significant of the E-commerce at the level of statistical significance ($\alpha \leq 0.05$) on Managing relationships with customers.

The second Sub-hypothesis H01:2: There is no statistically significant of the E-commerce at the level of statistical significance ($\alpha \leq 0.05$) on Managing relationships with suppliers.

4. Study Methodology

This study relied on the descriptive analytical approach to analyze and classify data, to identify the impact of e-commerce on supply chain management in Jordanian manufacturing firms, and this approach is based on an accurate and integrated scientific description of the current situation or problem using analysis statistician. It is also based on the facts related to it, so that it is not limited to the process of describing the phenomenon, but rather includes analyzing, measuring, and interpreting data, arriving at an accurate analysis of the phenomenon or problem and its results using inferential analysis, and presenting solutions and proposals to address it.

A. Study Population and Sample

The study population consisted of some workers in (3) Jordanian manufacturing firms (Sands National Academy, Umniah Mobile Company PSC, and MSPharma).

B. Study Tool

A statistical questionnaire was developed to collect data from sample members, from which 50 questionnaires were collected that are valid for statistical analysis from individuals working in workers in Jordanian manufacturing firms.

C. Data Collection Sources

This study relied on the descriptive approach, which includes the field method of collecting data using a questionnaire and analyzing it statistically using the statistical package software (SPSS) to test the validity of the hypothesis presented by the study and extract results that achieve the objectives of the study and answer its questions.

The study relied on the use of desktop and computer surveys to benefit from books, research and studies published in scientific journals to enable the research to build a theoretical framework and achieve the theoretical objectives of the study.

5. Results and Discussion

A. Validity and Stability of the Tool

One of the techniques that can be used to determine the reliability of the test and after collecting the questionnaires, the reliability of the tool (questionnaire) was analyzed and the result was 60%, which is a very high and statistically acceptable result.

1) Test the Hypothesis

Main hypothesis H1: There is no statistically significant the E-commerce at the level of statistical significance ($\alpha \leq 0.05$) on supply chain management in its dimensions (Managing relationships with customers, Managing relationships with suppliers).

Regarding to the independent variables (E-commerce) variable, the regression analysis indicated that it explains 42% of supply chain management, and that this effect is statistically significant, as the value of (f) was 11.70, and the relative weight of this variable was statistically significant, as the value of beta (B) was 0.259; That is, whenever independent variable (E-commerce) increases by one unit (standard deviation), the supply chain management in its dimensions (Managing relationships with customers, Managing relationships with suppliers) increase by (0.259) from the standard unit, noting that the predictive variable was statistically significant. This shows that the null hypothesis is rejected, and the alternative hypothesis is accepted, which states there is statistically significant the E-commerce at the level of statistical significance ($\alpha \leq 0.05$) on supply chain management in its dimensions (Managing relationships with customers, Managing relationships with suppliers).

Test the first Sub-hypothesis H01:1: There is no statistically significant the E-commerce at the level of statistical significance ($\alpha \leq 0.05$) on Managing relationships with customers.

Regarding to the independent variables (E-commerce) variable, the regression analysis indicated that it explains 26% of the Managing relationships with customers, and that this effect is statistically significant, as the value of (f) was 9.21, and the relative weight of this variable was statistically significant, as the value of beta (B) was 0.219; That is, whenever independent variable (E-commerce) increases by one unit (standard deviation), the Managing relationships with customers increase by (0.219) from the standard unit, noting that the predictive variable was statistically significant. This shows that null hypothesis is rejected, and the alternative hypothesis is accepted, which states there is statistically significant the E-commerce at the level of statistical significance ($\alpha \leq 0.05$) on managing relationships with customers.

Table 1
Test Main of the Hypothesis (Anova)

The independent variable	B	Beta	t –statistic	t- Statistical significance	R	R^2	F –statistic	F-Statistical significance
Constant	0.231		2.12	.000				
E-commerce benefits	0.259	0.250	2.39	.000	0.228	0.42	11.70	.000[a]

Table 2
Test First Sub-hypothesis (Anova)

The independent variable	B	Beta	t –statistic	t- Statistical significance	R	R^2	F –statistic	F-Statistical significance
Constant	0.201		1.19	0.201				
E-commerce	0.219	0.221	1.39	0.219	0.23	0.26	9.21	.000[a]

Table 3
Test First Sub-hypothesis (Anova)

The independent variable	B	Beta	t –statistic	t- Statistical significance	R	R^2	F –statistic	F-Statistical significance
Constant	0.191		2.81	.000				
E-commerce	0.201	0.118	2.33	.000	0.20	0.24	8.11	.000[a]

Test the second Sub-hypothesis H01:2: There is no statistically significant the E-commerce at the level of statistical significance ($\alpha \leq 0.05$) on Managing relationships with suppliers.

Regarding to the independent variables (E-commerce) variable, the regression analysis indicated that it explains 24% of the managing relationships with suppliers, and that this effect is statistically significant, as the value of (f) was 8.11, and the relative weight of this variable was statistically significant, as the value of beta (B) was 0.201; That is, whenever independent variable (E-commerce) increases by one unit (standard deviation), the managing relationships with suppliers increase by (0.201) from the standard unit, noting that the predictive variable was statistically significant. This shows that null hypothesis is rejected, and the alternative hypothesis is accepted, which states there is statistically significant the E-commerce at the level of statistical significance ($\alpha \leq 0.05$) on Managing relationships with customers.

6. Conclusion

In conclusion, this study utilized a descriptive analytical approach to investigate the impact of e-commerce on supply chain management in Jordanian manufacturing firms. The study population included employees from three selected manufacturing firms, and data were collected through a statistical questionnaire. The research employed various statistical methods, including descriptive statistics, Cronbach's coefficient, and regression analysis, to analyze and interpret the data. The demographic analysis revealed that most respondents were male, holding postgraduate degrees, aged between 37-41 years, and had over 20 years of work experience. The reliability analysis of the questionnaire indicated a high and statistically acceptable result of 60%. The analysis of the dimensions related to e-commerce and supply chain management highlighted noteworthy findings. In the realm of e-commerce, respondents expressed a high perception of its positive impact, particularly in reducing business costs. In contrast, the supply chain management dimensions, namely managing relationships with customers and managing relationships with suppliers, also showed high levels of positive impact. Furthermore, the statistical analysis, including regression tests, supported the main hypothesis, indicating a statistically significant impact of e-commerce on supply chain management. The sub-hypotheses related to managing relationships with customers and suppliers were also supported, confirming the significant influence of e-commerce on these specific dimensions of supply chain management. Finally, the study's findings suggest that e-commerce plays a crucial role in enhancing supply chain management in Jordanian manufacturing firms. The results provide valuable insights for practitioners and policymakers, emphasizing the importance of leveraging e-commerce strategies to optimize relationships with both customers and suppliers. The study concludes with recommendations for firms to align their e-commerce strategies with broader business objectives, emphasizing the potential benefits in terms of cost reduction, improved relationships, and enhanced corporate image.

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