EFFECT OF BLOCKCHAIN BASED SUPPLY CHAIN MANAGEMENT ON SUPPLY CHAIN RESILIENCE: MEDIATING ROLE OF SUPPLY CHAIN MAPPING AND CHANNEL INTEGRATION

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I would like to dedicate my PhD thesis work to God Almighty, my source of inspiration, wisdom, knowledge and understanding. A special feeling of gratitude to my loving parents Mr. & Mrs. Mubarik Ahmed whose words of encouragement and prayer are always with me. I am very thankful to my brothers for unlimited support, guidance, and encouragement. I will always appreciate all they have done for helping me. Dedications to my sister and brother-in-law, all sisters in law & relatives for their infinite prayers and praise. To my wife & her family for being supportive throughout my PhD journey and to my beloved daughter Haniya Fatima and my adorable nieces-nephews Merab Fatima, Emaan Fatima, Abdul Hadi & Mohd. Hashim.

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ABSTRACT

During the onset of COVID, one of the major challenges that various companies started facing was poor supply chain resilience (SCR). Number of firms could not survive due to the poor response of their supply chains and even more struggled hard to keep their supply chains afloat. Practitioners, and researchers started arguing that implementation of blockchain technologies to manage supply chains, blockchain based supply chain (BCSCM), could be one of the viable solutions to the problem of resilience. Despite of having anecdotal evidence on the impact of blockchain base supply chain on various forms of SC resilience, there was void of scholastic literature clarifying as to how it improves SC resilience directly and through other essential strategies like SC mapping and channel integration. Against this scenario, present study aims to explain the impact of BCSCM on supply chain resilience. The study also examines the roles of supply chain mapping and channel integration (CI) in the association between blockchain based supply chain management and supply chain resilience. The study took the case of Malaysian Electrical and Electronics Industry, one of the largest contributors to Malaysian exports and GDP. A close-ended questionnaire was sent to 465 E&E sector firms for the purpose of data collection. As a result, 261 filled questionnaires were received out of which 247 fulfilling the set criteria were considered for final data analysis. Afterwards, Partial Least Square Structural Equation Modelling (PLS-SEM) was applied to test the modelled relationships. Findings of the study revealed a significant positive impact of BCSCM on supply chain resilience (SCR.) Further, the mediating role of SC mapping and channel integration between BCSCM and SCR was confirmed. Based on the findings of the study, we recommend policy makers to infuse the BC technology in upgrading the E&E sector's supply chains to make them resilient. This will also improve the integration among the three streams of supply chain (upstream, midstream, and downstream) which in turn can improve SC resilience. Testing the impact of BCSCM directly and indirectly, through SC mapping and CI, is one of the prime contributions of this study. The findings of the study can provide key guidelines to improve the supply chain resilience of the firms especially in E&E sector.



ABSTRAK

Semasa Covid melanda, salah satu cabaran utama yang dihadapi oleh syarikat ialah daya tahan rantaian bekalan yang lemah. Banyak syarikat yang tidak dapat bertahan kerana tindak balas yang lemah terhadap rantaian bekalan (SC) dan lebih banyak syarikat bergelut untuk mengekalkan rantaian bekalan mereka. Pengamal, dan penyelidik mula berhujah bahawa pelaksanaan rantaian bekalan berasaskan teknologi blockchain (BCSCM) bagi mengurus rantaian bekalan, boleh menjadi salah satu penyelesaian yang berdaya maju kepada masalah daya tahan rantaian bekalan. Berdasarkan latar belakang ini, kajian ini bertujuan untuk menjelaskan kesan rantaian bekalan berasaskan blockchain terhadap daya tahan rantaian bekalan. Kajian itu juga mengkaji peranan pemetaan rantaian bekalan dan penyepaduan saluran (CI) dalam perkaitan antara pengurusan rantaian bekalan berasaskan blockchain dan daya tahan rantaian bekalan. Satu soal selidik tertutup telah dihantar kepada 465 firma sektor E&E untuk tujuan pengumpulan data. Hasilnya, 261 borang soal selidik yang telah diisi telah diterima, di mana 247 daripadanya memenuhi kriteria yang ditetapkan telah dipertimbangkan untuk analisis data akhir. Partial Least Square Structural Equation Modelling (PLS-SEM) telah digunakan untuk menguji model kajian. Penemuan kajian mendedahkan kesan positif BCSCM yang signifikan terhadap SCR. Selanjutnya, peranan pengantara pemetaan SC dan integrasi saluran antara BCSCM dan SCR telah disahkan. Berdasarkan penemuan kajian, kami mengesyorkan pembuat dasar untuk menerapkan teknologi BC dalam menaik taraf rantaian bekalan sektor E&E untuk menjadikannya berdaya tahan. Ini juga akan meningkatkan integrasi antara tiga aliran rantaian bekalan (huluan, pertengahan dan hiliran) yang seterusnya dapat meningkatkan daya tahan SC. Menguji kesan BCSCM secara langsung dan tidak langsung, melalui pemetaan SC dan CI, adalah salah satu sumbangan utama kajian ini. Dapatan kajian boleh menyediakan garis panduan utama untuk meningkatkan daya tahan rantaian bekalan firma terutamanya dalam sektor E&E.



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LIST OF ABREVIATIONS

AFTA	-	Asian Free Trade Agreement
ASEAN	-	Association of South-East Asian Nations
AVE	-	Average Variance Extracted
BC	-	Block chain
BCSCM	-	Blockchain based Digital Supply Chain
BCSCM	-	Blockchain based Supply Chain Management
CBA	-	Cronbach Alpha
CI	-	Channel Integration
CR	-	Composite Reliability
DCI	-	Downstream Channel Integration
DM	-	Downstream Mapping
E&E	-	Electrical and Electronics
EMS	51	Electronic Manufacturing Service
ERP	-	Enterprise Resource planning
FDI	-	Foreign Direct Investment
FMM	-	Federation of Malaysian Manufacturers
FTZ	-	Free Trade Zones
GATT	-	General Agreement on Tariff and Trade
GDP	-	Gross Domestic Product
GSP	-	Generalized System of Preferences
HTMT	-	Hetero-Trait Mono-Trait
ICT	-	Information and Communication Technology
IoT	-	Internet of Things
MCI	-	Mid-stream Channel Integration



MGA	-	Multi-Group Analysis
MIDA	-	Malaysian Investment Development Authority
MITI	-	Ministry of International Trade & Industry
MM	-	Mid-stream Mapping
MNCs	-	Multi-National Corporations
MNEs	-	Multi-National Enterprises
МРС	-	Malaysian Productivity Corporation
MTSCI	-	Multi-tier Supply Chain Integration
MTSCM	-	Multi-tier Supply Chain Management
OSAT	-	Outsource Semi-conductor Assembly and Testing
PDA	-	Personal Data Assistant
PLS-SEM	-	Partial Least Squares Structural Equation Modelling
РМ	-	Process Mapping
RCEP	-	Regional Comprehensive Economics Partnership
RFID	-	Radio Frequency Identification
SC	-	Supply Chains
SCI	-	Supply Chain Integration
SCM	-1	Supply Chain Management
SCMap	-	Supply Chain Mapping
SCR	-	Supply Chain Resilience
SEMI	-	Semiconductor Equipment and Materials International
SMEs	-	Small and Medium Enterprises
UCI	-	Up-stream Channel Integration
UM	-	Upstream Mapping
VIF	-	Variance Inflation Factor

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CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter briefly provides a snapshot of the context of the study, research problems, and significance. The first section of the chapter explains the background of the study in briefly, setting the context for the problem statement, which is explained in Section 1.2. Research questions and objectives derived from the problem statement are exhibited in Section 1.3 and Section 1.4 of the chapter, respectively. Then, the scope of the study and significance of the study is explained. Finally, the contribution of the study and outline of the study is provided.

1.2 Background of the study

The advent of disruptive Industry 4.0 technologies is staggeringly changing the business landscape (Mubarik et al., 2021; Kusi-sarpong et al.,2022). This is resulting in the development of digital business environments for value co-creation through the use of information and communication technologies (ICT) in supply chains (Graça & Camarinha-Matos, 2017; Deepa et al.,2022). This in contrast to traditional business environments, represents an innovative approach for collaborative organizations across multiple industries to effectively leverage technological and service resources (Senyo et al., 2019) such as collaborations with suppliers and customers. Businesses that are adopting these disruptive technologies are becoming cost effective and resilient. (Bär et al., 2018). These technologies help transition from uncoordinated silos to integrated operational improvement focused on end-to-end internal processes and external consumer interactions.

Nevertheless, the use of technology and operational skills would need to be coordinated and sequential in order to produce a holistic and compound effect (Bollard et al., 2017; Novak et al., 2021).

Today's business world, in which everything is linked, provides a digital imperative for businesses to facilitate changes through technology, which in turn serve as facilitators for new types of innovation such as supply chain innovation (Michael et al., 2013; Dutta et al.2020,).In the pursuit of better supply chain integration, efficiency, resilience, various businesses are adopting Industry4.0 technologies, especially block chain technology (Mubarik et al. 2021). Further, given the catastrophic impacts of COVID19 on the supply chains across the globe, now the firm are striving more than ever to adopt industry 4.0 technologies, especially blockchain, to build their supply chain resilience (Alzoubi et al.,2022). Likewise, the COVID-led SC disruptions has aggravated the need of strategies and ways to make supply chains more prepared, responsive, and agile. Further, as organizations are competing based on their supply chain networks, they are trying to transform their supply chains to stay ahead of the game (Pflaum et al., 2017; Hassan and Abbasi 2021).

Recognizing this, though recent literature has emphasized the critical role of digital technologies in operations and supply chain management, including cloud computing (Gonul Kochan et al., 2018; P. Gupta et al., 2013; Novais et al., 2019), big data analytics (Govindan, Cheng, Mishra, & Shukla, 2018), and artificial intelligence (Büyüközkan & Göçer, 2018; Kshetri, 2018; Queiroz & Fosso Wamba, 2019) while the sufficient empirical evidences are yet to be established especially in the case of high-tech sectors such as electrical, electronics, and ICT. As noted by Khan et al.,(2022), Mubarik et al.,(2021) and Kusi-sarpong et al.,(2022), there is a dearth of study on as to how the businesses can capitalize on blockchain technologies to uplift its supply chain resilience. The extant literature lumps blockchain as part of Industry4.0 technologies and does not focus on it explicitly (Chen, 2018; Kshetri, 2018; Chen et al., 2019; Viriyasitavat et al., 2020; Mubarik et al., 2021).

This research views blockchain as a technology advancement that has the power to contribute a number of supply chain management objectives, including cost, quality, speed, reliability, and risk mitigation (Kshetri, 2018; Dutta et al.,2020). A blockchain-based digital Supply chain allows information to be shared across the value chain in a secure, reliable, and trusted way (Dmitry et al., 2019). It has established new trends in productivity through the digitization of key business processes and enhancing



by intra and inter-enterprise integration (Hines, 2014; Sadouskaya, 2017; Ozdemir et al.,2022). Due to its inherent efficient structure, blockchain-based digital supply chain is replacing traditional operations, and many of the businesses are now working to adopt it (Milani et al., 2016; Modgil et al., 2021). Studies (e.g., Milani et al., 2016; Chichoni & Webb, 2018; Dmitry et al., 2019; Mubarik et al., 2022) suggests that for competing in the environment of disruptive technologies, businesses need to relook at their supply chain strategy to adopt digital supply network (DSN) driven by blockchain technologies in order to synchronize the physical product's flows, information, talent, and finance (Chichoni & Webb, 2018). BCSCM is more connected, intelligent, scalable, and swift than old-style supply chain management (Heiskanen, 2017; Dujak & Sajter, 2019; Kusi-sarpong et al., 2022). BCSCM network enables organizations, customers, suppliers, and other stakeholders to connect in real- time environments through the extended enterprise. Such networks develop a new level of collaborations, link more directly with customers, and grasp new markets rapidly and build and scale new offerings quickly. The best supply chains of today use state-of-the-art information and technologically enhanced communication systems such as PDAs, GPS, scanners, and tagging methods as RFID and barcodes (Jonsson et al., 2013; Kusi-sarpong et al.,2022). Digital technologies are progressively ousting paper-based supply chain reports. Businesses need to project and forecast variations in their customers' demand in order to cater to them effectively. In such a situation, transparency, extended collaboration with suppliers and customers are essential for meeting the demand fluctuations (Pirvulescu & Enevoldsen, 2019) and such projections and forecasting can be managed effectively through blockchain based technology.



In short, owing to the innate complexities and sluggishness of traditional supply chains and due to the agility, security, and effectiveness of BCSCM, the majority of the firms are either in the process of digitalizing their supply chain operation or have already adopted it. Further, firms are increasingly adopting technological developments like predictive analytics and robotics, which make them more resilient to have better movement of products and keep inventory inflow in warehouses and distributions centers (DCs) (Chichoni, 2018; Dujak & Sajter, 2019). Even though there are profound ways for accomplishing competitive advantage based on advanced supply chains. Against the above discussion, the basic premise of the

present study is that that blockchain technology-based supply chain (BCSCM¹) can play a significant role in uplifting the supply chain resilience of a firm. It helps firms to collect real time data and improves its end-to-end SC visibility, allowing the firm to access a vast volume of data for effective decision – making. (Queiroz & Wamba 2019; Kusi-sarpong et al.,2022). Number of scholars argue that transition toward BCSCM is slower because of the absence of comprehensive framework, backed by scientific research, illustrating as to what can be the impact of BCSCM on the various aspects of SCM like SC resilience, agility, and performance (Büyüközkan & Göçer, 2018). Further, organizations face many issues in the digitalization of their supply chain processes due to various strategies void as well. Such as strategies to improve the visibility, supplier sourcing and integration amongst multiple layers of suppliers and customers. These issues can be catered with the help of supply chain mapping and multi-tier channel integration strategies (Mubarik et al.,2021).

The need for uplifting supply chain through any strategic intervention could be well understood from the case of Malaysian Electrical and Electronics (E&E) sector. This sector is not only the largest contributor to the Malaysian exports but also considered as the significant contributor to the country's GDP and employment. Its contribution to the Malaysian export is more than 39%, and close to 7% in the GDP (Statista, 2019). This sector sits at the top of in the top priority areas list of Malaysian Government with the aim to upgrade them by Infusing Industry 4.0 technologies especially Block chain (BC) technology (MITI, 2021). Despite being one of the significant contributors to Malaysian economy, overall performance of this sector has remained stagnant from last many years. To stay competitive and efficient this sector is continuously looking to improve its supply chain operations by making them more resilient. However, the sector is still having some conventional practices in their supply chain, such as the limited view of integration as supply chain integration (SCI) view, where the tier -1 customers and suppliers are integrated while the multiple and subsequent layers of these stakeholders are neglected (Mubarik et al., 2022). Furthermore, to cater the multiple layers of supply chains suitable strategies related to visibility of supply chain networks are absent (Kusi-Sarpong et al., 2022) that can prove as cornerstone for robust supply chain structure towards its resilience. The efforts at various levels and stakeholders are being initiated to understand and mitigate these issues related to resilience of supply chains by adopting the sophisticated supply chain systems such as blockchain based supply chain management (BCSCM). Even at

government level efforts are also being made to learn from the experience of developed countries regarding this issue which shows the importance of this issue and sector. Recently, MITI's senior Minister Datuk Seri Mohamed Azmin Ali mentioned, ".... *supply chain resilience top Malaysia's agenda in MITI trade mission to US data.*" (TheEdgeMarket, 2022). It reflects that working on the SC resilience of E&E sector is timely in a manner and well aligned with the broader agenda of Malaysian government encapsulating the objectives of MySTIE (Malaysian Science, Technology, Innovation and Economy Socioeconomic Drivers – Manufacturing), SPV (Shared Prosperity Vision 2030) under KEGA5 (Key Economic Growth Activities – ASIAN Hub). However, at the firms and supply chain network level the efforts still need to take place in order to achieve the goal of supply chain resilience (SCR) envisaged at government level.

1.3 Problem Statement



Contemporary supply chains are innately complex, consisting of multiple layers, dispersed geographical organizations collaborating to serve the customers worldwide (Lambert, 2017; Mubarik et al., 2019; Khan et al., 2022). Supply chain networks embedded with globalization, diverse cultures, different policies, customers' pressures, and human behaviors make information evaluation and supply chain management highly challenging (Dmitry et al., 2018; Junaid et al., 2022). Whereas the need for information evaluation is increasing as the failure to do so may raise the transaction cost, pilferage, and fraud, further leading to trust deficit. Often incidences of altering information about the provenance of high-value products or their losses have been reported by supply chain partners (Maurer, 2017; Mahmood and Mubarik 2020; Deepa et al., 2022). To resolve such issues the attributes like readiness, responsiveness and reconfiguration of supply chains with respect to mitigating the potential disruption is critically important (Kusi-Sarpong et al., 2022). In this context, traceability, verifiability, and transparent information sharing appear as the cornerstone supply chain capabilities in any industry to compliment the abovementioned strategies (Mubarik et al., 2021; Kusi-sarpong et al., 2022; Khan et al., 2022). Lower transparency in the supplied value of any product precludes supply chain players from evaluating and validating the actual value of that product. Further, the cost of intermediaries, their dependability, and clarity make traceability even complicated. These risks and lack of transparency can give rise to contentious and even reputational issues (Mubarik et al.,2021). The occurrence of such risk is high in conventional supply chains as such supply chains heavily rely upon centralized; in some cases, heterogeneous and standalone; information management systems (IMS). In such a situation, supply chain partners need a higher level of trust to rely upon a single firm or agent in order to store their valuable, strategic and sensitive information (Abeyratne and Monfared, 2016; Khan et al., 2022). Furthermore, a conventional centralized system may be exposed to the "single point failure," putting the whole system at the mercy of errors, hackers and attacks (Dong et al., 2017; Dutta et al., 2020). Therefore, a blockchain based supply chain network along with supply chain resilience will equip firms to prepare and mitigate such issues.

A case in hand is Malaysian Electrical and Electronics (E&E) sector. In the past two decades E&E sector exports have been either stagnant or at decreasing trends, especially from year 2000 as high as 61.7% to 38.1% in 2019 (Yew & Hamid, 2021). While facing challenges maintaining a largest share of Malaysia's export composition, the E&E's companies have to fully utilize its resources effectively either in supply chain or operations to secure its position and resilience. Researchers have reported about the issues in this sector such as dis-integration and inefficiencies in supply chains mainly due to conventional supply chains (Yew and Hamid, 2021; Mubarik et al., 2021). These problems point out towards lack of readiness, responsiveness, and recovery plans of firms that are the core issue which supply chain resilience notion caters. Further, COVID-19 led global supply chain disruptions in this industry (products including electronics chips and industrial electronics) that emerged in China have brought this issue even more in the limelight. Malaysian E&E sector was not an exception in this disruption. China adopted near shoring approach which is "the transferring of a business operation to a nearby country from a more distant one".In this regards, the Malaysian, E&E sector appears to be the most suitable sector in this regard and can become a global hub for the manufacturing of semiconductors for that this sector to transform its supply chain as make them resilient. Hence, to face the challenges of SC disruptions, and capitalize on the opportunity the need for the SC reliance is much higher than ever (Business Today, 2022).

Furthermore, this sector encounters high demand and supply volatility, which can prove fatal in the absence of a resilient supply chain. The supply chain of E&E

sector supply chain also requires an active inter- and intra-organization supply chain integration to achieve its goals efficiently and systematically (Hofmann et al., 2018; Zailani et al., 2019). That is so policy makers, practitioners and researchers are increasingly looking toward SC strategies and capabilities that can help uplift the SC resilience of the E & E sector directly and/or indirectly.

BCSCM appears as such a capability(ies) that can uplift SC resilience of the E&E sector of Malaysia. BC-SCM driven by blockchain technology, the internet of things, artificial intelligence, and predictive analysis can drastically improve the supply chain integration and competencies (Abeyratne and Monfared, 2016). Blockchain technology provides better economically, and technologically viable solutions as this technology entails the capabilities of having a decentralized 'trustless' database (Abeyratne and Monfared 2016; Deepa et al., 2022). This not only allows the large-scale transactions globally but also permits decentralization and process disintermediation among multiple supply chain entities (Crosby et al., 2016; Dutta et al., 2020).



Anecdotal evidence on the use of blockchain technologies in managing various aspects of supply chains from plan to delivery can be seen (Abeyratne & Monfared, 2016; Khan et al., 2022). Overall, the literature on blockchain based digital supply chain management have exponentially increased in the last three years; however, the discussion on its implementation and adoption is yet in initial phases of development with several challenges from technological, behavioral, policy-development, and organizational perceptive (Yli-Huumo et al., 2016; Kusi-sarpong et al., 2022). These aspects require the serious attention of researchers to address them integrally and effectively. Furthermore, it is argued that BCDSM significantly increases the supply chain resilience (SCR) which is a key goal of upgrading any supply chain network (Mubarik et al., 2021). In this connection, supply chain mapping (SCMap) can play an instrumental role in order to make the overall supply chain network more resilient (Mubarik et al., 2021b). SC mapping can play an instrumental role in encountering the variety of disruptions like COVID-19, Storm Eunice, Cyclones, and earthquakes etc. It also helps identify the area where cost can be saved, and greater efficiencies can be achieved. SC mapping can significantly contribute to key SC resilience-this study defines SC resilience as the ability of a firm to prepare for, respond to and bounce back any unforeseen SC disruptions (Kusi-Sarpong et al., 2022; Khan et al., 2022). Kusi-Sarpong et al., (2022) argue that BCSCM can contribute to the SC mapping of a firm

by providing a medium for closer collaboration with various SC entities. Whereas SC mapping, in turn, can contribute to the SC resilience. For example, SC mapping can help firms to build a greater understanding and orientation of various essential factors like related risks, costs, timeframes, and delay points. The provision of such information helps firms to deploy the appropriate supply chain/business strategies in case of any disruption or volatility e.g Supplier faces any shortage, sudden increase in demand, or any unexpected disruption (Mukherjee et al., 2022). This discussion reveals that SC mapping can mediate the relationship between BCSCM and SC resilience. Since SC mapping has recently caught the attention of the scholars, during COVID, there is a void of literature clarifying this role of SC mapping (Mubarik et al.,2021). Further, another factor which has recently come under limelight and is considered a lynchpin between BCSCM, and SC resilience is Channel Integration. It is claimed that BCSCM improves a firm's integration with various tiers of suppliers and customers i.e., Channel Integration, which further improves its SC resilience. Unfortunately, research studies investigating the Channel Integration's role in the association between BCSCM, and SC resilience are scant (Khan et al., 2022).



Putting altogether there is a void in literature as to how BCSCM impacts SC resilience and what roles Channel Integration, and SC mapping can play in the association between BCSCM and SC resilience. Therefore, this study is novel in terms of establishing and investigating the role of BCSCM to upgrade the SCR of Malaysian E&E sector. Furthermore, the interplay of supply chain mapping and multi-tier channel integration strategies are addressed very first time by this study focusing the context of E&E sector of Malaysia. Addressing these questions can significantly help devise appropriate policies for uplifting resilience of the Malaysian E&E sector. This leads us to draw the research questions of study given in next section.

1.4 Research Questions

This study addresses the following research questions.

- i. What is the impact of BCSCM on the supply chain resilience of Electrical and Electronic sector firms of Malaysia?
- Does Supply Chain Mapping mediate the relationship between BCSCM and SC resilience in Electrical and Electronic sector firms of Malaysia?

iii. Does supply Channel Integration mediate the relationship between BCSCM and SC resilience of Electrical and Electronic sector firms of Malaysia?

1.5 **Research Objectives**

Corresponding to above questions, the research objectives of this study are following:

- i. To examine the impact of BCSCM on the SC resilience of Electrical and electronics firms of Malaysia.
- ii. To investigate the mediating role of supply chain mapping in the relationship between BCSCM and SC resilience in Electrical and Electronic sector firms of Malaysia.
- iii. To examine the mediating role of Channel Integration in the relationship between BCSCM and SC resilience in Electrical and Electronic sector firms of Malaysia.
- To develop a strategy model to uplift Supply chain resilience of Malaysian iv. Electrical and electronics firms.

Scope of the study 1.6



The current study focuses on the blockchain-driven supply chain management in the Electrical and Electronics (E&E) of Malaysia. The targeted population of this study is the Electrical & Electronics sector of Malaysia. The response has been taken from the experts who are representing the organizations. Experts are primarily the employees from supply chain departments of the organizations who respond on behalf of their organizations.

1.7 Significance of the Study

The E&E Sector of Malaysia is actively looking for strategies to transform its SC based on BCs and digitalization. It is noteworthy that the transformation of traditional SCs of Malaysian E&E Sector to the BCSCM is one of the major agenda of the Government of Malaysia. This study undertakes this task by highlighting the way BCSCM can help improve the SCs of E&E sector of Malaysia. In doing so, the study is also linked with the broader agenda of the Government of Malaysia. The proposed research model will act as a guideline for improving the supply chain resilience and overall competitiveness of Electrical and Electronics of Malaysia.

1.8 Contribution of the study

The contribution of this study is three-fold catering policy, practical and theory.

The foremost goal is to make the manufacturing sector's supply chains more resilient through achieving the three-fold aspect of Supply Chain Resilience (SCR) which are readiness, responsiveness, and recovery (3R) (Khan et al. 2022). This is aimed to be accomplished through blockchain based supply chain. In addition, the contribution is to illustrate the integration of supply chain processes that can be significantly improved by transforming the supply chain based on blockchain and digitalization. Furthermore, this study tends to perform the mapping of all three streams of supply chains in order to make them more resilient (Kusi-Sarpong et al., 2022). In doing so, it could be established that which type of information has to be passed through which stream and to which stream the material flow should go on. In this way, policy makers will be able to get guidelines to improve their policies and strategies related to supply chains. Further, to the manufacturing concerns of Malaysia, this study will provide an instrumental approach to make their supply chain resilient and more stable on the basis of which they can achieve the competitive edge in the international market (Mubarik et al., 2021). In this process, the integration and streamlining of their all processes can be performed with the help of Supply Chain Mapping (SCMap) and multi-tier Channel Integration strategies. Moreover, upon successful implementation and execution of this research's recommendations, the manufacturing concerns overall will be able to achieve their competitiveness while making their supply chain networks more robust. As a theoretical contribution, this study extends the dynamic capability view by infusing the new capabilities required for Supply Chain Resilience (SCR). These capabilities include the blockchain based supply chain which makes supply chain resilient. As well, the capabilities to streamline the supply chain streamlines by extending and testing the concepts of Supply Chain Mapping (SCMap) and multi-tier Channel Integration that leads towards resilient supply chains.

Furthermore, the dynamic capabilities view, and network theory concept is also



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APPENDIX C

List of Publications

- Mubarik, M. & Raja Zuraidah RM Rasi (2019). Triad of big data supply chain analytics, supply chain integration and supply chain performance: Evidences from oil and gas sector. *Humanities and Social Sciences Letters*, 7(4), 209-224. (Scopus).
- Mubarik, M., Raja Zuraidah RM Rasi & Faraz, M. (2020). Fostering supply chain integration through blockchain technology: A study of Malaysian manufacturing sector. *International Journal of Management* and Sustainability, 9(3), 135-147. (Scopus).
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 - Faraz, M., S., Petraite, M., Mubarik, M., & Raja Zuraidah RM Rasi (2021). How Industry 4.0 technologies and open innovation can improve green innovation performance? *Management of Environmental Quality: An International Journal*, 32(5), 1007-1022. (ESCI/Scopus).
 - Mubarik, M. S., Bontis, N., Mubarik, M., & Mahmood, T. (2021). Intellectual capital and supply chain resilience. *Journal of Intellectual Capital. https://doi.org/10.1108/JIC-06-2020-0206 (SSCI indexed Impact factor 7.198)*.
- Mubarik, M. S., Naghavi, N., Mubarik, M., Kusi-Sarpong, S., Khan, S. A., Zaman, S. I., & Kazmi, S. H. A. (2021). Resilience and cleaner production in industry 4.0: Role of supply chain mapping and visibility. *Journal of Cleaner Production, 292, 126058. (SSCI indexed Impact factor 11.072).*

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- Ghobakhloo, M., Iranmanesh, M., Mubarak, M., Mubarik, M., Rejeb, A., Nilsashi, M. (2022). Identifying Industry 5.0 contributions to sustainable development: A strategy roadmap for delivering sustainability values. Sustainable Production and Consumption. https://doi.org/10.1016/j.spc.2022.08.003 (SSCI Impact factor: 8.92).
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- Mubarak, M. F., Yusoff, W. F. W., Mubarik, M., Tiwari, S., & Kaya, K. A. (2019). Nurturing entrepreneurship ecosystem in a developing economy: myths and realities. *Journal of Technology Management and Business*, 6(1).

VITA

Mobashar Mubarik was born in Pakistan. He finished his Bachelor of Commerce from University of Karachi, Pakistan. Then went to United Kingdom for further studies from where he completed his bachelor's in strategic management & Leadership from Pearson UK. After completing Bachelor, he accomplished his Master of Business Administrations from University of Northampton in 2018. He has also obtained his certification in entrepreneurship from Institute of Business Administration, Karachi. Finally, Mr. Mubarik completed his PhD in technology management from Universiti Tun Hussein Onn Malaysia in 2022. In addition, he worked as adjunct lecturer at Mohammad Ali Jinnah University, Dadabhoy Institute of Higher Education, Benazir Bhutto Shaheed University, Sarhad University Karachi Campus, and Federal Urdu University in Karachi Pakistan. Besides he worked as Gradate Research Assistant at Universiti Tun Hussein Onn Malaysia from 2019 to 2022. He also worked as Visiting Researcher at Comenius University Bratislava, Slovakia and visited Copenhagen Business school, Denmark, and University of Vienna, Austria as PhD student. He has published his research in several reputable journals including Journal of Cleaner Production, Journal of Intellectual capital and Journal of Business Strategy and the Environment, to name a few and participated and presented his research in several international conferences and symposiums.

