

The Impact of Technology Adoption on Supply Chain Practices in Business Education. Lessons from Small and Medium Enterprises (SMEs)

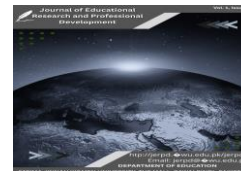
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Abstract

Business education increasingly emphasizes the integration of real-world practices to prepare students for evolving professional demands. Small and Medium Enterprises (SMEs), which play a vital role in economic growth, job creation, and innovation, provide important lessons for teaching and learning in this domain. This study explores how the adoption of basic technological tools by SMEs enhances customer satisfaction, builds loyalty, and strengthens competitiveness. By examining SMEs as case examples, the research highlights how technology-driven supply chain practices can be integrated into business education curricula to bridge the gap between theory and practice. Using a structured questionnaire, literature analysis, and thematic data interpretation, the study demonstrates that technology adoption in SMEs not only reduces operational costs but also creates opportunities for re-investment in product development and market expansion. From an educational perspective, these findings underscore the importance of equipping future business professionals with the knowledge and skills to effectively apply technology in supply chain management. The results provide both theoretical insights and applied implications, offering educators a framework for aligning business education with contemporary industry practices.

Keywords: Small and Medium Enterprises (SMEs), Technology adoption, Customer satisfaction, Cost reduction, Market share.

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Introduction

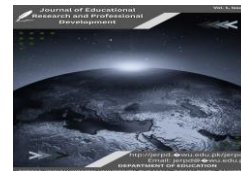
In such a competitive and globalized business landscape, supply chain management (SCM) has become essential for businesses who wish to increase productivity, save expenditures, and to provide a better experience for customers. Supply chain management has significantly changed over the last few decades. In the past, supply chains were managed manually with manual procedures and disjointed systems. Typically, this approach was inefficient, costly, and led to poor communication among the different segments of the chain. However, these procedures have been completely revolutionized by the incorporation of technology, through which businesses have reached maximum productivity and better results (Christopher, 2016).

This change is mainly a result of the appearance of Enterprise Resource Planning (ERP) systems. An ERP brings several departments together (e.g. production, sales, inventory and procurement), to keep effective communication and collaboration between departments. This has allowed both streamlining of supply chain processes as well as better decision making since they can access this data instantaneously. Thus, businesses are capable of handling their resources better, reduce waste and minimize supply chain disruptions (Acar et al., 2017).

Another major achievement in terms of SCM is the emergence Internet of Things (IoT). The Internet of Things devices including GPS trackers and sensors enable the real time tracking of assets and items as they pass through the supply chain. Ben-Daya et al. (2017) point out that these technological devices collect and disseminate information about the location, state and transportation of goods, allowing businesses to better view and control how their logistics activities take place. This real-time information allows businesses to increase the overall efficiency of their supply chain; plan routes more effectively, and anticipating any disruptions. For example, as part of automated warehouses equipped with Internet of Things (IoT), a stock level is automatically monitored and replenishment orders are triggered.

An Overview of Technological development in Supply Chain Management

SCM has been revolutionized by another life changing technology which is big data analytics. The ability to use massive data from multiple sources can help businesses to understand and evaluate supplier performance, customer demand trends, manufacturing efficiency and other business activities. The big data can be used for predictive analytics by the organizations to keep inventory under control, modify production schedules and ensure more accurate demand predictions. With the predicted changes in the market and the needs of the



clients they have been able to be more responsive and flexible; cutting lead times and increasing customer satisfaction levels (Gunasekaran et al., 2017).

At the same time with these developments, machine learning and artificial intelligence (AI) are increasingly becoming relevant in supply chain management. AI systems can help analyze complex datasets looking for patterns and trends that humans may not notice. For example, AI can help with supply chain network optimization for deciding the least costly shipping routes, forecasting machinery repair, and AI can even automate decision making processes. Recently customer service has been boosted by AI driven chatbots. Chat bots provide virtual assistants, provide latest order updates and explains and resolves issues faced by customers (Dubey et al., 2019).

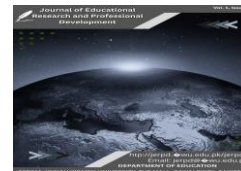
Importance of SMEs in the Global Economy

SMEs tend to create more jobs per unit of investment than larger firms because of their particular labor-intensive nature. In both industrialized and developing countries, SMEs are the main employers of labor in manufacturing, service and retail related industries. Smaller enterprises in India account for more than 45% of industrial output and 40% of exports and employ 80 million people in more than 36 million units. As employment creation function, this is particularly important in nations with fast expanding populations where SMEs help in the employing of new workers into the labor force (Singh et al., 2018).

The role of SMEs in global value chains emerged most evidently during the COVID-19 pandemic outbreak. The flexibility in shifting market requirements, such as the need to produce items related to personal protective equipment, or changing in the distribution networks due to the breakdown of conventional supply chains was evidenced by SMEs' high level of invulnerability to disruptions. This adaptability shows that SMEs can respond quickly to issues and deliver customized solutions that larger organizations may struggle to quickly integrate (Juergensen et al., 2020).

Research Gap and Justification

A large body of literature has been done on the adoption of technology in large organizations, most of which examined how multinational corporations and large enterprises use technology to enhance the processes related to supply chain management (Gunasekaran et al., 2017). Small and Medium Enterprises (SMEs) are ignored even though they matter a lot in

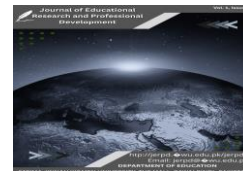


the world's economy. Much of the present collection of research mainly focusses on the success of technology adoption in large enterprises, which may neglect some of the specific challenges SMEs face when they are trying to implement similar systems. Large organizations have access to trained personnel, a specialized IT department, and are able to integrate modern and advanced technologies, such as Internet of Things, Big Data analytics and Enterprise Resource Planning Systems (Wamba et al., 2017). Furthermore, many SMEs operate in more specialized or local markets, so much of the research on matching technology may not be relevant. As SME's have more limited resources and operational restrictions, they need adaptable, scalable solutions. Whereas larger organizations can invest in modern and advanced technologies that provides more wide application benefits (Gunasekaran et al., 2017). This dissertation will assist the stakeholders of SMEs in accessing the role of technology in their businesses.

Need of Modified Approaches Required for SMEs

However, this indicates that more study is needed on customized approaches regarding the adoption of technology by SMEs. As SMEs usually have less funding, fewer staff and less market share, they need affordable and easy to implement solutions. Big corporate solutions are too expensive for smaller companies to afford, and often, underuse or zero adoption of these technologies. For example, systems like Cloud systems are a scalable solution that could be just right for SMEs but the literature published till this time fails to explain how they can overcome challenges in selecting the best platform, data security and employee training to use the system efficiently (Dubey et al., 2019).

Other areas of targeted research needed include difficulties that SMEs face in acquiring technical competence. SMEs mostly rely on staff that lack the knowledge and skills needed to adopt and manage these technologies. On the other hand, larger organizations can afford to hire professional IT staff as well as consultants to support the adoption and managing of those advanced technologies. Hence, this gap is closed by establishing accessible training programs or training alliances with academic institutions to supply the SMEs with skills, yet, they are not much looked into the literature (Gunasekaran et al., 2017). This study fills the research gap in the area of technology adoption and addresses how it can help SMEs achieve two major goals through cost reduction and increased customer satisfaction. The significance of these two results to SMEs is very important. Cost reduction is really important for SMEs because of the profit margins, and they cannot afford inefficiencies from manual processes which might



hinder the effective tracking and monitoring of goods (Wamba et al., 2017). Technology such as inventory management software, and Internet of Things tracking devices can improve small and medium sized enterprises (SMEs) operational efficiency, reduce waste, lower expenses associated with stock outs, over production and delays in delivery. SMEs need to prioritize customer satisfaction over cost reduction if they wish to compete with larger companies and build a long-lasting relationship with clients.

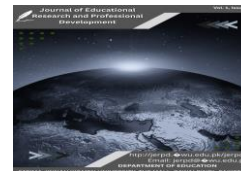
Problem Statement

Although there is significant evidence of the advantages of technology adoption in supply chain management (SCM), most of the research that has been done so far has been on large businesses with substantial financial and technological resources. Large companies use complex technology such as an Internet of Things (IoT) devices, Enterprise Resource Planning (ERP) systems and Big Data analytics to optimize their supply chains, save costs and increase efficiency. However, SMEs are so important to most economies, this emphasis on big businesses ignores the particular difficulties that they face (Ben-Daya et al., 2017).

Small and medium sized enterprises (SMEs) are critical drivers of employment and innovation, and economic diversity. But they are often hindered by lack of funds, insufficient technical expertise, and narrow sufficiency of resources and help. These obstacles have stopped many SMEs from being able to implement the kind of technical advancements that have changed the supply chains of large companies. SMEs find it difficult to compete in an increasingly digital environment as a result of the technology gap (Fernie & Sparks, 2018). This research gap is critical because small and medium-sized businesses (SMEs) operate in very different environments than larger companies, demanding the usage of alternative approaches when integrating technology into supply chain operations.

Addressing this gap will have wider effects on academic research and policy making. This study can help shape policy initiatives meant to assist SMEs' digital transformation by offering insights into how they might successfully integrate and employ technology in their supply chains. Governments and industry stakeholders could also provide more efficient support systems such as financial incentives, training courses, etc. to help SMEs to navigate in the technological world (Wu et al., 2013).

In conclusion, by concentrating on the particular difficulties and chances associated with technology adoption in SMEs in the supply chain industry, this study fills a significant gap in



the literature. The research's conclusions could have a big influence on the SME market as well as supply chain management as a whole. They provide important new information about how smaller businesses can use technology to stay resilient and competitive in a changing global market.

Research Objectives

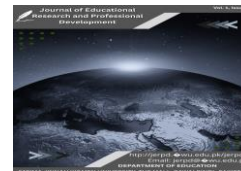
1. To assess the current level of technology adoption among SMEs in supply chain management and explore its relevance for business education.
2. To evaluate how the use of simple technologies in SMEs contributes to operational cost reduction and identify lessons that can be integrated into business education curricula.

Research Questions

1. To what extent are SMEs adopting technologies, such as cloud computing or ERP systems, in their supply chain management, and how can these practices inform business education?
2. How do simple technologies, such as inventory management software or online order tracking, help reduce operational costs in SMEs.
3. What implications do these have for teaching business students about technology-enabled supply chain practices?

Significance of the Study

The significance of this research is due to the way it addresses the major challenges Small and Medium Enterprises (SMEs) face when incorporating technology into supply chain management (SCM). SMEs are important in most economies because they help local growth and employment. Due to a lack of resources, many SMEs, find it difficult to integrate technology, as a result it affects their capacity to compete. The purpose of this research is to offer useful insights that can assist SMEs in increasing their cost-effectiveness and customer satisfaction by concentrating on the adoption of technology in supply chains. Second, the study will concentrate on how customer satisfaction is affected by the use of new technologies. Customer satisfaction is essential for SMEs because this will promote repeat business, customer loyalty and positive image of the business. Upgraded technologies can help SMEs to increase customer satisfaction, reduce delays and more effectively deliver their goods. These



upgrades allow the company to compete in the market by improving the total customer experience (Christopher, 2016). Finally, this research will fill a gap in the literature by focusing on SMEs, which are often overlooked in studies on technology adoption that tend to focus on large firms. The particular possibilities and challenges faced by SMEs are very different from those faced by larger organizations, and this study will offer much-needed insights related to their situation (Brouthers et al., 2015). Through an examination of how technology affects consumer satisfaction and cost reduction, this study will provide actionable advice on how SMEs may enhance their supply chain efficiency and boost their competitiveness in the digital economy.

Methodology

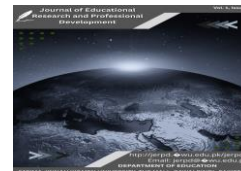
This study will employ a qualitative methodology in order to investigate how Small and Medium Enterprises (SMEs) use technology in supply chain management and the difficulties they encounter. The qualitative method is preferred because it allows for having an in depth understanding of experiences, viewpoints and activities of SMEs. Qualitative methods work towards producing vibrant and detailed and context specific insights, while quantitative research concentrates on numerical data. This methodology is appropriate for this study because, rather than assessing predetermined variables, the purpose is to investigate the actual experiences of SME managers and owners about the adoption of technology (Creswell, 2014).

Research Design

Qualitative design of this study was used to collect non numerical data through semi structured interviews with SME managers and the supply chain professionals. Semi structured interviews are very flexible both in terms of allowing participants to present their ideas freely as well as making sure the major issues are covered, which makes this sort of research ideal (Bryman, 2016). The data gathered through these interviews will be an overview providing an insight into the specific issues faced by small and medium sized enterprises, such as lack of technical skills, resistance towards change and financial constraints. This method can also be used to ask further questions that could help to clarify and expand on the insight.

Research Method and Sampling Method

In the study, convenient sampling will be used to choose participants. This sampling strategy is acceptable because it includes participants that can be reached and are willing to participate

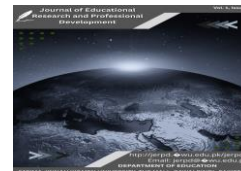


(Etikan et al., 2016). If the time and budget constraints of the research prevent an excessively restrictive selection procedure, then convenient sampling ensures that the study can include a wide range of SMEs, from different industries and regions, so that it will not be too restrictive. However, the outcomes of this technique may not be relevant for all SMEs but will help to investigate specific themes prevalent and problems encountered by the selected participants in a focused manner.

Participants will be selected on the basis of if they are responsible, or can be held responsible, for how the technology gets introduced in the supply chain operations of their small and medium sized enterprises. The target group consists of SME owners, managers and supply chain experts who have either attempted or experienced an implementation of technological solutions. For qualitative research attempting to generate in depth insights the sample size will be about 10 to 15 participants, which is appropriate (Guest et al., 2006). The size of the sample depends on what we define to be 'data saturation' -- at which point, we have no newer themes or information to emerge from the interviews.

Within this qualitative study, the number of participants is decided according to the concept of data saturation. The purpose of qualitative research is not to increase the sample size until eventually new insights or themes are created (Guest, Bunce, & Johnson, 2006). Qualitative studies rely on each participant giving rich, exhaustive information, and we determine data saturation with less participants than in quantitative research. Mason, (2010) notes that sample size for the qualitative research sometimes averages 10 to 15 people to well comprehend the research and identify the patterns or the themes of the data in the research. The sample size is justified since the goal is to gather detailed information regarding SMEs' experiences with technology adoption, with an emphasis on cost savings and customer satisfaction. By focusing on a smaller group, the study will be able to gather detailed opinions and give a full examination of the barriers and advantages of technology adoption in the SME setting.

Participants will be selected from different industries such as manufacturing, retail/wholesale and transportation services. The participants will be SME owners or managers who are responsible for supply chain decisions. Participants will be selected using industry networks and business education directories. Businesses from both urban and rural areas will be targeted to capture diverse perspectives. This selection ensures the study reflects a wide range of experiences with technology adoption.



Addressing Bias in Convenience Sampling

Though it has been convenient for convenience sampling, we must note potential bias associated with this sampling approach. Convenience sampling can choose the convenience of people available for the purpose of sampling, thus reducing the accuracy of the sample (Etikan, Musa and Alkassim, 2016). But we will use some measures to reduce bias as well as to make sure results are as trustworthy as they can possibly be.

We will first try to diversify the participants in terms of SMEs that may vary in terms of industries, geography and degree of technological adoption. Doing so prevents the study from assuming a homogenous set of participants and thereby saves the study from the possibility of bias caused by the choice to interview such a homogeneous lot (Robinson, 2014).

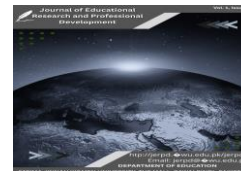
Second, so as to minimize further bias, the study will draw from triangulation and member checking. Cross checking data from several participants to ensure that no one individual's perspective plays a role in the conclusions (Denzin, 2012). Additionally, members check will allow the participants to verify their interview transcript to authenticate that their comments were authentically served by the interviewer and the final record of the explicit interview will be accurate in its representation of the interviewees' perspective (Birt, et al., 2016). If employed, this technique will enhance credibility and validity of the study's results.

Data Collection

Data will be collected through semi structured interviews with participants via in person or via video conferencing platforms, depending on the locations and the availability of participants. Each interview is expected to last twenty to thirty minutes, with a flexible guide covering the main issues relating to the adoption of technology in supply chain management. Participants will be asked open-ended questions such as:

- "What types of technology have you adopted in your supply chain management?"
- "Can you describe the main challenges you faced during the adoption process?"
- "How has the adoption of technology affected your supply chain operations?"

These open-ended questions will encourage participants to share their experiences and opinions in their own words, which is essential for qualitative research (Kvale & Brinkmann, 2015). Informed consent will be obtained from all participants, and they will be assured of



confidentiality and anonymity in the reporting of results. While these open-ended questions will encourage participants to participate in their own words, which is important for generative research (Kvale and Brinkmann, 2015). Participants will be assured of confidentiality and anonymity of reporting of results, and informed consent will be obtained from all.

Validity and Reliability

Several techniques will be used for the validity and reliability of the study. First, participants will be offered the opportunity to review the transcripts of their interviews and to comment before it is deemed that their opinions have been recorded appropriately (Birt et al., 2016). This is a process called member checking. This procedure increases the credibility of the data. The second will be a triangulation, i.e. the comparison of the themes identified in interviews with the results of other previous research on SMEs adoption of the technology. It will then point out any new or different results and make sure the results are in accord with what we know right now.

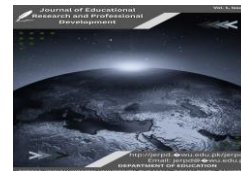
Ethical Considerations

All participants will provide their informed permission, before their participation into the study. The freedom of the participants to withdraw without consequence at any time, as well as the precautions taken to protect their privacy will be explained to them. Everything will be saved securely and only the study team can see it. The final report will use fake identities to protect participant identity. Research proposal will be filed for ethical approval from institution board of supervision in order to ensure that all procedures are conducted professionally and ethically (Bryman, 2016).

To ensure that the data remain private and secure, all of the collected data will be stored on password-protected devices and secure folders. Only the researcher will have access to the collected data. Personal identifiers of the interviewee will be removed. Data will be used only for research purposes and make sure not to share with others. Participants will be informed of these measures and will provide consent before taking part. After the study, all data will be deleted in line with ethical guidelines.

Data Analysis

Thematic analysis will be used for analyzing the gathered qualitative data. Thematic analysis provides us the opportunity to find patterns, themes, and categories in qualitative data. The



study is suitable for this approach since it provides a flexible but comprehensive approach for the study of SME managers' experience with technology adoption (Braun & Clarke, 2013).

The six-step procedure described by Braun and Clarke (2006) will be used in the analysis:

- i. **Familiarization with the data:** It involves transcribing the interviews and hearing the material numerous times to understand what the material means.
- ii. **Generating initial codes:** The data will be recognized and classified into its key features. During the coding process, the parts of the data that are of relevance to achieve goals and answers to what we're being asked to research are identified.
- iii. **Searching for themes:** The data is then looked over to identify common themes or patterns in the codes to form the next step of the analysis. Themes are broader looking at more abstract notions or ideas as relevant in the research context.
- iv. **Reviewing themes:** They will be examined to make sure that the themes accurately represent the facts. There are some topics that may be combined or improved while there are some that we may end up dropping if they do not make sense.
- v. **Defining and naming themes:** Precise names and explanations will be given to themes to clarify what each theme means, and how each theme relates to the research topics.
- vi. **Producing the report:** The conclusion is written up in a logical and organized form using participant quotes to support the conclusion and, finally, the themes.

Research and Findings

This chapter reports the results of data collected through semi-structured interviews and questionnaire responses. It highlights how the adoption of technology affects SCM in small and medium enterprises, in terms of cost reductions and improved customer satisfaction. Furthermore, it sheds light on the issues that are being encountered by SMEs when trying to integrate technologies and possible future developments. Following figure shows the priority of technologies being adopted in the supply chain industry (Fernie, 2018).

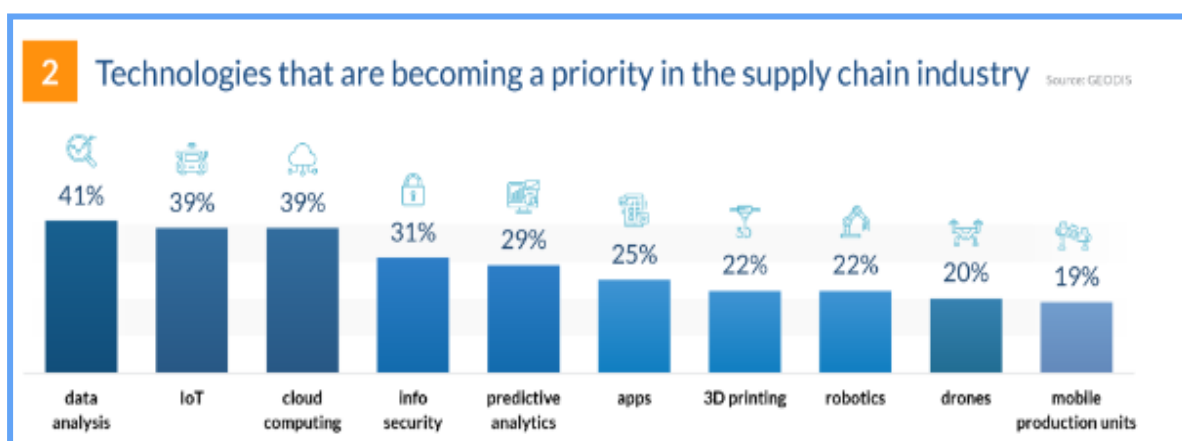


Figure 1 Technologies that are getting popularity in the supply chain industry

Source: (KPMG, 2024)

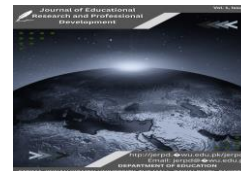
Not all the SMEs have the capacity to design and implement technological advancements in their system, some enterprises outsource the IT solutions to save their resources (Jacob, 2023). Following is the figure showing percentage of the supply chain areas outsourcing IT solutions:



Figure 2 Areas of supply chain which outsource IT Solutions in SMEs

Sources: (Jacob, 2023)

In this section we discussed different technological advancements such as ERP, IoT, and AI and their role in the efficiency of supply chain in business education. Operational efficiency, decision making and customer satisfaction drive these innovations with these having a significant impact on Small and Medium Enterprises (SMEs). Based on the information and content obtained from research articles from top journal, following hypotheses have been derived for analysis. The hypotheses will be accepted or rejected depending on the significance of trends in the data obtained through interviews and research.

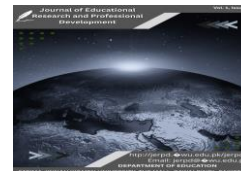


Technological Adoption in SMEs

Technology is slowly but steadily changing supply chain operations in the many of the SMEs. In many African, Asian and Latin American nations, SMEs play main role in employment and poverty reduction. In areas where jobs are limited and formal, millions of people depend on SMEs for their living. For example, in Sub-Saharan Africa SMEs, comprise about 40 percent of GDP and more than 60 percent of employment, indicating their fundamental capacity in structuring the region's socioeconomic interface (Grau, 2024). Hence, SMEs are playing great role in elevating economic condition of the working class in SMEs and hence stakeholders are inclined for implementing advanced technology in the system for sustainability of the sector.

Small and medium sized businesses ('SMEs') play a vital role in the economies of many countries, providing considerable inputs to economic growth, innovation and job creation. SMEs are the greatest number of firms in developed and also in developing country, and they make a big contribution to GDP. SMEs are consisted of approximately 90% of enterprises and create more than 50% of jobs globally. Their economic importance is areas where large businesses are scarce and stability and growth depend on economic diversification (World Bank, 2020).

In Europe, North America and some regions of Asia, SMEs are a major source of innovation and growth. In many ways, they support the both mature and developing industries, often setting the standard for the adoption of new ideas and business education practices. For instance, in countries like Germany, SME's, commonly known as the Mittelstand, are often very specialized, and demonstrating very high levels of specialties in term of technical proficiencies (Audretsch, 2018). We have established that these companies contribute not only to the export of the country but also to the country economic production. According to a European Commission (2020) it is SMEs that make up 99 % of all companies in the EU, and they produce 56 % of the value added to the economy. SMEs also embedded in supply chains as they also have their unique contribution toward it. In many cases SMEs are acting as supply sources, distributors, or intermediaries of larger companies. More often, they provide specialized parts or services, and these are critical to the functioning of larger supply networks, particularly in the pharma and electronics and auto industries. Due to this, SMEs play a very important role to the large firms since they provide a wider and efficient supply chain solutions.



Most of the people surveyed asserted that central to their operations was the integration of Enterprise Resource Planning (ERP) systems as this provided them with real-time access to up-to-date data as well as improved interdepartmental communication (Mishrif and Khan, 2023). This result is aligned with the results found in the already conducted research studies found through secondary research studies. For instance, a number of small manufacturers had reduced their inventory management and procurement costs by installing a cloud-based ERP system. Before implementation, the organizations have written records, but the records would routinely lead to stock shortages and manufacturing delays. When the ERP system integrated, the enterprises became able to automate order processing and track inventory in real time, which resulted in the optimized purchasing strategy. And due to this a reduction in inventory holding costs of 25% was achieved (Wamba et al., 2017).

IoT technologies hold the significant importance in the supply-chain of enterprises by the involvement of GPS trackers and sensors in real-time inventory tracking and route optimization. Further, data analytics tools enabled SMEs to data-mined decisions on optimizing inventory levels and accurately forecasting demand patterns (Soomro, 2024). Though, some SMEs still largely relied on affordable and scalable solutions, such as cloud-based ERP systems, because the budget was still small. This information is aligned with our results of the questionnaire, in which 60% of the respondents rated technology adoption in SMEs between 4 or 5 on a scale of 5 to 1 (5 being most important to 1 being least important) regarding the extent to which they considered it important.

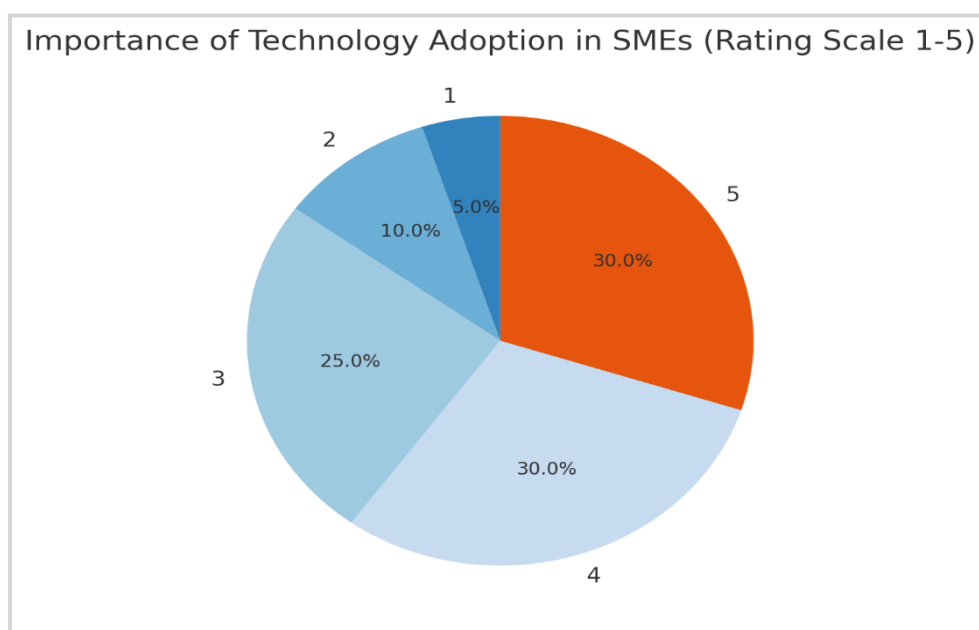
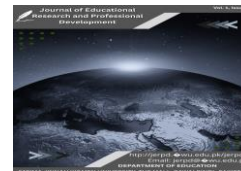


Figure 3 Survey of the result

Link: <https://app.onlinesurveys.jisc.ac.uk/s/northampton/supply-chain-smes?name=N>

This is further indicated by the pie chart, where the respondents hold high importance in technology adoption in SMEs as majority of the respondents consider technology highly important for the optimization of technology and enhancing supply chain operations.

The following chart depicts the reduction in cost due to implementation of technology in the supply chain system of an enterprises. The SME reported achievement of a 15 percent reduction in logistics costs through optimized routing before and after adoption of IoT inventory control system in its supply chain management (Kumar, Ali and Pandey, 2020). Another advantage in terms of cost reduction was found in process automation. The automated processes gave a reduction in human error and costs of labor through ERP systems. But restrictions in finance were one of the barriers to advanced technology adoption, as SMEs often prioritize the short-term operational needs over long-term technological Investments.

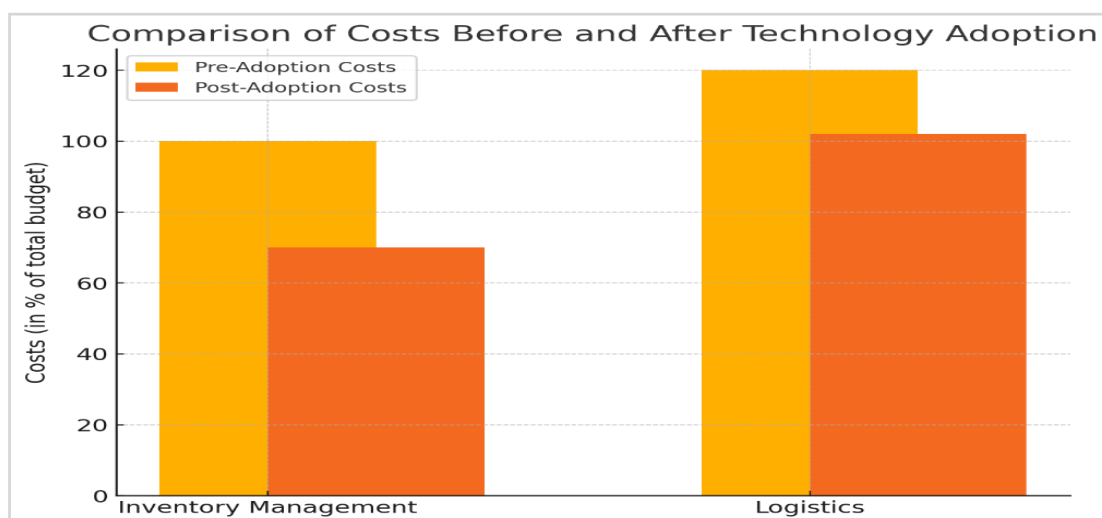
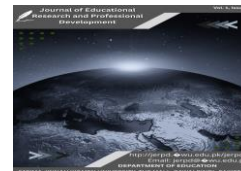


Figure 4 Graph of before and After adopting IoT in the supply chain management

Source: (Kumar, Ali and Pandey, 2020)

In the post-adoption phase of technology, the cost reductions observed in inventory management and logistics are enormous, as shown by this bar graph. An example of such reductions is a 30% drop in inventory management costs, indicating the efficacy of automation and systems of real-time tracking.

In the survey, respondents identified Enterprise Resource Planning (ERP) solutions and IoT technologies as the most transformative in the supply chain system of SMEs, with cost reduction and increased customer satisfaction rating as top advantages of their use. This information should be placed within the paragraph discussing the survey results about technology adoption-that is, starting with "Though, some SMEs still largely relied on affordable and scalable solutions." It should follow the sentence that notes 60% of respondents consider technology adoption very essential for maintaining efficient system.

Conclusion

From the above findings and discussion, it can be concluded that the educational enterprises have greatly benefited with the technology driven supply chain strategies. The biggest benefit lies in enhancing operational efficiency and increasing customer satisfaction. The automated processes with effective data collection minimizes the manual intervention and human mistake, making decision making faster and more precise. For instance, automated systems can keep an eye on production processes continually, and if they detect a problem, they can alert



management about it before it devolves into a bigger issue, which further helps time consumption and ultimately increase productivity.

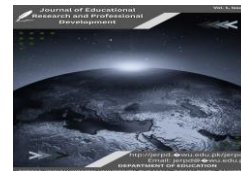
SME's ability to operate in a more efficient and response to market demands in a faster time, further strengthen and adapt the global supply chain. Moreover, the technological developments in SCM also lead to an increase in consumer satisfaction. Precious tracking and predictive analytics allow businesses to notify customers in advance of possible delays and be able to give a very precise delivery schedule. Furthermore, better inventory control reduces stock outs, and the overall customer experience is improved by ensuring goods are available where required.

The difficulties of SMEs to implement technology in SCM highlights the need of more specialized solutions addressing those difficulties. In order to achieve improved performance and sustainability of SMEs in the rapidly digital marketplace, it is necessary to understand the obstacles that prevent these SME's from adopting those technologies efficiently, and to explore potential ways to increase their efficient integration of this technology. The identified issues obstructing SMEs from using new technologies are high costs, lack of skills, and reluctance to adopt may generate focused solutions that help these companies overcome difficulties and thrive in the digital economy.

From the content derived in literature review and data and information found in the section four, four main hypotheses were found and depending on the significance and quality of data found in research articles from journal articles and respondents' responses, majority of the hypotheses are accepted with significance. The result conclude that SMEs can increase their operational excellence and customer satisfaction by implementing advanced technologies in their system, meanwhile reducing cost and time in the process. All the SMEs are not capable to adopt latest technologies due to constraints like financial burden, lack of expertise and training but these hurdles can be overcome by the strategic moves and target of advanced technically systems can be achieved by SMEs.

Recommendations

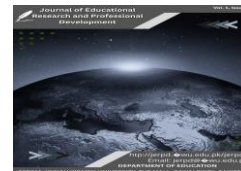
- Following are some of the recommendations for SMEs to adopt and implement technologies in their systems:
- SMEs should conduct proper research before implementing technology to balance the cost and benefit of the proposed technology.



- From the alternative options, businesses should opt for the technology/advanced tool that provide maximum benefit to the business.
- SMEs should approach government sectors for taking advantage of the relevant government programs, getting some financial support, and get them into the employee's skill enhancing programs offered by state.

References

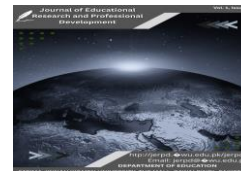
- Acar, M.F., Tarim, M., Zaim, S., Zaim, H., & Delen, D. (2017). Knowledge management and ERP: Complementary or contradictory? *International Journal of Information Management*, 37(6), 703-712.
- Acar, Y., Huo, B. and Huo, B., 2017. The Role of Information Sharing in Supply Chain Management: A Literature Review. *Journal of Manufacturing Technology Management*, 28(1), pp.105-121.
- African Development Bank, 2019. *Supporting Small and Medium Enterprises in Sub-Saharan Africa*. [online] Available at: <https://www.afdb.org/en/documents/publications/sme-support-africa>
- ASCM (2022) 'What is supply chain?' [Online]. Available at: <https://www.ascm.org/topics/supply-chain-technology/>
- ASCM, 2022. What is supply chain?. [Online] Available at: <https://www.ascm.org/topics/supply-chain-technology/>
- Audretsch, D.B., 2018. *The Role of Small Firms in Innovation and Entrepreneurship*. Small Business Economics, 51(2), pp.151-158.
- Barney, J. (1991). Firm Resources and Sustained Competitive Advantage. *Journal of Management*, 17(1), pp.99-120.
- Ben-Daya, M., Hassini, E., & Bahroun, Z. (2017). Internet of things and supply chain management: a literature review. *International Journal of Production Research*, 57(15-16), 4719-4742.
- Birt, L., Scott, S., Cavers, D., Campbell, C., & Walter, F. (2016). Member checking: A tool to enhance trustworthiness or merely a nod to validation? *Qualitative Health Research*, 26(13), 1802-1811.
- Braun, V. & Clarke, V., 2013. *Successful Qualitative Research: A Practical Guide for Beginners*. London: SAGE Publications.



- Brinch, M., Gunasekaran, A., & Møller, C. (2018). IoT applications in supply chain management. *Production Planning & Control*, 29(7), 1-10.
- Brouthers, K.D., Nakos, G., & Dimitratos, P. (2015). SME entrepreneurial orientation, international performance, and the moderating role of strategic alliances. *Entrepreneurship Theory and Practice*, 39(5), 1161-1187.
- Bryman, A. (2016). *Social Research Methods*. 5th ed. Oxford: Oxford University Press.
- Christopher, M., 2016. *Logistics and Supply Chain Management*. 5th ed. Harlow: Pearson.
- Creswell, J.W., 2014. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. 4th ed. Thousand Oaks: SAGE Publications.
- Davis, F.D. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly*, 13(3), pp.319-340.
- Dubey, R., Gunasekaran, A. & Childe, S.J., 2019. Big data analytics capability in supply chain agility. *Management Decision*, 57(8), pp.2092-2112.
- Etikan, I., Musa, S.A. & Alkassim, R.S., 2016. Comparison of convenience sampling and purposive sampling. *American Journal of Theoretical and Applied Statistics*, 5(1), pp.1-4.
- European Commission, 2020. *Annual Report on European SMEs 2019/2020*. [online] Available at: <https://ec.europa.eu/docsroom/documents/43833>
- Fernie, J., & Sparks, L. (2018). *Logistics and Retail Management: Emerging Issues and New Challenges in the Retail Supply Chain*. 5th ed. London: Kogan Page.
- Grau, T. (2024). Improving customer satisfaction in SMEs | Workcapital. [online] Workcapital. Available at: <https://workcapital.es/en/financial-news/Strategies-to-improve-customer-satisfaction-in-SMEs/>
- Guest, G., Bunce, A. & Johnson, L., 2006. How many interviews are enough? An experiment with data saturation and variability. *Field Methods*, 18(1), pp.59-82.
- Gunasekaran, A., Papadopoulos, T., Dubey, R., Wamba, S.F., & Childe, S.J. (2017). Big data and predictive analytics for supply chain and organizational performance. *Journal of Business Research*, 70, 308-317.
- Gunasekaran, A., Rai, B.K., & Griffin, M. (2011). Resilience and competitiveness of small and medium size enterprises: empirical research. *International Journal of Production Research*, 49(18), 5489-5509.



- Jacob (2023) 'How outsourcing IT services can benefit SMBs and SMEs' [Online]. Available at: <https://www.n-able.com/resources/how-outsourcing-it-services-can-benefit-smbs-and-smes>
- Juergensen, J., Guimón, J. and Narula, R., 2020. European SMEs amidst the COVID-19 Crisis: Assessing Impact and Policy Responses. *Journal of Industrial and Business Economics*, 47(3), pp.499-510.
- KPMG (2024) 'Supply chain trends 2024: The digital shake-up' [Online]. Available at: <https://kpmg.com>
- Kumar, Ali and Pandey, D.A. (2020) 'Impact of online resources/technology adoption on SMEs performance' [Online]. Available at: https://papers.ssrn.com/sol3/Delivery.cfm/SSRN_ID3775467_code4052220.pdf?abstractid=3775467&mirid=1
- Kvale, S., & Brinkmann, S. (2015). *InterViews: Learning the Craft of Qualitative Research Interviewing*. 3rd ed. Thousand Oaks: SAGE Publications.
- Lockett, A., Thompson, S. and Morgenstern, U., 2009. The development of the resource-based view of the firm: A critical appraisal. *International journal of management reviews*, 11(1), pp.9-28
- M, D. (2024). How can you improve customer satisfaction in a small business? | Rize Credit Union. [online] Rize Credit Union. Available at: <https://rizecu.com/article/improving-customer-satisfaction/>
- Madhani, P.M., 2010. Resource based view (RBV) of competitive advantage: an overview. *Resource based view: concepts and practices*, Pankaj Madhani, ed, pp.3-22.
- Mason, M., 2010. Sample size and saturation in PhD studies using qualitative interviews. *Forum Qualitative Sozialforschung/Forum: Qualitative Social Research*, 11(3), Art. 8.
- Mishrif, A. and Khan, A.I. (2023) 'Technology adoption as survival strategy for small and medium enterprises during COVID-19', *Journal of Innovation and Entrepreneurship*, 12(1). doi: <https://doi.org/10.1186/s13731-023-00317-9>.
- Mittal, S., Khan, M.A., Romero, D., & Wuest, T. (2018). A critical review of smart manufacturing & Industry 4.0 maturity models: Implications for small and medium-sized enterprises (SMEs). *Journal of Manufacturing Systems*, 49, 194-214.



- OECD, 2019. *Financing SMEs and Entrepreneurs 2019: An OECD Scoreboard*. Paris: OECD Publishing. Available at: https://doi.org/10.1787/fin_sme_ent-2019-en [Accessed 29 Sep. 2024].
- Robinson, O.C., 2014. Sampling in interview-based qualitative research: A theoretical and practical guide. *Qualitative Research in Psychology*, 11(1), pp.25-41.
- Rogers, E.M. (2003). *Diffusion of Innovations*. 5th ed. New York: Free Press.
- Shelley, S. (2024) 'Navigating the digital age: The role of technology in supply chain management' [Online]. Available at: <https://www.ucumberlands.edu/blog/the-role-of-technology-in-supply-chain-management>
- Singh, R.K., Kumar, R., & Shankar, R. (2018). Supply chain management in SMEs: a case study. *International Journal of Engineering and Technology Innovation*, 8(2), 153-163.
- Tech, E. (2023). The Future of Technology for SMEs. [online] Everything Tech. Available at: <https://www.everythingtech.co.uk/the-future-of-technology-for-smes/>.
- Teece, D.J., Pisano, G. & Shuen, A. (1997). Dynamic Capabilities and Strategic Management. *Strategic Management Journal*, 18(7), pp.509-533.
- Venkatesh, V., Morris, M.G., Davis, G.B. & Davis, F.D. (2003). User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly*, 27(3), pp.425-478.
- Wamba, S.F., Akter, S., Edwards, A., Chopin, G., & Gnanzou, D. (2017). How 'big data' can make big impact: Findings from a systematic review and a longitudinal case study. *International Journal of Production Economics*, 165, 234-246.
- Wamba, S.F., Akter, S., Edwards, A., Chopin, G., & Gnanzou, D. (2017). How 'big data' can make big impact: Findings from a systematic review and a longitudinal case study. *International Journal of Production Economics*, 165, 234-246.
- World Bank, 2020. *Small and Medium Enterprises (SMEs) Finance: Improving SMEs' Access to Finance and Finding Innovative Solutions to Unlock Sources of Capital*. [online] Available at: <https://www.worldbank.org/en/topic/smefinance>
- Wu, F., Mahajan, V. & Balasubramanian, S. (2013). An analysis of e-business adoption and its impact on business performance. *Journal of the Academy of Marketing Science*, 31(4), pp.425-447.