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The adoption of procurement 4.0; Drivers and barriers

By

Badar Shahzad 01-321211-005

Supervisor

Sir Saqib Mushtaq

Department of Business Studies

Bahria University Islamabad

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ABSTRACT

The adoption of automatic procurement systems has been an emerging trend in the supply chain area. In this study, we develop a conceptual model using a technology–organization framework to investigate the factors which influence manufacturing firms to adopt technology. Our model proposes that the adoption of technology is influenced by Technology advancement, cost, firm size, firm scope and operational performance. The objective of this study is to identify the conditions, as well as the contributing factors, for the adoption of automatic procurement systems in firms. Data were collected from 120 firms in Pakistan, and structural equation modeling with partial least squares is adopted to analyze the data. The results suggest that high Technology advancement, firm size, cost, firm scope, operation performance, are important factors affecting IT adoption in manufacturing firms. Therefore, decision support should be provided for enterprises from the aspects of technology, organization to improve the adoption of automatic procurement systems.

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Glossary

Iot	Internet of things
SCM	Supply chain management
AR	Augmented Reality
BDA	Big Data Analytics
AI	Artificial Intelligence

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CHAPTER 1: INTRODUCTION

Overview

Supply chain - A supply chain is a process by which any raw material is converted into a consumable product. It includes every individual, step, equipment or source and activity through which a product is created and sold. There are many stages or steps which are involved in whole supply chain which vary from organization to organization and product to product. Generally supply chain steps, stages or components are logistics, operations or manufacturing, sales and services. So we can say that supply chain is a complete system of creating and delivering a product or service and a process which layout each and every aspect of making goods.

Procurement - Procurement simply means buying or purchasing something but when it comes to talk with respect of business field procurement means obtaining and acquiring goods or services after a critical process and under scarce resources from any third party vendor or supplier. Procurement is different from purchasing in many aspects as purchasing is a subset of procurement and it involves fewer steps. In other words procurement is a complete value adding process in which many other things are being observed other than price only like relationship, satisfaction, environment and commitment etc.

Supply chain 4.0 and procurement4.0 is about reprocessing the whole process of supply chain and procurement by using advance gadgets and technologies in "industry 4.0" like Internet of things (IoT), big data analysis and block chain etc (Michael J. Ferrantino, 2019)

Background and Importance

In this section a background of supply chain and industry revolution is discussed and how 1.0 to 4.0 version of industry works moreover that what is the impact of SCM 4.0 and procurement 4.0 which will then lead to the problem statement of this thesis and formulate the research questions.

In 1980s many scholars start defining supply chain and many articles were about

the definition and scope of supply chain management this was due to the increased globalization and information availability. But over these years Information technology and gadgets are improved and advanced with a significant percentage and every aspect of life is affected by this change. Manufacturing process and services sector is totally changed what it was just 20 years ago. The most important change from this revolution was that now instead of computers gadgets and smart devices equipped with cloud computing and databases are used. (B.Tjahjono, 2017)

Supply chain 1.0 was basically the era when purchasing process was refined and stuff was connected in a network. Supply chain 2.0 is paper based supply chain in which digital instruments are not used and process are complicated and manual. Data availability in this section is very low. Supply chain 3.0 consists of basic IT components and there are very low posts of data analyst and IT engineers in a firm while supply chain 4.0 is a maturity point in which processes are interconnected and are eased with IT capabilities. (Knut Alicke, 2016)

Organizations now consider technological devices and smart devices as a good and long term tool for their performance and future success. (Davenport, 2006). According to a survey in 2016 Supply chain4.0 will lower down the operational cost of firm to 30% and 75% of lost sales will be recovered within the time span of two to three years. (Knut Alicke, 2016)

Supply chain4.0 provides complete transparency along the whole line on graph and provides complete information to supplier, vendors, manufacturers and ware house managers for zero lack in a complete process. (Bhardwaj, 2021).IoT technologies will help in store retailing and also provide better customer experience and will make managers to use better management strategies. (Gregory, 2015).

As pace of industry revolution is very high so its clear that industrial ages are very shorter and managers need to be more innovative and strategically strong to create a competitive advantage (Schrauf, 2016).

Therefore the problem is crucial to be addresed as there is a great impact of technology on performance of the firm. However its important to mention that impact of technology adoption vary from organization to organization, from firm to firm and even from country to country as countries which are developed are digitization impact is higher than in developing countries (Katz, 2015)

Statement of Problem

In this modern age of technology, advancement and internet the whole business scenario is changed all of the things process, plans working environment and conditions there efficiency and demand of error free service and product is increased in short whole paradigm is changed.Companies which want to remain in business and not to quit in such type of culture are having an attitude of adoption of different technological devices and digitization on the other side those who are reluctant to change this culture of shifting from manual data handling to digitization they are vanishing from the list of industries. (Amjad et al., 2020). The processes which were used before to run business are now rabidly changing because many phenomenal developments in each field. Similarly with the passage of time supply chain processes and procedures are also changed and many different other functions are now attached with this field and this change is not fruitful in all manners for the business because if they are making ease in different ways they also have increased vulnerability and quality demand but all these kind of vulnerability are manageable by the use of technological advancement and different kind of gadgets like IoT, Big data, RFID and many others(Oláh et al., 2018). Now let us talk in the context of Pakistan, As we know that country is considered as a developing state and counted in a third world countries due to this reason many of the industries either is still using manual systems or have adopted some technologies later Moreover, technology advancement is not yet stopped its changing very rapidly and new technologies are emerging day by day but in our country it is not implemented with such a pace that is why it is important to analyze the barriers and drivers which are crucial in the implementation of these technologies. A survey's findings indicate that in order to support the organization and supply chain's efficiency and effectiveness, procurement extends its strategic decision-making focus to the collection, analysis, and processing of data inside its environment the industry as a whole is currently implementing Procurement 4.0 at varying degrees (M.D. Khan, 2022). So it is important to carry out this study.

Research Gap

At present, the level of Procurement 4.0 implementation varies widely across the industry. From a survey with 417 procurement leaders nearly two-thirds (65%) of organization’s have self assessed their procurement maturity as advanced. However, using the Forrester maturity framework it is found that only 12% have truly become advanced, leaving the vast majority at

risk of lagging behind their competitors who are more effective in the procurement process. (M.D. Khan, 2022) There is currently no accepted definition of smart procurement in the literature. However, it may also be viewed as the integration of new digital technology with procurement procedures to enable the procurement of goods and to move along the supply chain more rapidly and effectively to satisfy client needs without incurring additional expenditures. Due to numerous fantastic advancements in every industry, the techniques that were previously employed to run businesses are now radically changing. Similar to how supply chain processes and procedures have changed over time, many different other functions are now associated with this field. This change is not always beneficial for businesses because while they are becoming more flexible in various ways, they are also becoming more vulnerable to quality demand. However, all of these vulnerabilities are manageable through the use of technological advancement and various devices like IoT, Big data, and RFID. (Oláh et al., 2018).The same study is done in the field of warehousing and its important to find the impacts in the field of procurement for that reason this study is conducted.

Research questions

Using SC4.0 technologies shows that its work best for the integration in a firm and it brings high level of connectivity and integration by advancing supply chain management. We also get to know that Supply chain 4.0 also give better operational performance in the firm and lead to better results.

This study is about the factors that are affecting the adoption of digital solutions/systems and processes in procurement and supply chain. So we can say that we are going to address the following questions in this study & e are going to answer the following questions in our conclusion section .

RQ1: What are the drivers in adopting PDA?

RQ2: What are the barriers in adopting PDA?

The scope of this study will be to find out the drivers and barriers of the procurement process digitalization and we will not touch other processes or parts of the supply chain ike logistic automation, ware housing automation etc

CHAPTER 2

Literature Review

Introduction

Supply chain management is crucial for any organization as in now a day's it's not a competition between two organizations it's a competition between supply chains of organizations and it plays a significant role in acquiring a competitive advantage for any company. It is also important to note this fact which was highlighted by (Day, 2002) that for innovation and improvement of value chain procurement department plays a vital role because of the fact that any product or service which is procured by an organization can be 80 percent of an organizational expense. Moreover, when there is an optimal level of stock in supplier and buyers ware house it effects the organization in a positive way by reducing capital commitment, price level reduction because of the innovation and also improve buyer supplier relationship by increasing supply chain intelligence (Gelderman, 2005).According to (Deloitte, 2014) what we have to focus in the upcoming few years are the concepts of "Artificial intelligence", "Big Data", " Industry 4.0" and "Digitization" because these are having the great influence on organizations. IBM identified three drivers for the future supply chain which are based on the technology named instrumented, interconnected and intelligent which are further discussed in the detail below.

First driver is instrumented driver which means that transaction process will be assisted by different technologies and automated by , e.g. sensors, Global positioning system GPS, Global mapping systems GMS, Radio frequency identification RFID and many other technologies which will help in reducing risk, cost and complexity of processes and will increase visibility by using "Artificial intelligence" and "Big Data" (IBM, 2009).

Second on the list is interconnected which is about connecting your operations and supply chain to the internet technologies which will create another environment of collaboration with suppliers in other words collaboration will move from direct path to the flexible one by using different market developments e.g., A real time customer feedback tool can be used to monitor and follow up the activities done by consumer which are easy to share and monitor (IBM, 2009). This concept is also supported by study of who says that "www" and other social media platforms are interactive methods because they convert the one way communication to two way and allows consumer to be fully engaged and ask

anything about the content. (Doolin, 2002)

Lastly, Intelligent it is like the artificial creation of different scenerios that may occur in future and organization take advantage of different technologies to tacle those challenges and gain maximumm from that opportunity and to mitigate the risk up to maximum level In other words you one can run and organization in a simulator simmilar to that of pilot training by creating an artificial enviroment. (IBM, 2009)

So these are the drivers based on technology which are linked with supply chain as well as procurement and other supply chain elements like warehousing, production etc. and will also impact supply chain network and enterprise management in future.

Industry 4.0 and its impact.

Some of the managers may say that it is “digitization” some call it “smart management” other named it “Next Industrial Revolution” or “Industry 4.0”. Whatever termonology is used it is about the combination of new technologies like clooud computing, storage , big data analytics or 3D printing are chnaging the pattern how organizations are working or they are managed and the processes at operational level. Moreover almost each firm is now attached with atleast one digital product either in manufacturing or service sector and creating more innovated products.

According to due to the involvement of new tchnologies and arise of new digital products the organization system and production process are completely changed as they are having the component of high R&D , high capital inensity,rapid innovation cycle and require highly skilled labour.Moreover,with these technologies innovation of goods and services are possible in many productive departments and along the supply chain. (Commision, 2009)

In an other study of ((MISE), 2016) it was highlighted that if technologies are adopted in an accurate manner several benfits will occur like flexibility will increase along with the pace of production and in complete value or supply chian processes integration is attainable,Furthermore, machinery and equipment’s setup time will also reduce also with the reduction of errors done by humans In other words sophistacated sensors will lead to the better quality of production with minimum waste.

Let’s now talk with an other aspect as world is now facing a pandemic of COVID 19.This pandemic has changed many things as a mega level of lockdowns were imposed in different countries which disturbed almost every sector of production. (DELOITTE,

2020) highlithed that to tacle these disruptions eneabling technologies plays many important roles so that a smooth work may continue in organizations.

During this COVID 19 pandemic those organizations which adopted these new technologies and gadgets were able to overcome the reaction created by pandemic: production continuity was able because of the intelligent machinery other than manufacturing and transporting of goods many of the fields were having robotic like in warehousing which makes work continous,Internet of things make it possible by collaborating operations and remote control,as supply chain of different raw materials was disturbed 3D printing plays vital role in producing different parts which were not properly supplied and on site staff was supported by real time solutions of augmented reality.All of these events are indicating that organization must review their processes and embed them with new technologies and gadgets so that they can overcome the crisis that may occour from different risks like pandemic (Ailvia Bruzzi, 2021)

Procurement 4.0

Despite the abundance of literature on the effects of enabling technologies on supply chain management and enterprise management, few studies have examined the effects of these technologies on specific business processes (CHANDRASEKARA S., 2020)

All business departments' operational efficiency and their interactions with other supply chain participants will be impacted by enabling technologies (BRUZZI S., 2019).

Other company areas including R&D, production, IT, and management tend to be more active in enabling technology than the procurement function is (ZHENG T., 2020). The body of research demonstrates that in the development and management of new networked and automated supply chain ecosystems, enabling technologies value the role of procurement (BIENHAUS F., 2018).

First, procurement helps ensure that supply chain operations are interconnected by influencing the decision and acquisition of new technologies and the selection of suppliers (KLEEMANN F.C., 2017)

Additionally, via the use of enabling technology, procurement helps to make all processes related to the organisation and the entire supply chain more efficient, quicker, more flexible, and transparent (CHANDRASEKARA S., 2020).

The way that purchases are made may alter as a result of digital technologies. The availability of data and information in real-time made possible by enabling technologies

like IoT, AI, and Big Data, for instance, can increase the efficacy of market analysis, supplier evaluation, make-or-buy decisions, and inventory management. It can also increase predictability, making the procedures for buying goods and services more efficient (BRUZZI S., 2019). Additionally, these technologies make procedures more visible, shed light on the various steps of the supply chain, and enable procurement units to take immediate action when necessary (REJEB A., 2019)

The traditional procedure is backed by a system that gathers all information and activities, resulting in "one-to-one" communication between the customer and supplier. This is another benefit of e-sourcing. The gathering of data on a digital platform that can be accessed, shared, and processed with all supply chain participants in the most transparent manner and in real-time to build a "many-to-many" communication is one digital solution mentioned by (SCHMOCK D.A., 2007).

Data integration will substantially change supplier management as well. A good example — one of many — is supplier risk management. Companies will be able to employ big data analytics, looking at enormous quantities of customer, financial, and external data — from the weather all the way to credit ratings — to predict changes in risk ratings.

Procurement has to be adequately equipped to carry out digital transformation to meet the challenges of enabling technologies and to contribute to their effective adoption. Their for its important to highlight the technologies or processes with which a simple procurement can be transformed into procurement 4.0.

Automation

Automation has now changed the whole scenario of supply chain because it has evolved different process and operations along the whole supply chain. What automation has done is that it gives the advanced principals of supply chain and it also enables that we can integrate different process with each other with the help of technology advancement and in industry related to manufacturing and production this new technology and automation allows to attain low operational cost. (Radanliev, Roure, et al., 2019).

The automation of supply chain means that along with whole supply chain the work which is done manually should be reduced by using flow of electronic information between departments which decrease the use of papers and also increase the fact of traceability, and by using different kinds of robots we can pick, sort and move products automatically and also improve the production process with robotics(Dallasega et al., 2019).

On the other side if we use automation and make our supply chain digitalized it makes us enable to meet the uncertain demands and also reduce the error of human faults by using the artificial intelligence. Following are some advantages which one firm can attain by using automation and digital advancement

- If we deploy automation in production and manufacturing industries it will help in power saving and also load of manual resources and boost the overall efficiency of system.
- It is also helpful in sustainable approach as it helps in reducing different kind of wastages like carbon footprints etc
- It makes the overall working environment much safer by reducing different risks of accidents and mishaps

In ware housing different automation initiatives have been taken by large warehousing companies which includes AGV or automated guided vehicles these are much economic and sustainable and are designed in such a way so that they can perform particular dedicated tasks.(Bechtsis et al., 2017). Moreover an other important aspect which should be discussed over here is that firm should also educated and train there staff in a proper way so that they can use that advance digital devices in an optimal way to get maximum utilization. There are many barriers due to which our manufacturing companies are not adopting digitalization which includes financial position of the firm, employment problems, strength of a firm in sense of finance and the overall structure of organization(Dallasega et al., 2020). By using automation production industries can get more accuracy and different kind of advantages like speed advantage, standardization and many others which are not attainable with manual work. One of the research has also point out different cons of using these devices like quality improvement, energy saving, productivity enhancement, and reduction in different type of costs like production and operation costs these machine work on the process of real time updating which sends data to the different servers and software which produce different kind of reports son one can take corrective action and plan accordingly(Parizi & Radziwon, 2017).

Digitization

What digitalization means is that you develop or enhance the mechanism of whole manual methods along with complete process and also lessening the role of human in daily process. An important new concept of CPS is emerged in which there is a vertical coordination of complete data set and of materials both in upward direction and downward direction in short whole information will be flowed and provided to each partner and this creates a foundation

of digitization in supply chain(Armengaud et al., 2017). Digitalization is what you cant avoid for the up gradation of different data sets which is very crucial to create a flexible chain.From the frame work view point digitalization of data sets and sharing of that along the supply chain effectively can increase the proficiency and transparency of data with an extraordinary percentage (Schlüter et al., 2019).

There are two different way to digitalize this flexible chain One is to use the web technology in which an employee is given with a ortal where he can login with his particulars credentials and can manage different types of modules the data in this way is also updated in a real time and web applications can also produce different types of repost in a matter of seconds more over data in such technology is also transferred and posted to different other departments creating more productivity and reducing different kind of errors, a plus point with such kind of technology include that one can access data remotely, physical presence is not required but firm also have to spend money on the security of important data and may require to create a cyber security department in their organization On the other hand firm can also use there personal network called VPN virtual private network these type of networks are mostly non accessible from remote position because it works only in the premises of organization but this also prevent firm from spending on cyber security department.

Digitalization focus on those IT arrangements which can create worth along with whole supply chain, inside the organization and also cross organizational improvements can occur by its implementation this whole process will actually create a better flow of information and knowledge bits throughout the chain and also along with the product lifecycle which will in turn create more efficiency and better plans of actions(Brzeziński, n.d.).

Even the interactions between the businesses that run the supply chain will alter. Enterprises will no longer behave as isolated actors, even if they are managed optimally, thanks to the widespread use of enabling technologies. Instead, they will become a component of an interconnected system in which activities and information will flow across organizational boundaries (Vaidya et al., 2018). The primary component of the integrated system will be integrated and continuous communication among supply chain participants, which will expand options for customisation and efficient manufacturing of small batches while reducing stockpiles and waste (Russmann et al., 2015).

Thus, supply chains can be changed into hybrid supply networks (Porter and Heppelmann, 2014), which are made up of both physical and virtual components and are driven by

information and process flows that are no longer only linear between the network's members. Through this integration, it will be feasible to increase production-side flexibility and efficiency while also being more responsive to changes in demand. A stronger company performance and improved demand satisfaction can help to overcome the trade-off between variety, volume, and variability of demand (Slack et al., 2013).

If technical innovation is thought of in terms of a supply chain or network logic, that is, if it involves all of the actors involved and permits the sharing and integration of their production and decision-making processes, the impact might be profound (Evry, 2016). As with industry 4.0, operations and supply chains of many industries and businesses will be redesigned (Pfohl et al., 2015) according to a logic of strong integration (Russo et al., 2015). As a result, the ability to create value and gain a competitive advantage will depend more and more on the integration of business functions and processes (Porter and Heppelmann, 2014).

The fourth industrial revolution is centred on processes, and continuously, it is through processes that the interaction between people and machines and between businesses that operate processes can innovate.

Therefore, significant changes to the system of organisational and interorganizational relations are intended. As a result, the problem is not just technical; it also has a strong managerial and organisational value and calls for a culture change. It will be vital to find new business models that firms may use to facilitate this shift.

The impact of such changes on management may take on a historical significance: a huge cultural challenge that has probably never been experienced in this dimension. If the fourth industrial revolution will make it possible to overcome the trade-off between man and machine, confirming the enhanced role of the man in economic activity (Caselli, 1995; Tagliagambe and Usai, 1998) and integrate decision-making processes across business boundaries.

Because of this, management researchers should give these changes their fullest attention in order to first comprehend the phenomena and then direct its evolutionary process.The discussion that has developed around Industry 4.0 makes this very evident. In a recent study based on a Content Analysis of the relevant literature, Glas and Kleeman (2016) claim that, despite the lack of a generally accepted definition of the term "Industry 4.0," the common thread among the various definitions put forth by the literature is the importance placed on

the organisational and managerial dimension of innovation: technologies do not act as the driving force behind Industry 4.0, but rather they are an enabling component to activate professional services.

In fact, enabling technologies will have an overall impact on all business processes and services. They will alter not just how these entities operate but also how they interact with one another and with other supply chain participants.

The other business functions will therefore need to realign themselves in order to enable firms to meet the challenges if Operations, which is in charge of managing the production processes, constitutes the business function that will be most affected by the changes taking place. Among these, procurement plays a crucial part and has the potential to spur innovation (Nicoletti, 2018). Porter already emphasised the significance of procurement when he included it in the value chain of supporting activities for the primary ones, emphasising its strategic worth for gaining competitive advantage (Porter, 1985). The role of procurement is to provide the business with everything it needs for its operations in a timely manner. Therefore, it is a role that can significantly advance the quest of value by operating on the input side and serving as a conduit between suppliers and customers (Giunipero and Brand, 1996). (Ellram and Carr 1994; Johnson and Flynn, 2015). In view of the rising significance of purchasing costs (Farmer and Day, 2002), as well as the outsourcing practises implemented by businesses, its contribution has also increased over time (Grant, 2016; Cantone, ed. 2003).

With the help of enabling technologies, procurement can play a bigger role. Procurement 4.0, coined in line with Industry 4.0, emphasises the necessity for procurement to assist the growth of integrated and digital operations and supply chains.

One way to approach Supply Chain 4.0 is to think of it as merely the supply chain's implementation of Industry 4.04. And a typical method of approaching Industry 4.0 is to view it as nothing more than a collection of 21st-century technologies that have already emerged or are just beginning to do so. The challenge then may be as simple as mapping Industry 4.0 technology to each stage of the supply chain, including design and planning, production, distribution, and consumption.

The list of these technologies varies from author to author, despite the fact that each of the "industrial revolutions" is often characterised by a cluster of common technology. The IoT, big data analytics, 3D printing, advanced (autonomous) robotics, sensor-using smart

factories, augmented reality, artificial intelligence, and cloud computing are the most frequently mentioned among the 17 technologies identified by Cirera et al. (2017) as being representative of Industry 4.0. 9. Pfohl et al. (2015) list more than 50 technologies connected to Industry 4.0, mind-mapping them to concepts like "digitalization" (which refers to everything), "mobility," "modularization," "network cooperation," "autonomization," "transparency," and "socialisation."

As previously mentioned, it can be tempting to try to understand Supply Chain 4.0 as the application of Industry 4.0 to supply chains and then map each stage of the supply chain (planning and design, production, distribution, consumption, reverse logistics) to one or more of the iconic technologies said to be typical of Industry 4.0: the IoT, cloud computing, artificial intelligence, etc. The issue that arises right away is that there is flexibility in how technologies are applied to different problem sets, and it takes a while to identify which technologies would be most effective in a particular field.

For instance, during the period of 1880–1920, it was not at all clear how the three energy sources—steam, electricity, and gasoline—would be applied to two distinct areas of activity—factories and automobiles.After extensive, mostly successful experimentation with all other possible combinations of power and activity, a consensus eventually evolved that factories should be powered by electricity and automobiles by gasoline (Freeman and Soete 1997 75-80, 139-140). Fortunately, there is a more effective method to handle the issue because Industry 4.0's broad functional impact on supply chains is now clear. Information flow within the supply chain is substantially altered by Supply Chain 4.0. Traditional supply chains provide a linear connection between suppliers and consumers, with each company obtaining inputs from suppliers before distributing its goods to consumers.

Each company has a planning mechanism in place to make sure that deliveries match up with customers' sourcing needs, suppliers' delivery needs match up with customers' sourcing needs, and returns of unused or undesired goods are tracked (PWC 2016b). The Supply-Chain Operations has formalised the procedures for doing this. Reference (SCOR) model, originally developed in 1996 by the management consulting firm PRTM

Tools

There are numerous industry 4.0 technologies that businesses are utilizing to boost productivity and effectiveness, improve the experiences of suppliers and customers, and ensure long-term viability (Vaidya, 2018).

The following discussion will focus on a few of these industry 4.0-related technologies.

Internet of things (IoT).

As for smooth work information is a basic thing which is required and collecting of that information is more critical which is done by internet of things which is a great and well interconnected network of devices, basically these devices collect and share information on a common platform with the help of very sophisticated sensors, these sensors now a days are used in almost every device (Minoli et al., 2017).Collected data is analyzed to give very fruitful inputs helpful in analyzing any situation in a better way and to provide customer with better satisfaction and also improving overall efficiency in supply chain of an organization (DeLong et al., 2005). Internet of things has many advantages including planning of demand in procurement of raw material and forecasting price and quantity of the material required moreover the production planning and also by using three stage model, product recovery (Fang et al., 2016).

Augmented reality (AR).

What is AR? It's a mixture of different things like illustrations, information, different type of images, texts for better approach to understand any situation and execution of any task. What AR do is that it takes input from physical world and create a HD quality visuals, graphics and pictures in a very comprehensive way for better understanding (Henderson and Feiner, 2011; Blaga et al., 2021). AR not just help visualizing the information or just the transformation of information from one form to another its helps bringing efficiency in business and also increase customer satisfaction and employee experience. According to (Cascini et al., 2020; Harley et al., 2020) there are many benefits of augmented reality and it is used in different kind of industries like logistics, tourism, social media, e-commerce, retail education and many other industries moreover different industries have started using AR in many ways.

One other benefit of AR includes that it makes a process of integration between available

resources and the employees easy and also helps in replicating the good image of the real world and how work is done. What actually AR can do is that it helps a half skilled workforce into a trained one in a smooth and easy way with higher pace (Kumar, Singh and Dwivedi, 2020).Using this technology it is possible to present any product or other things to customer in a 3D mode rather that in a landscape of 2dimensions.AR will also change the processes of supply chain and operations management for example buyer supplier coordination during bidding, signing contracts and negotiations and meetings between different parties can be done in a different way, bringing organizations stakeholders more closer to each other and enhancing collaboration (Mukherjee, 2017).

Artificial intelligence (AI).

Another technology based science which work on algorithms and use trial and error methods to explore human intelligence is artificial intelligence (Bird et al., 2021).

AI s making machines intelligent by using deep learning and machine learning and also using data and algorithms so that they can make shift in industries, a positive impact and change. Its not easy to solve the problems of business which are more complex in nature but when a human brain and intelligence is supported by different algorithms it create a system to analyze situations and helps in making a solid decisions based on large data sets which will reduce errors and cost used in training and operations (Lecun et al., 2015).

Almost every organization is using artificial intelligence only the way and shapes of using it is different. One study (Singh et al., 2021) shows that AI has a great impact on pharmaceuticals industry because it helps in many ways like diagnosing a disease more easily and on early stage , clinical developments and in many other ways. We all are aware of the impact of COVID 19 on organizations but AI cater this impact by managing it through tracking, diagnosis, treatments and predictions etc(Naude, 2020).

Big data and analytics (BDA).

Collecting data is a difficult task but even more difficult is analyzing it and it become more difficult when quantity of data is high for this purpose whatever the type, location and size of data is Big data analysis is a technology or electronic technique to handle it. It helps in information examination and discovering the facts and finding a different types of patterns and relationship. This is a technique which helps in analyzing a data which is mostly bulky in a mannered way so that we can make decisions and make cloud based examinations

(Lecun et al., 2015).This technique is useful as study shows that its impact on an organization performance is positive as it helps in more coordination, control and better planning (Akter et al., 2016).This technique is also used for the development of sustainable products and development of this technology is "the suggested pathway for firms seeking to develop sustainable supply chain outcomes" (Bag et al., 2020a).

A study has proved that if we combine BDA and AI technologies it will be helpful and will bring more flexibility in the manufacturing and this is due to the fast and autonomous decision making after analysis of big data.

BDA will help to reduce disruption in supply chain and will make "enhanced collaboration and agility in the supply chain" (Bag et al., 2021).

However, To gain maximum benfits of these technologies these three pillars are need to be assumed and focused

Capability of infrastructural, Capability of BDA management which involves planning, investment, coordination, and control, and personnel expertise capability, to enhance this a high technological training is required (Wamba et al., 2017). Innovations and technologies of this age are gaining more importance which include AI, cloud computing and sharing and 3D printing (Ooi et al., 2018).As everything is changing very rapidly cloud computing is also gaining more importance as it make organization to keep a better track of changes in real time and sharing with other stakeholders of organization in better way and also chaging the behavior of complete organization.

3D printing enables organization to change the whole process for many disabilities and lack of resources like time and making of more customized parts (Lecun et al., 2015).

The customer-centric methods can now be changed by analyzing consumer behavior and the impact of past innovations and developments with the help of machine learning and big data. Some medicines need special environment a specific temperature and also a regular checkups which is possible only by the use of sensors.

The above-mentioned technologies are enhancing the processes, boosting productivity, and changing the ways the companies operate and think.

RFID technology and supply chain management (SCM)

RFID is that tool which have showed a very significant results along the whole supply chain either it is a department of warehousing or it is packaging from procurement to distribution it's a very important tool it is also consider as a technology enabler.

(Delaunay et al., 2007; Chanchaichujit et al., 2020; Paul et al., 2022). What RFID do is that it enables user to control and manage a real time data different kind of process can be handled with a lot of ease through this real time data such as identification or tracing/tracking of goods or products in whole supply chain that where they are at current time which provides a sustainable competitive edge and better quality. (Chanchaichujit et al., 2020; Liang et al., 2021).RFID is actually that tech device which is made up of a tag and a reader which uses radio waves to identify different things different objects having different tags send different data to the reader which can generate different kinds of reports on the basis of real-time that can be related to dispatching or completion of packaging etc. Inventories which are managed by vendors or replenishment which is done on a continuous basis is now automated because of RFID. The tag of device contains IC chips, assembly process and different types of antennas. The cost of this Radio Frequency Identification Device can vary from anywhere between $0.30 to $0.90 USD (Chen et al., 2017). One other advantage of these devices includes the reduction in price of IC chips and different other process along the assembly. Now a day's almost above thirty billion devices which are connected with RFID are working in different functional areas of different organizations. Moreover, regardless of level either it is itra firm or inter firm a new RFID is also used which do not contains chips these chip less RFID uses the reflection method simply it just multiplies the waves coming from device this type of technology is now getting more popular and are called Nano-technology genre (Lu et al., 2017).The use of RFID is done in almost every department and along the whole supply chain its deployment can be done in almost each process to make things easier like it can be Pos Point of sales or it can be warehouse in which automation can be done by using this technology efficiency of distribution process can also be attained using RFID but the crucial thing one should keed in mind while using this technology is gateways (Abdullah et al., 2020).To acknowledge the importance of RFID we can have a look in studies of Lagorio et al. (2020) and Benčić et al. (2019) which is about the new methods of stock inventory, storage and procurement. This study shows that when we compare recorded data with the physical stock of 350000 units or above the error amount was 70% this type of mistake in recording or overstocking create a big loss for the company which is almost 20% of the net profit. Different types of challenges occurs for the management and also effect the whole efficiency of complete supply chain when inventory management is not done properly this type of flaw or glitch is avoid able using RFID and this is because that such technology can collect precise data of supplier and their delivered raw material that

in ware housing and in the last whole distribution process.

Chapter 3

THEORETICAL FRAME WORK AND METHODOLOGY

INTRODUCTION

In this chapter we will discuss the complete design which is applied in the current study following points are going to be addressed in this chapter purpose of the study, what type of technique will be used to conduct the current study and for data collection and how data will be analyzed in this study. This chapter is having two sections, theoretical framework and the methodology. The first section is about the detail of the theory used for the framework and the second one will tell the logic behind the method used for this study.

PURPOSE OF THE RESEARCH

The main objectives of this research are to highlight the benefit of implementation and adoption of digital procurement and also to find out that what are the barriers or drivers for this digitization process. As in this study the main focus is on digitization and procurement that is why study is conducted in two context

• Technology context • Organizational context

These two categories are thought to represent the motivators or obstacles that firms will face if they successfully implement digitization. In conclusion, this study will evaluate how the use of PDAs has affected the aforementioned factors. Some of the benefits that accrue to an organisation from the application of PDA have previously been highlighted by the literature review, with authors tying it to the aforementioned variables.

THEORETICAL FRAMEWORK

“A theoretical frame work is a conceptual model of how one makes logical sense of the relationship among the several factors that have been identified as important to the problem” (Sekaran, 2003).Elements which are mostly used in research include cases and variables. Cases mean the objects whose behavior or characteristics are studied in the research most of the time this is person but it can be organization or any department or office within that organization even it can be any event or meetings etc. and on other hand variables are the characteristic of these cases they are actually the characteristics, qualities, attributes or detail

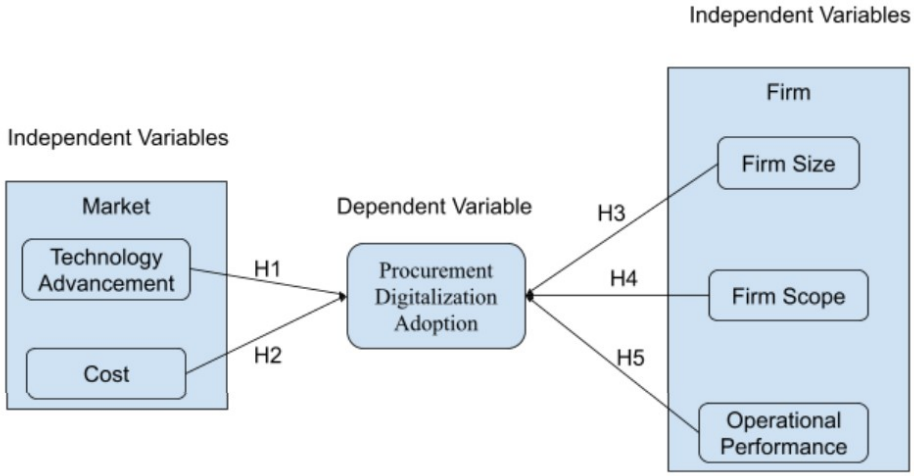
that are measured and recorded in the study. For instance if person is a case the variable of this can be gender, education, city, height, management ability etc these are named as variables because of the assumption that the cases may vary in their scale or numbers about these qualities or attributes, For example, if the variable is age, we obviously recognize that people can be different ages.

In any specific study their can be different type of variables. Two of the most important to mention here is about independent variables and dependent variables. Most of the time study have one dependent variable, and it is the outcome variable, the one you are trying to predict. You are attempting to explain variation in the dependent variable.

The elements that you believe account for variance in the dependent variable are referred to as independent variables, often known as predictor or explanatory variables. These are the causes, in other words. (Adapted from www.analytictech.com at http//)

HYPOTHESIS FORMULATION

This gives an insight into how the researchers derived the hypothesis formulated for this research. Three major hypotheses will be tested in this research which will help to answer the research questions highlighted in chapter one. The hypothesis development is divided into two parts, namely Technology based and Organization based (Figure 3.1).



Technology Context

An analysis of advantages related with procurement digitalization adoption PDA can be judged by several aspects that can be any from efficiency of work or resource utilization or

output or employee production anything.

There is a proposed analysis method given by Premkumar and Roberts (1999) proposed TOE model to find out the reasons of IT acceptance by new firms or organizations.
What TOE model was that this model contains ten independents variables which are categorized in three dimensions of innovation, organization and environment.
According to this study the acceptation of new technologies is based on advantages attached larger the advantages larger the chances of getting adopted by the firm.

According to an other study by Ingrid and Patrick (2015) Electric vehicles are used by those who perceive the advantage of vehicle emotionally and the decision making variables are what is the relative advantage of vehicle, its compatibility and how much easy it is to use along with the WGO (Comments about that vehicle in social media).
Another similar kind of study by Park and Lim (2018) showed that
Cost element of electronic vehicles is negatively related to its usage means that higher the cost less people are going to use EVs. As firms focus on profit making its crucial for it to cut the cost.
The reasons why firms avoid digitalization is high prices of devices and advancements regardless of there green profit and also they are worried about the training of there employees about the usage of these devices.
Firms in supply chain connected with logistics and moving of goods also consider and give more importance to the cost of moving those goods and they analyze this thing even before the sorting process.Different types of services are being provided by Logistic companies worldwide for example ware housing, cross docking moving or transportation of goods and freight forwarding etc. All other departments and process along supply chain which may includes processing, load and unloading of goods, cross docking, ware housing and storing, packaging and logistic information.
All these processes can be made easier by deploy of different kind of tech devices but it also associated with a cost a cost of acquisition and also the cost installation and most importantly the training cost of employees is much high in these cases where firm is shifting whole culture of manual data handling as all these things require firm to spend more resources on them.

Some other factors like durability of PDA and installation, monitoring and updation of different software can affect the decision of PDA

Accordingly, we have discussed the following hypotheses in this research:

Hypothesis 1 (H1). Technology advancement creates a high possibility of adopting PDA.

Hypothesis 2 (H2). If the cost of PDA is high its adoption chances are low.

Organization Context

When we talk about adopting something or bringing any change in the organization the common question which arise in our mind is that large firms can do it easily than small firms, and one more thing we thought of that every year large firms acquire more patents than the small firms. But in reality this is not what happening small and medium size firms are also adopting technology and many of them are adopting better than the larger firms and in addition national patents acquired by small and medium firms are large in relative to the large firms. Large size firms have penalty of financial resources and they also posses greater ability of using new technologies. A study by shows that larger the firm size is directly proptional to the adoption of technology ie that larger the firm size larger the chances of IT acceptance. Aboelmaged (2014) stated that electronic maintenance technology is affected by organization ownership and scale of that organization. Premkumar and Roberts (1999) suggests that an organization may be already possessing considerable resources of electronic maintenance technology. This is the reason that using new technology is much easier for larger firms because of their capacity to buy and invest in digitalization.

In order to produce a shared value for all stakeholders, business sustainability enables the integration of financial sustainability performance and performance requirements for non-financial, social, and corporate governance practises. Any company's growth is based on the clientele it has amassed. By meeting their needs, a company can keep repeat clients by building a solid reputation. PDA may have immediately undermined employees' jobs, but it has also recently generated record numbers of job prospects. A flexible business process model made possible by the new green technology enables businesses to react rapidly to the demands of brand-new clients, market prospects, and rivalry threats. Customers are more likely to buy different versions if products aren't updated to reflect the invention. As a result, businesses must release new products to meet consumer tastes. Every business keeps its market share in a constantly shifting market by learning new items or enhancing its current services. However, developing new items is challenging and frequently calls for cutting-edge

technology. The business's operations are the main source of the trust between the consumer and the company. To complete deals, businesses must ensure timely delivery or uphold commitments. Customers search for a new partner when a company misses deadlines or fails to satisfy their expectations. Companies should uphold a positive reputation.If a company completes customer orders and makes timely delivery with high quality, then customers continue to support that company. Manufacturing firms that produce the same products or provide the same services spend considerable effort to maintain their market share in the face of intense competition. However, a company can only participate in the market by providing quality services to customers. Accordingly, we propose the following hypotheses:

Hypothesis 3 (H3). Firm size effects positively on PDA adoption.

Hypothesis 4 (H4). Firm scope effects positively on PDA adoption.

Hypothesis 5 (H5). Operation performance effects positively on PDA adoption.

Methodology

In order to establish this relationship a questionnaire consisting of 20 questions was developed (Appendix A). A questionnaire "include all techniques of data collection in which each person is asked to respond to the same set of questions in a predetermined order". Saunders et al (2008) argue that this kind of technique is especially suitable for explanatory studies because it gives an opportunity to examine and explain the relationships between variables and more specifically cause-and-effect relationships. The questionnaire for this study is a combination from the questionnaires of these two articles

"*Procurement 4.0: factors influencing the digitisation of procurement and supply chains*" by abu haddud

"*Adoption of Automatic Warehousing Systems in Logistics Firms: A Technology–Organization–Environment Framework*" by jingjing hao

Method of data collection

Collection of data in simple words the way one is gather information for study. There are two ways of collecting data primary and secondary.

Secondary Data Collection

The data which is collected by someone else for other purposes and may vary for that of the researcher is known as secondary data. This is a combination of both published and

unpublished documents which are relevant to the study or research hiving a high value and importance because it composites the logical framework of the study (Sekaran, 2003, Fink, 1995). The collection of this type of data has both pros and cons, one of the most important advantages of acquiring secondary data is that it makes research problem mre clearer to the researcher, for scientific conclusions to be drawn. But it should also be noted that this data is gathered by someone else and also for the other purpose that is why it may not be according or relevant to the study of researcher. For this study the secondary data includes: textbooks, academic articles and journals related to the implementation of automated procurement process. More over some of the online websites are also used for the material required in literature review .This type of data collection was mainly used for the literature review since it was unable to meet the research objectives.

Primary Data Collection

This type of data is not the work of any other rather it's a data which is collected by the researcher it self and this is done when researcher is unable to collect enough information from the secondary data collection or data collected is not enough to find conclusions (Sekaran, 2003). And this is done by a special kind of instrument, that can be a questionnaire or any interview designed specifically for a specific topic. For this study primary data were collected by questionnaire. The core for this was to find the drivers and barriers of PDA studied in the research.

Questionnaire

This is basically an instrument which is used in research and comprising of different question and some other things with a purpose of collecting information from the public or respondents and almost each of the time it is further used in statistical analysis by running different statistical test on the results gathered from it. As per Sekeran, (2003), It is a question set which is formulated before conducting research and for the collection of responses from respondents and have defined close alternatives. This instrument can have two types of questions one which are called close ended and others are called open ended

Open ended questions have no particular answer like one can not answer with yes or no these types of questions are some time important to collect data about the perceptions of people that what they think and from there point of view what is the answer there are both pros and

cons of such questions that one can use the quote words exactly and on ther side the problem is that its cataloguing and interpretation is much difficult(Fink, 1995).

On the other side close ended questions are those which have a particular answer on can chose a specific answer from the given set so the answers of different respondents can be same In these questions also one can gather opinions by giving the option of others however data handling of these questions is much easier and analyzing this data statistically is very helpful (Fink, 1995).But these questions also have some issues that writing of such questions is not easy and can be done in short time or by own one have to put and analyze his questionnaire also because he have to put each and every answer one can give or think of but once it is formed collecting and analyzing these results will be much easier. One can get results by using different types of scales like Likert Scale having 5 or 7 points as these scales are ordered and one dimension respondent can give the best answer which is in his mind.

Population And Sample

According to Sekaran (2003) sampling means that what numbers and what type of elements one is going to study in his research and having a specific population size whereas population is meant by the whole group of elements which are under study. Element is meant by the bit part, the smallest one or a single unit of whole population

And sample is a part, portion or you can say a subset of the complete set of population. Sample size is based on which type of study is being done and also some other constraints like time and financial resources are also considered during the determination of sample size (Fink, 1995). So that is why sampling is about defining sample and its important for the study because it make work easier for the researcher and to examine the whole population is not possible (Frankfort-Nachmias, 1996).

Population and Sample size

The population of study will be drawn out of the various manufacturing firms in Paksitan. Questionnaires will be distributed in each of the firm and at different managerial level through google docs . The choice for fillers is borne out of the fact that they are believed to know the procurement process more. Approximately 130 questionnaire will be distributed.

Data Analysis.

The data will be analysed using a parametric test, this determined statistically the significance between two independent samples. Hypothesis testing will be adopted to test the differences in the means. This will be aided with the use of the SPSS software.

CHAPTER 4
ANALYSIS AND FINDINGS

Introduction

In section of analysis and findings we are going to discuss the results or outcomes and scrutiny of the information which we have collected with the help of structured questionnaire which was discussed before and sample of which is given in the end. After that we judge the whole scenario and have complete view of complete data along with the background and knowledge of respondents such as their designation, age and others.

Software used:

The software we have use for running statistical test and find results like correlation and regression is SPSS 26 version

Data coding:

After selection of software data was entered with proper coding method.

Data Analysis

Descriptive Analysis

To conduct this study we have grouped the whole data into different classes we can interpret the data easily. We have also make groups of sample size on the basis of their gender, at what post they are working ie their designation and from how many years they are working in the field as an experience and only those questionnaire are included in the study which are up to mark and were filled in a proper manner (completely and without and biased answer)

Following are the demographic details of respondents

Table 1. Demographics of the Respondents.

Demographic Variables	Category	Percentage
Gender	Male	83.3%
	Female	16.7%
Age	Less than 30 years	26.70%
	30 – 35 years	58.30%
	35-45 years	15%
	45+ years	0%

Designation	Senior manager	18.30%
	Middle level manager	70%
	Support Staff	10%
	Other	1.70%
Experience	Less than 5	31.70%
	5 to 10 years	55%
	more than 10 years	13%

Out of 120 respondents, based on gender, 100 respondents with the percentage of 83.3% were males. On the other hand, 20 having the percentage of 16.7% were females respectively. On the basis of age, 32 respondents with the percentage of 26.7% were having age less than 30 years and 70 respondents with the percentage of 58.3% were having age between 30 to 35 years. Furthermore, 18 respondents with the percentage of 15% were having age between 35-45 years but no respondents were recorded having age above 45.On the basis of the experience, 38 respondents with the percentage of 31.7% were having the experience of less than 5 years. Similarly, 66 respondents with the percentage of 55% were having the experience between 5 to 10 years. Furthermore, 16 respondents with the percentage of 13% were having the experience of more than 10 years. Moreover if we look into the designation 22 respondents comprising of 18.3% belongs to the cadre of senior management and the large portion of the respondents comprising 88 out of 120 with a percentage of 70% are on the seat of middle level manager while out of 120 respondents only 12 or 10% belongs to support staff.

Reliability and validity

Under this heading we are going to test the validity. And table 2 shows the consistency regarding every measurement item as per theoretical dimension of questionnaire questions. After the factor analysis of the variables we have found that loading factor of each variable is greater than 0.5 which is according to the rule of convergent validity. Moreover we have also calculated the CR and AVE of each variable.

Table 2. Composite Reliability (CR), Average Variance Extracted (AVE), and Loading.

Concept	Measurement Item	Loading
Technology Advancement CR= 0.867 ; AVE = 0.486	TA1	0.637
	TA2	0.754
	TA3	0.869
	TA4	0.707
	TA5	0.646
	TA6	0.551
	TA7	0.670
Cost CR= 0.775 ; AVE = 0.535	CO1	0.778
	CO2	0.678
	CO3	0.736
Firm Scope CR= ; AVE = 0.649	FS1	0.833
	FS2	0.778
Operation Performance CR= ; AVE = 0.496	OP1	0.772
	OP2	0.852
	OP3	0.728
	OP4	0.551
	OP5	0.570

Next table is about the mean and variances of different factors and show that highest mean values of these factors Technology advancement and operational performance which means that firm focuses on technology advancement and firms having better operational performance focuses more on adoption. More over table also shows that the mean value of cost is 2.49 which is high in number which means to say that high costs of different technologies discourage companies to adopt digitalization

Table 3: Mean Value and Variance

Constructs	Mean Value	Variance
TA	4.2	.252
CO	2.49	0.820
FS	1.97	0.735
OP	3.84	0.250

In the very next table (table 4) AVE an average variance extracted square root of all variables and compared with the correlation coefficient with each other and it can observed that AVE average variance extracted is higher than correlation coefficient of all other variables and is a sign of discriminate validity of data. Moreover we can see that correlation coefficient along each variable is less than 0.5 which indicates that all variables are mutually independent with each other. So we can say that the items through which we measured variables are not influenced mutually and we can measure respondents attitude effectively.

Table 4. Average Variation Amount Extraction Square Root, and Correlation Coe_cient.

	TA	CO	FS	OP
TA	0.697			
CO	-0.377	0.731		
FS	0.054	0.243	0.805	
OP	0.309	-0.185	-0.115	0.704

So all these statistical analysis predict that variables are having validity and reliability which means that our model of influence of organization and technology on procurement digitization is also having validity. This all in other words means that we can have precise measurement and the information which we have collected through questionnaire survey is having high quality

Structural Model Analysis and Hypotheses Test

In below figure we have done path analysis and also the explanatory power of the model in below figure R2 refers to the explanatory variable and then we have done hypothesis testing results of which is given in table 2

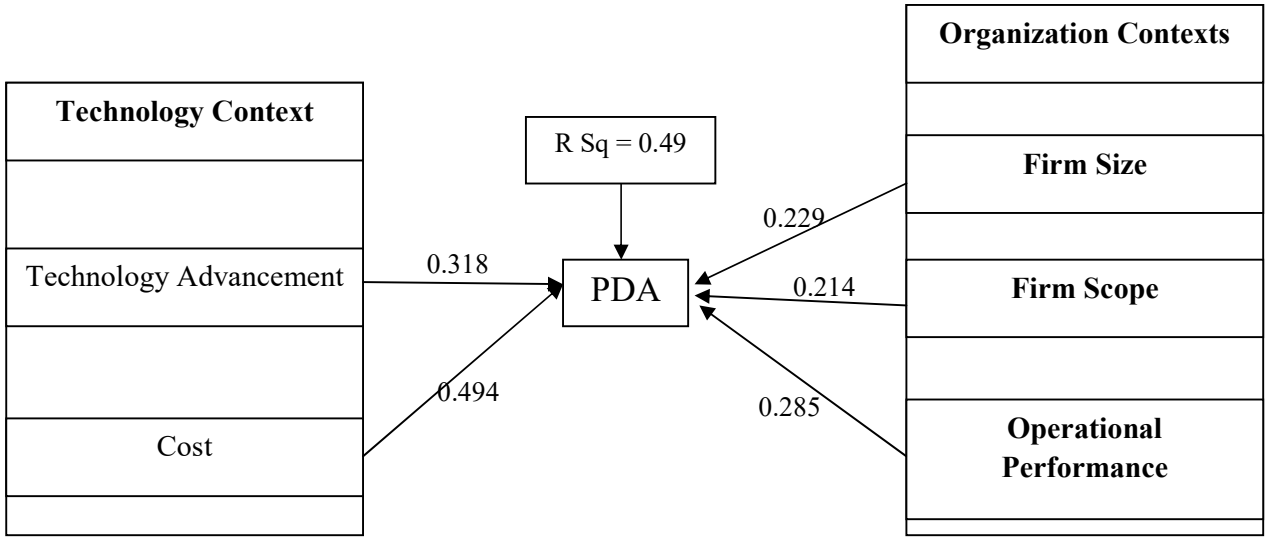


Table 2. Summary of Tests of Model Paths and Comparison of Path Coefficients.

Hypothesis	*β* Value	*t* Value	*p* Value	Support
TA-AA	0.318	4.086	0.000	Yes
CO-AA	-0.494	-4.79	0.000	Yes
IS-AA	0.214	2.0	0.045	Yes
FS-AA	0.229	2.834	0.008	Yes
OP-AA	0.285	3.44	0.01	Yes

The analysis of these result shows that perceived technology advantage of procurement digitalization is having a significant positive influence on the use of PDA ($\beta = 0.318$, $t = 4.086$, and $p < 0.05$). So we can say that hypothesis one is supported and when a firm perceive that technology advancement is high they move more toward the adoption of digitization of procurement and its implementation actually when firm look into technology advancement they also consider different advantages which can be attained. Next

procurement digitization adoption cost is having a significant negative influence on its adoption and utilization as ($\beta = -0.494$, $t = -4.79$, and $p < 0.05$).Hence, Hypothesis 2 is also supported. Study says that when cost of digitization is high the chances of its adoption by firm is low and vice versa. As both hypotheses one and two are accepted it shows that technology has a significant influence on digitization of procurement and its implementation in an organization. Firm size is having a high influence on positive scales ($\beta = 0.229$, $t = 2.834$, and $p < 0.05$) on adoption of digitization and proving the hypothesis 3 that says that larger the firm size larger are the chances and probability of adoption of digitization in procurement department. If we look at variable firm scope negative value of beta and t is showing that it is having negative relation with PDA. Both Operation performance and firm scope is having a high influence on positive scales ($\beta = 0.285$, $t = 3.44$, and $p < 0.01$ of operation performance) & ($\beta = 0.214$, $t = 2.0$, and $p < 0.045$ of firm scope) on adoption of digitization and proving the hypothesis 4 and 5 both are now supported.

CHAPTER 4
Conclusions and Recommendations

Conclusions

Procurement digitalization adoption is significant evolution in supply chain and procurement department. The primary goal of PDA is to have better procurement and control over information and supplies which in result will create value in terms of cost also. The findings of this study show that the technology advancement and cost of its adoption is having a high influence in above framework and it adoption. Similarly other variables are also having positive influence over the adoption but not all are having the positive effect as cost of PDA is having adverse influence over the adoption and usage of PDA

Moreover the technology advantage and cost of PDA significantly influence PDA adoption. The organization after checking and evaluation PDA cost if it is bringing value and improvements in current position of an organization. If these technology advancements cost is high for a firm against the advantages they are giving to an organization or in other words they not making high value then their cost a firm will perceive such technology inappropriate to adopt. Typically most of the firms give importance to cost factor while taking this decision either thay going to adopt new technology or they will remain stick with the primary technology they are using. In short lower the PDA cost, high the chances of firm to adopt new technology.

This research analyses those factors which are influencing the adoption of new technology in procurement department. So these findings are pointing the significant variables or predictors including technology advancement and cost along with the operational performance, size and scope of the firm Cost is related to the technology while on the other hand scope is related to firm in which cost is influencing negatively while scope positively.

Our study contributes about the enhancement in procurement digitalization adoption measurements and also provide the evidence for the organizations to adopt PDA and create value in supply chain and procurement department which in turn will create overall value. This study which is basically an empirical research will help the organization in decision making process of adoption of new technology and PDA. Firms can mitigate the problems brought on by this technology having consideration of the other side by referring to the

factors that influence the adoption of new technologies. By taking into account the theoretical and methodological implications of the findings, this contribution can be strengthened.

Thus, managers in the logistics sector can use this study as actual empirical data. Small businesses fail to adopt new technology because they lack confidence in its promise of value that digitalization can bring. The adoption of new technology is also influenced by a company's size. When a company has multiple branches, management might use modern technologies more due to their large scope and size. As soon as businesses and management have collected an appropriate amount of intellectual assets through patenting operations, they need to take care of reducing cost and creating more efficiency in there process by bringing in the new technology and gadgets.

Limitations

This study is also having several limitations. As our study is suggesting that cost is a significant variable or factor influencing but there may be some variation in adoption basing on the factor that firm size varies which require further investigation. And the main limitation is of the quantity of respondents as there is a limitation regarding number of managers in each organization.

Recommendations and Future Research

For future we are having many directions. We can segregate the topic regarding the enterprise scope and the significant challenges they face on each level as medium and small enterprise. Secondly some of the other factors and variables are also important and can be investigated like attitude of upper level management towards the adoption of change and technology. Third different other departments can be studied in this context like corporate social responsibility, marketing and different other levels

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Appendix 1

Questionnaire

Firm scope

FS1: Multi-established (Y/N)
FS2: Establishments outside of country (Y/N)

Firm size

SI1: Assets
SI2: Number of employees
SI3: Annual sales

Operation performance

OP1: Our firm can quickly modify products to meet our major customer's requirements.
OP2: Our firm can quickly introduce new products into the market.
OP3: Our firm can respond to changes in market demand.
OP4: Our firm has an outstanding on-time delivery record for our major customers.
OP5: Our firm provides a high level of customer service to our major customers

Cost

CO1: We believe that the cost of PDA is high for our company.
CO2: We believe that the amount of money and time of training for PDA applications is high for our company.
CO3: We believe that the maintenance and support fees for PDA applications are high for our company

Technology Advancement

TA1: Procurement platforms based on "many-tomany" communication will simplify my daily business.
TA2: Mobile applications, cloud solutions, and cloud-based ERP solutions will enable me to work with a full remote access
TA3: A common user interface (for platforms and applications) will enable me to work more efficient and effective.
TA4: Social media platforms will be a helpful tool for internal and external communication and collaboration.
TA5: Radio frequency identification and smart sensors will increase the transparency and traceability of processes.

TA6: Cyber security requires a cross-functional approach and must be developed and forced by all supply chain stakeholder.
TA7: Predictive analytical tools and algorithms will automate and speed-up transactions and processes

PDA adoption

AA1: I would like to adopt PDA in the next (n) months.
AA2: I would like to adopt PDA in the next (n) months.
AA3: I would like to adopt PDA in the next (n) months.

Procurement 4.0 V-II

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