People's Democratic Republic of Algeria

Ministry of Scientific Research and Higher Education

University of Ibn Khaldoun – Tiaret –

Faculty: Economics, Business, and Management sciences
Branche : Management

Field: Economics, Business, and Management sciences
Department : Management

Specialization : Financial Management

A Dissertation submitted in Partial Fulfilment for the requirements of the Master Degree in Financial Management

Submitted by :

Amani Salma Belhaouari

The role of Digital Transformation in Procurement and Supply Chain Management - A field study of several institutions in Tiaret -

Board of examiners:

Chairman : DR. Khaldia Beladjine	MCA	University of Ibn Khaldoun - Tiaret -
Supervisor : DR. Abdelhak Ziani	Prof	University of Ibn Khaldoun - Tiaret -
Examiner : DR. Brahim Chablaoui	MCA	University of Ibn Khaldoun - Tiaret-

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Dedication

To my beloved parents, the source of my strength and constant support,

To the loveliest sister Ritadj,

To my dear friends Amira and Lina,

I dedicate this achievement with all my respect and love.

Acknowledgment

I am deeply thankful to my thesis supervisor Dr. Abdelhak Ziani.

His guidance and feedbacks helped to organize and complete this research.

I would also like to express my gratitude to the Faculty of Economics, Businesses and Management of Ibn Khaldoun University in Tiaret for creating a stimulating academic environment.

Their dedication to advancing research has made my academic journey very successful.

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Acronyms list:

SCM	Supply chain management
SC	Supply chain
Iot	Internet of things
SCP	Supply chain and procurement
PMO	Programme management office
DT	Digital Transformatio,
CAD	Creating competitive advantage
PCM	Purchasing and supply management
CSCMP	Council of supply chain management professionals
AR	Augmented reality
CIM	Computer integrated manufacturing
JIT	Just in time
ToC	Theory of constraints
RPA	Robotic process automation
AI	Artificial Intelligence
B2B	Business to Business
SaaS	Software as a service level
SLA	Service level agreement
PaaS	Platform as a service
IaaS	Infrastructure as a service
DBMS	Database management system
6G	Sixth generation
CAD	Computer aided design
VR	Virtual reality
MR	Mixed reality
BDA	Big data analytics
IT	Internet Technology
SCP	Supplier Collaboration portals
AD	Additive manufacturing
DTS	Driverless transportation system
APM	Auto pallet movers
PARC	Palo Alto Research Cente
ERP	Enterprise Resource Plannin
P2P	Peer-to-peer
CPS	Cyber-Physical Systems
RFID	Radio frequency indentification
CAM	Computer aided manufacturing
SCADA	Supervisory control and data acquisition
DbaaS	Database as a service
KPI	Key performance indicators
3D	Three dimensional
PSCM	Procurement and supply chain management
SDCOM	Systéme distribution commerciel
NAFT COMPTA	Naftal Comptabilité
ETUS	Etablissement public de transport urbain et semi- urbain

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Introduction:

Digital transformation is omnipresent topic in the media, almost everyday there are reports of new business models, new products or new processes. It reaches mainstream businesses, including their procurement and supply chain management activities. (Hess, 2022).

This digital revolution is an ongoing process of strategic renewal using technological advancements to build capabilities that refresh or replace organizational structures and processes. (Karttunen, Lintukangas , & Hallikas, 2023)

These advancements are not just technological breakthroughs, but synergistic combinations of components, a technical and a professional (content-related, application-specific) solution. (Hess, 2022).

It may enable procurement and supply management to become a value-adding and revenue-generating function with a strategic focus instead of administrative and clerical roles. (Karttunen, Lintukangas , & Hallikas, 2023)

In recent years, procurement and supply chain management has evolved from a sole focus on cost reduction, manufacturing large volumes, and delivery. Currently play a role in ensuring the most important and highest quality innovation available to suppliers is constantly maintained throughout the supply chain, effective in providing fast delivery times provide internal, and reduce supply market risk. The specific focus on these critical value areas varies from company to company with its member ordering and supplying systems.

Naturally, the value dimensions are also weighted differently within an industry, for example, there will be a difference between savings and quality depending on whether the company is striving to be a cost or a quality leader. Based on this overall direction, the right focus areas can then be selected, and specific designs created at category level. (Schnellbächer & Weise, 2020)

According to Ning & Yao (2023) “Digital transformation directly influences supply chain capabilities and supply chain competitive performance, with the four dimensions of supply chain capabilities playing a mediating role between digital transformation and competitive performance” (Ning & Yao, 2023) This impact is achieved through various technologies that contribute to the concept of a digital supply chain which comprises systems (e.g., software, hardware, communication networks) that support interactions between globally distributed organisations and orchestrate the partners' activities in supply chains. These activities include buying, making, storing, moving, and selling a product. It aims to achieve speed, flexibility, global connectivity, real-time inventory, transparency, intelligence, scalability, innovation, proactive, and eco-friendliness. (Magdalena, Hatta, & Solikhah, 2024)

One way to unlock these benefits is internet of things (Iot) which connects all objects to facilitate interaction whith each other, forming an interconnected network (Zhang, Yu, Wan, Cao, & Huang, 2024, p. 3).

In addition, Big data describes a way of collecting, managing and analysing large amounts of data and it is mostly referenced with the four Vs, i.e. volume, velocity, variety and veracity. (Zhang, Yu, Wan, Cao, & Huang, 2024, p. 4)

Despite the acknowledged advantages of digital advancements for procurement and supply chain management (SCM), there is still a need to thoroughly grasp their true role on these areas. This study aims to close this gap through a full examination of the following:

How digital transformation is changing traditional procurement and Supply chain mangement processes?

Driven by this shift are basic digital technologies and their specific applications in these roles. Opportunities and challenges associated with implementing these digital developments. Critical success factors that organizations must consider in their procurement and SCM activities to achieve successful digital transformation.

Sub-Questions:

To gain a more detailed understanding, the following sub-questions were developed based on the research issue:

- What digital technologies are driving changes, in procurement and supply chain management (SCM)?

- In which ways is transformation impacting procurement and SCM procedures?

- What advantages and challenges come with implementing digital innovations in these fields?

- How do digital technologies change traditional procurement and SCM procedures ?

Research Hypotheses:

These hypotheses are formulated to address the research issue and questions:

- Digital transformation leads to efficiency improvements in each stage of the supply chain by reducing time and cost and improving transparency.

- E-procurement drives strategic supplier management and optimizes sourcing strategies.

Research Objectives and Significance:

Objectives:

This research explores how digital transformation changes procurement and supply chain management (SCM). By investigating new technologies, their effects on traditional practices, this study seeks to:

-Identifies the digital technologies in procurement and supply chain management

-Explores how digital transformation changes each stage of supply chain from procurement to delivery.

Significance:

This research indentifies the role of digital transformation in procurement and supply chain management (SCM).

The findings of this study will offer insights for organizations embarking on their digital transformation journey in procurement and SCM contributing knowledge to the existing literature on digital transformation.

Reasons for choosing the topic:

This topic was seleted for the following reasons:

- Digital transformation in procurement and supply chain management (SCM) is highly relevant and timely due to rapid advancements and their crucial role on modern businesses.

- Limited research exists on the effects of digital transformation on procurement and SCM in developing countries, highlighting the need for this study.

Delimitations:

The study will only examine a selection of companies based in Algeria, specifically, Naftal Fuel Branch Tiaret 614, Algeria Telecom -Tiaret- , The Urban and Suburban Transport Public Company and Sonelgaz Tiaret it will focus on recent advancements and emerging trends in digital transformation affecting procurement and SCM.

This research is limited to a specific data collection method of interview.

Research Method:

To achieve the objectives, this study employs a descriptive research design, utilizing qualitative approaches and case studies. Data was collected through semi-structured interviews with employees from four Algerian companies: Naftal Fuel Branch Tiaret 614, Algeria Telecom, The Urban and Suburban Transport Public Company, and Sonelgaz Tiaret.

Thematic analysis was used to interpret the data, allowing for the identification of patterns and themes related to the role of digital transformation on PSCM.

Research Sample and Population:

Population: The focus group for this research comprises professionals in procurement and SCM functions, specifically those operating whithin Algerian entreprises.

Sample: A selective sample of 16 interviewees from different departments at each stage of supply such as procurement, inventory, distribution and delivery.

Literature review:

A critical analysis of existing research on digital transformation in procurement and supply chain management offers valuable insights, where experts agree and disagree on certain ideas, while some areas need more research.

The following table summarises 14 studies published between 2017 and 2023.

Reference	The research issue	Objectives	Method	Country	Findings
Bienhaus, Haddud, (2017)	The impact of Procurement 4.0: factors in the digitisation of procurement and supply chains	-Identifying the impact of digitisation on procurement and its role within the area of supply chain management. -Exploring potential barriers to digitising procurement and supply chains and ways to overcome them. -Examining the significance of potential enabling technologies to the digitisation.	A quantitative approached utilising an online survey was used to collect the primary data for this study. Data were collected from 414 participants directly involved with procurement or related business functions and work for different organisations in different industries.	UK	-Digitisation of procurement process can yield several benefits including: supporting daily business and administrative tasks, supporting complex decision-making processes, procurement will become more focussed on strategic decisions and activities, procurement will become a strategic interface to support organisational efficiency, effectiveness, and profitability, and supporting the creation of new business models, products, and services. -The authors were also able to confirm that there are barriers to digitising procurement process and supply chains. -The significance of a number of enabling technologies to the digitisation process was revealed.
Paul, Choi (2018)	Digital Transformation and Its Effect on Supply Chain Complexity.	deepening the understanding of how disruptive technologies impact upon supply chain complexity.	-Systematic literature review.	The countries with the highest number of authors are the United Kingdom, Germany, and Italy, the rest are in europe, asia, south and north america and Oceania.	digitalization may simultaneously impact upon supply chain complexity positively and negatively.
BENTALHA, HMIOUI& ALLA,(2019)	The digitalization of the Supply chain management of service companies	- analyze the digital Supply Chain Management (SCM) field by formulating research hypotheses and identifying major themes related to digital SCM through academic and professional journals.	-collecting articles on digital SCM, identifying major themes. -selecting experts in logistics and supply chain, conducting interviews, and analyzing responses collected through questionnaires	Morocco	This logistics process of the service company will streamline and improve the performance of the SSCM using the parameters of digitization, but with differences in approache and priorities. - The study highlighted various concepts related to digital SCM, such as technology, big data, internet of things, and artificial intelligence.

Hallikas, Immonen & Brax, (2020)	the impact of data analytics on supply chain performance	- investigating digitalization as a performance driver in supply chains, especially the role of data analytics in the digitalization of procurement. -investigating in how digital procurement capabilities are linked to data analytics capabilities and supply chain operational performance and how this links to business success.	studied the digital procurement capabilities and proposed the conceptual model and hypotheses for empirical testing. The collected industry survey data and structural equation method are then applied to test the hypotheses.	Finland	-The study confirms positive and significant relationships among digital procurement capabilities, data analytics capabilities and supply chain performance. - Digital procurement capabilities mediate the positive relationship between external data analytics capabilities and supply chain Performance
Seyedghorban, Samson& Tahernejad, (2020)	Digitalization opportunities for the procurement function	-investigating the common practical problem of how procurement can be transformed from tactical and administrative to becoming an organizational strategic partner and indeed a competitive weapon, using modern technologies in particular. -Investigating how procurement can be reinvented, from being digitized to digitalized to digitally integrated, ultimately contributing in business terms beyond supply chain effectiveness but also to profit generation.	A case study approach was designed to investigate three firms, each at very different stages of digital maturity in procurement. Interviews with managers, investigation of processes and documentary materials and in-depth follow-up discussions were conducted.	UK	The iterative digitalization transformation discovered encompasses complexities rooted in organizational structure, supply chain design and the management of the technology for employees' uptake. There are both operations and strategy implications as a result. This initial research phase led to mapping a model of digital maturity as well as identifying its underlying constructs.
ElSagheer, (2020)	The effect of using Blockchain technology in tracking manufacturing supply chains on activating Inter-organizational Cost management tools and enhancing competitiveness "A fiels study"	-Developing a methodology to test the effect of applying one of the mechanisms of digital transformation, which is the technology of Blockchain in tracking the supply chain on the activation of inter-organization-cost management tools for that series.	Method: Questionnaires Sample: - Cost managers in sample industrial companies. -A group of professionals from the in Linked network - Professional furniture container.	Egypt	- there is a positive statistical correlation between the application of Blockchain technology in tracking the manufacturing supply chain, coordinating efforts and relationships, and supporting value chain analysis -There is a statistically significant correlation relationship between the application of blockchains technology in tracking the manufacturing supply chain and activating the target cost method, and the method of accounting for open records. - There is a statistically significant correlation relationship between the application Blockchain technology to track the manufacturing supply chain, and support the competitive advantages of this chain.
MIKHAYLOVA, et al, (2021)	Impact of Digitalization on the Efficiency of Supply Chain Management in the Digital Economy	Explore the role of digital supply management from the perspective of the involvement in international trade.	SWOT Analysis, ICT Development Index (IDI), Logistics Performance Index (LPI), Correlation Analysis and Composite Index.	Russia	-the adoption of digital technologies contributes to the increase in the efficiency of supply management

Huang, et al., (2022)	The New Business Form of Smart Supply Chain Management Based on "Internet of Things + Blockchain"	The objective of the study is to establish an intelligent supply chain management platform that supports the Internet of Things and blockchain technology. The aim is to optimize supply chain management in Chinese enterprises and provide practicality for small and medium-sized businesses.	- theoretical Analysis Method - Case Analysis Method. In order to additionally check the feasibleness and effectiveness of the applying of the net of things and blockchain technology in enterprise offer chain management. - Logical Analysis Method. through the analysis of the relevant literature and data, the in-depth analysis of specific research content and problems is made.	China	-the intelligent supply chain management platform based on the Internet of things (IoT) and blockchain can make the operation of the entire supply chain clearly visible. -Information and data sharing can be achieved among the various departments of the supply chain to achieve scientific management and precision of the enterprise prediction. And this model can also be used in other industries to achieve industrial upgrading.
Chauhan, et al., (2022)	Digitalization of Supply Chain Management with Industry 4.0 Enabling Technologies	- discussing the significance and application of Industry 4.0-enabling technologies such as IoT, cloud computing, AI, big data, blockchain, and digital twin in sustainable SCM. - Indentifying the important areas for future research in the field.	The PRISM framework by using 114 articles to analyze the role and significance of sustainable SCM and the integration of Industry 4.0-enabling technologies. Research questions were framed to collect and analyze distinct research articles related to Industry 4.0's impact on finance management in firms.	_	IoT, AI, cloud computing, blockchain, big data, and digital twin are integrated for real-time tracking, inventory optimization, digital trading, demand analysis, and the optimization of operational management
Alabdali, Salam (2022)	The Impact of Digital Transformation on Supply Chain Procurement for Creating Competitive Advantage	Examining the impact of digital transformation (DT) on supply chain procurement (SCP) for the creation of competitive advantage (CAD).	- This study adopted a quantitative approach using a survey administered to 221 supply chain (SC) professionals through the professional networking website LinkedIn - The conceptual model was evaluated with the partial least squares-based structural equation model (PLS-SEM) using SmartPLS	Saudi Arabia	- DT has significant positive impacts on SCP and CAD, and that SCP has a significant positive impact on CAD. Supply chain procurement plays a significant mediating role in the relationship between DT and CAD. - digital procurement may be an SC game changer in a competitive market
Motaung, Sifolo (2023)	Benefits and Barriers of Digital Procurement: Lessons from an Airport Company	- Exploring the benefits and barriers of digital procurement at Airports Company South Africa (ACSA).	A qualitative approach in a form of a single holistic case study design was adopted. The sample involved 18 employees and individuals who were supply chain management (SCM), information technology (IT), and programme management office (PMO) professionals. Semi-structured interviews conducted focused on those with extensive experience on procurement, digital technologies, procurement automation or the implementation of transformation programmes.	South Africa	-Digital procurement is a value adding function at ACSA with the possibilities of providing cost reduction in the supply chain. - Job losses, cyber security, lack of interoperability, lack of skills and system downtimes are obstacles which affect the adoption of digital procurement as organizational barriers. -The infusion of digital technologies into various aspects of organisational processes and outcomes remains a complex, dynamic, fluid, and volatile phenomenon.

Delke, et al., (2023)	Future roles in purchasing and supply management	The article aims to forecast future roles in purchasing and supply management (PSM) within an Industry 4.0 context through a real-time Delphi study. The study focuses on developing projections based on previous literature and expert opinions to identify and describe new professional roles in PSM.	The research employs a four-step approach, including projection development, selection of experts, execution of the Delphi study, and analysis of outcomes. The study utilizes the World Café method for small focus group discussions to gather responses from PSM Professionals. A total of 70 experts participated in the study, with 47 completing the final Delphi survey.	Estonia, Slovakia, the Netherlands, Germany, and potentially others within Europe	The study reveals that the World Café method provides comparable results in less time compared to other qualitative research methods. It also highlights the importance of high heterogeneity in expert selection to reduce cognitive biases. The self-assessment questionnaire conducted before the Delphi study confirmed the experts' good understanding of the research focus, with advanced competence in various knowledge areas related to digital transformation in PSM.
Lo, (2023)	A data-driven decision support system for sustainable supplier evaluation in the Industry 5.0 era	- proposing a data-driven decision support system to execute the supplier evaluation process. First, variable precision- dominance-based rough set approach (VC-DRSA) is applied to extract the core criteria, to remove the noise factors and to generate decision rules for the decision-makers' reference.	-the criterion importance through intercriteria correlation (CRITIC) approach is adopted to obtain the dependency weights of the core criteria and their ranking. Finally, a modified classifiable technique for order preference by similarity to ideal solution (CTOPSIS) is used to integrate the final performance values of suppliers when new alternative suppliers are added. - Data provided by a multinational medical equipment manufacturer are used as an example to demonstrate the proposed model	Taiwan	real-time information sharing, and organizational culture transformation are the three main factors affecting the development of enterprises towards Industry 5.0. The results show that CTOPSIS can be used to quickly assess the ratings of new alternative suppliers are listed
Haque, Koohi & Waqa, (2023)	The Significance of Digital Transformation in the Supply Chain Management for Facilitating International Businesses Cases from Emerging Markets	-providing in-depth comprehension regarding the impending gratuities of supply chain revolutions availed by emergent markets expediting their international business with significant hindrances in the process.	- theoretical framework - qualitative case studies of the syndicates through semistructured interviews using an inductive approach under the interpretive methodology concept.	Iran, Pakistan and Bangladesh	- despite market and industry, human errors and manual processes resulting in extra cost, time and energy limiting a firm's overall capacity have been the crucial challenges optimised by supply chain renovations. - integrating dynamic capabilities theory with digital technologies offers a robust framework for organisations aiming to enhance their supply chain management practices in this digital era.

Table 1: Literature review summary (Source: Elaborated by the researcher)

Several studies provided conclusions on the impact of digitalization on supply chain management (SCM). These studies, including (Bienhaus & Haddud, 2017), (BENTALHA, HMIOUI , & ALLA , 2019), (Hallikas, Immonen, & Brax , 2020),)Elsagheer(2020 ،, (Seyedghorban & Samson, 2020), (MIKHAYLOVA, SAKULYEVA, SHCHERBINA, LEVOSHICH, & TRUNTSEVSKY, 2021), (Huang, et al., 2022) , (Chauhan, et al., 2022), (Alabdali & Salam, 2022), (Motaung & Sifolo, 2023), (Delke, Schiele, Buchholz, & Kelly, 2023), (Haque, Koohi, & Waqar, 2023), and (Lo, 2023), generally agree that

digital offers benefits such as increased efficiency, reduced costs, better decision-making and greater transparency.

Furthermore, all studies agreed that competitive advantage can be gained through digitalization.

In addition, several studies (Bienhaus & Haddud, 2017), (Elsagheer, 2020), (Hallikas, Immonen, & Brax , 2020), (Huang, et al., 2022), and (Chauhan, et al., 2022) identified specific technologies like big data, artificial intelligence (AI), and the Internet of Things (IoT) as key enablers of these benefits. However, they also identified challenges such as implementation barriers, Human ressources concerns and cybersecurity risks, as highlighted in studies by (Bienhaus & Haddud, 2017) and (Motaung & Sifolo, 2023).

Despite some shared findings, studies also offered different perspectives:

- (Paul & Choi, 2018) examined the negative aspects of digitalization, highlighting the potential increase in supply chain complexity, and departing from the usual positive view of the impact of digitalization.

- (BENTALHA, HMIOUI , & ALLA , 2019) examined digitalization specifically in service firms, suggesting possible strategic differences compared to other industries, providing a nuanced perspective on of digitization services.

- (Delke, Schiele, Buchholz, & Kelly, 2023) present a prospective approach that identifies new roles in supply chain management through real-time Delphi surveys, including valuable contributions.

However, these studies does not adequately consider some important areas for the future.

Firstly, Despite significant progress in understanding the role of digital technologies in supply chain management, there is a lack of comprehensive, stage-by-stage analysis from procurement to delivery. This study aims to address this gap by critically examining each component of the supply chain, highlighting the role of digital innovation.

Furthermore, although some studies discuss various digital technologies in supply chain management, more research is needed to understand the role of e-procurement. This study will examine how e-procurement technology contributes to digital transformation.

Additionally, many studies focus on developed countries, neglecting the unique challenges and opportunities that developing regions face in embracing digital transformation. Research specific to contexts like Algeria can help to ensure effective implementation and avoid overlooking potential barriers.

Outline:

The first chapter starts by explaining the fundamentals of procurement and supply chain management. Then, it dives into the concept of digital transformation, defining it and exploring how it affects different areas. Finally, this chapter examines how digital transformation can improve how companies handle procurement and supply chains.

The second chapter takes a more practical approach. It explains the research methods used to understand the connection between digital transformation and these business processes. Think of it as revealing the steps taken to reach the conclusions. Next, the chapter presents real-world examples from specific companies to showcase the impact observed. Finally, it analyzes these findings, discussing the benefits companies can gain by adopting digital tools in their procurement and supply chain operations.

Challenges daced during the study:

I have faced many difficulties in the process of doing these interviews, especially the new concept that is why, I did some modification to the initial question in order to adapt these questions whith the target approach.

Even companies with digital initiatives were not fully transformed, so I had to explain the deeper meaning of digital transformation. Limited awareness made data collection challenging, but I still gathered valuable insights.

In addition, Interviews were not recorded due to restrictions. Instead, detailed note were taking during each interview for further analysis.

1. Theoretical Framework :

This chapter aims to develop a theoretical framework for understanding the role of digital transformation in procurement and supply chain management, starting from the foundation of procurement and supply chain management including important concepts and their interrelationships will be provided. In addition, the term digital transformation will be defined, its domains, and the technologies involved. The next sections will delve into the contribution of digital transformation in procurement and supply chain management, focusing on its benefits and challenges.

This chapter is structered into three sections.

1.1 Foundations of Procurement and Supply Chain Management

1.1.1 supply chain management essentials

1.1.2 Procurement Management

1.1.3 The relationship between procurement and supply chain management

1.2 Digital Transformation

1.2.1 Definition of digital tranformation

1.2.2 The five domains of Digital Transformation

1.2.3 Technological Tapestry of Digital Transformation

1.3 The contribution of Digital Transformation in Procurement and Supply Chain Management

1.3.1 Digital technologies in plan and source processes

1.3.2 Digital technologies in Make processes

1.3.3 Digital technologies in Delivery processes

1.1 Foundations of Procurement and Supply Chain Management:

In the business world, ensuring continuity is important, and that's where procurement and supply chain management play a key role. Procurement focuses on getting the right products at the right price, while SCM is directed from source to customer. Understanding the connection between these two activities is the key to running a successful business in today's globalized world. This section digs deeper to show how they work individually and how their cooperation strengthens productivity.

1.1.1 Supply Chain Management Essentials:

New ideas often cause confusion – what does it mean, what does it do, and how do we use it? Supply chain management is no exception, with diverse definitions that highlight the broad scope of the concept.

Before delving into complex supply chain management, it is important to understand the underlying concepts of it starting with the definition of supply chain.

- **What is Supply chain?**

As defined by the APICS Dictionary supply chain is "the global network used to deliver products and services from raw materials to end customers through an engineered flow of information, physical distribution, and cash."

A supply chain involves various participants who perform a sequence of activities in moving physical goods or services from a point of origin to a point of consumption. A simple supply chain involves participants in the following order from upstream (toward the origin) to downstream (toward the ulti- mate consumer): source supplier, manufacturer, distributor, retailer, and customer. At each stage of the supply chain, the customers pay their suppliers for the goods and services received; consequently, funds flow upstream from the ultimate consumer to the original supplier. (Crandall, Crandall, & Chen, 2009, p. 3.4)

Figure 1: Basics Of Supply Chain (Source: Elaborated by the researcher)

- **Definition of supply chain management:**

According to Cooper, Lambert & Pagh (1997) SCM is: 'The integration of business processes from end user through original suppliers that provides products, services and information that add value for customers. '

This definition stresses the need for a broader understanding of the process concept, covering more than just the processes directly linked to the product and information flows.

Expanding the scope further, Handfield & Nichols (2002): 'Supply chain management (SCM) is the integration and management of supply chain organizations and activities through cooperative organizational relationships, effective business processes, and high levels of information sharing to create high-performing value systems that provide member organizations a sustainable competitive advantage.'

Furthermore, Christopher (2005) defined it as:' The management of upstream and downstream relationships with suppliers and customers to deliver superior customer value at less cost to the supply chain as a whole.'

This definition of SCM focuses on management of relationships as a means of achieving better results for all members of the supply chain, including customers. Christopher also claims that the term supply chain management is actually mismanaging. Demand chain management would be a better term and would stress the fact that the chain is driven by market forces and not by the supply side. Christopher further suggests that the word chain be replaced by network, because the supply chain is normally comprised of a complex network of players on both the vendor and the customer sides. In addition, the business' suppliers may often be customers and competitors in other scenarios. According to the Council of Supply Chain Management Professionals (CSCMP),

SCM encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all Logistics Management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and customers.

Additionally, Jespersen & Skjøtt-Larsen (2005) emphasized that: 'SCM is the management of relations and integrated processes across the supply chain that produces services and information that add value for the end customer. Business products.'

This definition contains several keywords. The first is relations, which is used here as the term for all activities linked with establishing, maintaining, and developing business relations with supply chain partners. The next keyword is integrated, defined as coordination across functional lines and legal corporate boundaries. The coordination may be organisational, for instance, in the form of crossorganisational teams and interfaces at many levels; system related, for instance, in the form of integrated information and communications systems, and EDI/Internet connections; or planning related, for instance, in the form of exchange of order data, inventory status, sales forecasts, production plans, and sales and marketing campaigns. Business processes is the third keyword, which is limited to the processes that are directly related to production of products, and services, and information. (Jespersen & Skjøtt-Larsen, 2005, p. 11.12.13)

From the above, we can conclude that the importance of supply chain management lies in :

1-Global competition and supply chain dependence

2-Profit optimization and fair distribution

3-Business sustainability through continuous profit improvement

4-Synchronization of product, information, and fund flows (Crandall, Crandall, & Chen, 2009, p. 5)

1.1.2 procurement Management:

Procurement is more, than just purchasing items; it serves as a tool, for securing the resources at an optimal cost to drive the success of the organization.

- **Procurement's process:**

The term procurement is widely used and familiar in everyday life of consumers, companies, and in literature. Alternative terms are purchasing, replenishment or supply which in the following are used synonymously. Procurement is defined as the totality of activities to provide a company with the goods it requires but does not produce itself (Darr, 2020, p. 11)

Every purchasing process is part of a company's value-added process and describes individual steps from the decision-making process of purchasing orders to handover of procured goods to the own production, i.e. the internal neighbors. The entirety of all process steps from buyer's decision-making process to receipt of procured goods is referred to as order cycle. It covers informational processes in purchasing and at suppliers and the logistical processes from suppliers to the purchasing company Overall, all following sub-steps can be distinguished in this order cycle (here for Make to Stock):

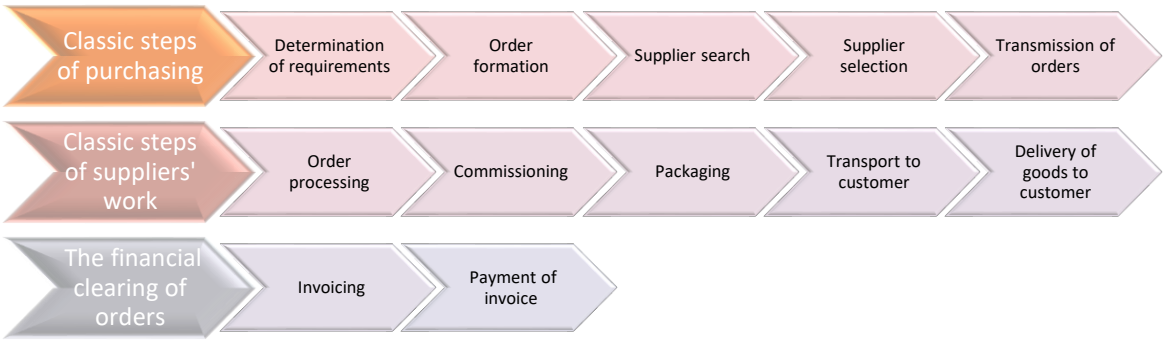

Figure 2 : Procurement Process (Source : Elaborated by the researcher)

Steps 1-5 are the classic steps of purchasing activities. Steps 6-10 are the classic steps of suppliers' work. Steps 11 and 12 relate to the financial clearing of orders. These steps are carried out for all purchasing activities between ordering and supplying companies. (Darr, 2020, p. 14.15.16)

- **Definition of Procurement management:**

There does not exist a single, universally accepted definitions of procurement management. This might seem to suggest it's a simple concept. However, according to Darr, (2020) Procurement management comprises the planning, controlling, and monitoring of all measures to make the required goods (required production material, operating supplies, capital goods, services and merchandise) available to the purchasing company in a suitable legal and factual form. Procurement management is part of enterprise management and must be coordinated with these other areas. It is divided into three main tasks:

■Supplier management: From whom are these external goods/services purchased?

■Material management: What and how much external goods/services are purchased?

■Management of the purchasing organization (procurement organization): Who organizes the external procurement?

This division into three main tasks allows to describe them clearly in detail. It is evident that these are also interdependent, and they must therefore be coordinated.

The supplier management directs all questions to purchasing partners (suppliers). This includes obtaining information about potential suppliers (market research), selecting and evaluating suppliers, establishing and maintaining relationships with suppliers, structuring the conduct of negotiations, managing risks posed by suppliers, and ensuring compliance to and with suppliers.

Material management refers to all questions concerning procurement goods. This includes, among other things, the determination of the goods to be procured, the determination of the procurement quantities, and the level of delivery service of procured goods and product

combinations (for example, assortments in retail).
The management of the procurement organization regards purchasing as an organizational unit, this includes, among other things, the structure of the purchasing organization, the requirements placed on purchasing staff, the planning and control systems used by Purchasing, and the forms of coordination between Purchasing and other organizational units of the own company or in the supply chain. (Darr, 2020, p. 7.8)

And from this, the importance of procurement management can be summarized as follows:

- Ensuring the availability of essential resources for a company's operations

- Optimizing costs and value.

- Procurement is a key component of overall enterprise management.

- Developments in the sales markets. (Darr, 2020)

1.1.3 The relationship between procurement and supply chain management:

Procurement and supply chain management (SCM) are closely linked but distinct functions within a business:

-Procurement strategies are generally created to respond to the needs of other internal organizations including supply chain management.

-the key to effective strategy for procurement is the proper alignment of procurement activity with the strategic plans of its internal customers and conditions in the supply base.

-Both procurement and supply chain management seek to balance cost and value.

The key to effective strategy for procurement is the proper alignment of procurement activity with the strategic plans of its internal customers and conditions in the supply base. (Sollish & Semanik, 2012). The table below details the relationship between procurement and supply chain:

Function	Procurement management	Supply chain management	Interconnectivity
Primary Function	Sourcing, acquiring goods and services	Flowing resources from source to customer	Procurement's choices directly impact supply chain efficiency
Objectives	Cost optimization, quality assurance, timely delivery	Efficiency, responsiveness, risk mitigation	Procurement strategies must align with broader supply chain goals
Activities	Supplier selection, negotiation, contracting, order management	Warehousing, transportation, logistics, distribution	Procurement decisions directly impact these activities
Planning	Commodity-specific strategies, aligning with internal customer needs	Holistic supply chain planning, factoring in procurement constraints	Effective collaboration is crucial for aligning short- and long-term plans
Technology	Procurement solutions for sourcing, negotiation, etc.	Supply chain management software for planning, tracking, visibility	Integration between systems is essential for data flow and decision-making

Table 2: The relationship between procurement and supply chain management (Source: Elaborated by the researcher)

1.2 Digital transformation:

The term "digital transformation" describes how a company's operations and value deliver are fundamentally altered by the integration of technologies into every facet of the business, but there has been a persistent confusion between digital transformation digitalization, and digitization, leading numerous scholars to offer definitions in order to rectify these terms. This section aims to describe digital transformation, its five domains and the technological taperstry of it.

1.2.1 definition of digital transformation:

In 2014, digital and business consultancy Altimeter defined digital transformation as" the realignment of, or new investment in, technology and business models to more effectively engage digital customers at every touchpoint in the customer experience lifecycle."

This definition acknowledges the shift required in not only technology but also business models and customer experience. Yet it perhaps does not emphasize enough the changes to processes, ways of working and culture.

So, bearing in mind Clay Christensen's way of summarizing the entire capabilities of an organization, according to Perkin & Abraham (2017) "The transformation and reinvention of the resources, priorities and processes of a company in order to be fit for purpose in a digitally empowered world." (Perkin & Abraham, 2017, p. 50.51)

While Zhang, Ye, Zhong, & Chen (2023) defined it as a process that aims to improve an entity by triggering significant changes to its properties through digital technologies.

From the soft aspect, digital transformation is more a managerial issue than a technical one. Successful digital transformation demands evolution or the creation of a business model that is precipitated by digital technologies. This paper defined digitaltransformation as the structural transformation of the enterprise development mode and the physical form that are driven by digital technologies and by data elements, covering field environmental monitoring, intelligent scheduling, material supervision, digital delivery, and other aspects. There are three stages for achieving digital transformation.

They are digitization, digitalization, and digital transformation. Digitization reflects the transformation of professions through computerization (e.g., the integration of digital technology with existing tasks). Digitalization describes the changes wrought in business processes by the implementation of digital technologies. Digital transformation describes the development of new business models. (Zhang, Ye, Zhong, & Chen, 2023, p. 2)

Brennan and Kreiss (2014) argue that any material with two differentiated states can store and communicate digitized signals. "This has motivated many scholars to highlight the "immaterial" (e.g. Manoff 2006) quality of information generated through digitization, while deemphasising the material systems (transistors) on which that information is housed."

On the other hand, Robert Machal talked about the "digitalization of society" with regards to the limitations and potential for computer-aided research. A digital business consultancy, I-SCOOP (2016), offers aconcise definition of digitalization. "Digitalization means the use of digital technologies and of data (digitized and natively digital) in order to create revenue, improve business, replace/transform business processes (not simply digitizing them) and create an environment for digital business, whereby digital information is at the core." (Schallmo & Williams, 2018, p. 5.6)

Features	Digitization	Digitalization	Digital Transformation
Goal	Converting analog to digital.	Enhancing processes with digital tech	Overall organizational change driven by digital
Scope	Individual tasks or artifacts	Processes and workflows	Business models, culture, and customer experience
Impact	Improved efficiency and accuracy	Increased competitiveness and agility	Fundamental change and disruption
Role	Creates digital representation of information	Uses digital tools to improve existing processes	Fundamentally redefines how an organization operates

Table 3: The difference between Digitization, Digitalization and Digital Transformation (Source : Elaborated by the researcher)

1.2.2 The five domains of digital transformation:

Five important strategy domains customers, competition, data, innovation, and value are changing as a result of digital dynamics.
Digital technologies are altering the norms by which businesses must operate to prosper and rethi nking many of the fundamental concepts of strategy across these five domains.

Customers: In traditional theory, customers were seen as aggregate actors to be marketed to and persuaded to buy. The prevailing model of mass markets focused on achieving efficiencies of scale through mass production (make one product to serve as many customers as possible) and mass communication (use a consistent message and medium to reach and persuade as many customers as possible at the same time).

In the digital age, we are moving to a world best described not by mass markets but by customer networks. In this paradigm, customers are dynamically connected and interacting in ways that are changing their relationships to business and to each other. Customers today are constantly connecting with and influencing each other and shaping business reputations and brands. Their use of digital tools is changing how they discover, evaluate, purchase, and use products and how they share, interact, and stay connected with brands. This is forcing businesses to rethink their traditional marketing funnel and reexamine their customers' path to purchase, which may skip from using social networks, search engines, mobile screens, or laptops, to walking into a store, to asking for customer service in a live online chat. Rather than seeing customers only as targets for selling, businesses need to recognize that a dynamic, networked customer may just be the best focus group, brand champion, or innovation partner they will ever find.

Competition: The second domain of digital transformation is competition: how businesses compete and cooperate with other firms. Traditionally, competition and cooperation were seen as binary opposites: businesses competed with rival businesses that looked very much like themselves, and they cooperated with supply chain partners who distributed their goods or provided needed inputs for their production.

Today, we are moving to a world of fluid industry boundaries, one where our biggest challengers may be asymmetric competitors—companies from outside our industry that look nothing like us but that offer competing value to our customers. Digital "disintermediation" is upending partnerships and supply chains—our longtime business partner may become our biggest competitor if that partner starts serving ourcustomers directly. At the same time, we may need to

cooperate with a direct rival due to interdependent business models or mutual challenges from outside our industry. Most importantly, digital technologies are supercharging the power of platform business models, which allow one business to create and capture enormous value by facilitating the interactions between other businesses or customers. The net result of these changes is a major shift in the locus of competition. Rather than a zero-sum battle between similar rivals, competition is increasingly a jockeying for influence between firms with very different business models, each seeking to gain more leverage in serving the ultimate consumer.

Data: The next domain of digital transformation is data: how businesses produce, manage, and utilize information. Traditionally, data was produced through a variety of planned measurements (from customer surveys to inventories) that were conducted within a business's own processes—manufacturing, operations, sales, marketing. The resulting data was used mainly for evaluating, forecasting, and decision making. By contrast, today we are faced with a data deluge. Most data available to businesses is not generated through any systematic planning like a market survey; instead, it is being generated in unprecedented quantities from every conversation, interaction, or process inside or outside these businesses. With social media, mobile devices, and sensors on every object in a company's supply chain, every business now has access to a river of unstructured data that is generated without planning and that can increasingly be utilized with new analytical tools. These "big data" tools allow firms to make new kinds of predictions, uncover unexpected patterns in business activity, and unlock new sources of value. Rather than being confined to the province of specific business intelligence units, data is becoming the lifeblood of every department and a strategic asset to be developed and deployed over time. Data is a vital part of how every business operates, differentiates itself in the market, and generates new value.

Innovation: The fourth domain of digital transformation is innovation: the process by which new ideas are developed, tested, and brought to the market by businesses. Traditionally, innovation was managed with a singular focus on the finished product. Because market testing was difficult and costly, most decisions on new innovations were based on the analysis and intuition of managers. The cost of failure was high, so avoiding failure was paramount. Today's start-ups have shown us that digital technologies can enable a very different approach to innovation, one based on continuous learning through rapid experimentation. As digital technologies make it easier and faster than ever to test ideas, we can gain market feedback from the very beginning of our innovation process, all the way through to launch, and even afterward. This new approach to innovation is focused on careful experiments and on minimum viable prototypes that maximize learning while minimizing cost. Assumptions are repeatedly tested, and design decisions are made based on validation by real customers. In this approach, products are developed iteratively through a process that saves time, reduces the cost of failures, and improves organizational learning.

Value: The final domain of digital transformation is the value a business delivers to its customers—its value proposition. Traditionally, a firm's value proposition was seen as fairly constant. Products may be updated, marketing campaigns refreshed, or operations improved, but the basic value a business offered to its customers was assumed to be constant and defined by its industry (e.g., car companies offer transportation, safety, comfort, and status, in varying degrees). A successful business was one that had a clear value proposition, found a point of market differentiation (e.g., price or branding), and focused on executing and delivering the best version of the same value proposition to its customers year after year.

In the digital age, relying on an unchanging value proposition is inviting challenge and eventual disruption by new competitors. Although industries will vary as to the exact timing and nature of their transformation by new technologies, those who assume it will be a little farther down the road are most likely to be run over. The only sure response to a shifting business environment is to

take a path of constant evolution, looking to every technology as a way to extend and improve our value proposition to our customers. Rather than waiting to adapt when change becomes a matter of life or death, businesses need to focus on seizing emerging opportunities, divesting from declining sources of advantage, and adapting early to stay ahead of the curve of change. (Rogers, 2016, p. 6.8.9.10)

Domain	From	To
Customers	-Customers as mass market. -Communications are broadcast to customers. -Firms is the key influencer. -Marketing to persuade purchase. -One-way value flows. -Economics of (firm) scale.	-Customers as dynamic network. -Communications are two-way. -Customers are the key influencer. -Marketing to inspire purchase, loyalty, advocacy. - Reciprocal value flows. -Economics of (customer) value.
Competition	-Competition whithin defined industries. -Clear distinctions between partners and rivals. -Competition is a zero-sum game. -Key assets are held inside the firm. -Products with unique features and benefits. -A few dominant competitors per category.	-Competition across fluid industries. -Blurred distinctions between partners and rivals. -Competitors cooperate in key areas. -Key assets reside in outside networks. -Platforms with partners who exchange value. -Winner-takes-all due to network effects.
Data	-Data is expensive to generate in firms. -Challenge of data is storing and managing it. -Firms make use only of structered data. -Data is managed in operational silos. -Data is a tool for optimizing processes.	-Data is continuously generated everywhere. -Challenge of data is turning it valuable information. -Unstructured data is increasingly usable and valuable. -Value of data is connecting it across silos. -Data is a key intangible asset for value creation.
Innovation	-Decisions made based on intuition and seniority. -Testing ideas is expensive, slow, and difficult. -Experiments conducted infrequently, by experts. -Challenge of innovation is to find the right solution. -Failure is avoided at all cost. -Focus is on the “finished” product.	-Decisions made based on testing and validating. -Testing ideas is cheap, fast, and easy. -Experiments conducted constanly, by everyone. -Challenge of innovation is to solve the right problem. -Failures are learned from, early and cheaply. -Focus is on minimum viable prototypes and iteration after launch.
Value	-Value proposition defined by industry. -Execute your current value proposition. -Optimize your business model as long as possible. -Judge change by how it impacts your current business. -Market success allows dor complacency.	-Value proposition defined by changing customer needs. -Uncover the next opportunity for customer value. -Envolve before you must, to stay ahead of curve. -Judge change by how it could create your next business. -“Only the paranoid survive”.

Table 4: Changes in strategic assumptions from Analog to digital age “Source: *(Rogers, 2016, p. 7)***”**

1.2.3 Technological Tapestry of Digital Transformation:

In recent years, technological advances in computing have included the cloud computing, analytics, artificial intelligence, blockchain, and robotics. Also, the emergence of the Internet of Things (IoT) and augmented reality (AR), where we can use data gathered from everyday devices, processing them into insights and predictions, has led organizations to think deeply about keeping pace with the growing technology due to the effects on consumers. (Khare, W. Baber, & Ishikura, 2020, p. 5).

Digital transformation tools can be broadly categorized into two types: Industry 4.0 which utilizes machines like industrial robots and AI for data-driven automation, while Industry 5.0 integrates digital twins and collaborative platforms to focus on human-machine harmony and sustainability.

Let's delve into some of the essential digital transformation technologies:

- **Internet of things:**

During the 1970s factory production systems began to adopt ideas from Computer Integrated Manufacturing (CIM), Just-in-Time (JIT) and Teory of Constraints (ToC). This evolved rapidly with various quality management fads as well as advances in computer processing, storage and Computer Graphics rendering in engineering CAD and CAM systems, together with the desire to connect with various enterprise and SCADA process control systems. The concept of Internet of Tings originated with the concept of “Ubiquitous Computing” at Palo Alto Research Center (PARC) by Mark Weiser, during the 1990s. Nearly ten years later, Kevin Ashton coined the term “Internet of Tings” (IoT), during the development of Radio Frequency ID (RFID) tagging and feedback loop optimization, for Proctor & Gamble’s supply chain management. By the early 21st century the fusion of these ideas enabled the customer to manage assets from the factory to their not just the production of goods, but also asset management from design, manufacturing through to delivery. The term IoT subsequently evolved and by 2014 (Skilton & Hovsepian, 2018, p. 10)

According to Gubbi, et al. (2013) the definition made by Kevin Ashton, in 1999, still is valid even though the usage of the technology has changed. It is defined as a computer’s possibility to sense information without any human interference. In other words, objects are automatically communicating directly to a computer. Noticeable is that what the computer does with the information is not included in the definition of IoT. (KARMEHAG & LÖFNERTZ, 2018, p. 22). IoTs describe a network of internet-connected devices that are able to collect and exchange data using their embedded sensors. The concept revolves around networks of data-gathering sensors from very different resources ranging from watches, autonomous cars, and thermostats to manufacturing facilities that process at edge or cloud depending on the business model; and in this way create value for the user, either corporate or consumer, and usually both. In every layer, a mixture of hardware, software and service components create a part of the value chain. (Ustundag & Cevikcan, 2018, p. 175)

- **Robotic process automation:**

In the 1990’s many companies were seeking cost reduction strategies in the form of labour arbitrage and as a result, many tasks were moved to low-cost countries in Asia, Eastern Europe and Latin America. Now that major companies from around the world have reaped the benefits of labour arbitrage, and system harmonization and process standardization has come to a reasonable level, automation of remaining tasks and processes is the new target. Companies take advantage of Robotic Process Automation in their back offices.

RPA enables companies to drastically improve cost effectiveness and quality improvements in their transactional processes.

A key advantage of Robotic Process Automation is that unlike previous IT transformations such as Enterprise Resource Planning (ERP's), RPA does not require a massive upfront investment or a significant change to the current IT systems and processes. In fact, RPA can be implemented relatively quickly when compared to previous digital transformations, as it requires minimal capital or infrastructure.

RPA can act as an additional employee that can work between the IT systems and with the back office processes in various functions. Similarly to humans, RPA can learn from people and copy their processes, eventually taking over the processes that humans once completed, at a much faster pace. Robotic Process Automation is going to continue to develop and work with increasingly complex processes and tasks. (Capgemini Consulting and Capgemini Business Service, 2016, p. 10)

- **Artificial Intelligence:**

According to Miller (2019), "artificial intelligence is the trigger for the emergence of Industrial Revolution (IR) 4.0 in the digital age. It enables the machine to learn and do tasks similar to humans".

Furthermore, Zhang et al. (2020) defined AI as a result of successfully leveraging big data and machine learning (ML) technology to comprehend the past and forecast the future using massive volumes of data" (Temitayo, et al., 2023). AI comprises a set of algorithms that make use of information – mainly in the form of data – to make decisions and carry out tasks, much like a human would. Of course, the emulation of human intelligence is not an easy task; as such, the AIs of today are rudimentary and specialized. Despite their shortcomings, though, these modern systems can be particularly good at the tasks they undertake, even better than humans. For example, an AI system, which is a standalone program implementing one or more AI algorithms, that is created for identifying words from speech, can be more accurate than humans doing the same task. It's important to note that all the AI systems we have today possess what is termed narrow artificial intelligence. This means that current AIs can do a limited set of tasks (or even just a single task) quite well but offer at best mediocre performance at any other task. For instance, an AI might be great at figuring out your age based on a headshot, but that same AI almost certainly couldn't tell a classical music piece from a pop song. Some AIs are designed to be used in robots, such as those designed for rescue missions, able to navigate various terrains. Other AIs are specialized in crunching data and facilitating various data analytics tasks. There are even AIs that emulate creative processes, like the AIs that generate artistic works, using the patterns they deduce from catalogs of existing work. Chatbots and other such AIs are focused solely on interacting with humans. The possibility of a more generalist AI (called Artificial Gen- eral Intelligence, or AGI) exists, but it may take a while before it can manifest, or before we are ready to integrate it into our world. Since all this may sound a bit abstract, let's clarify it a bit. If a system can make some decisions by capturing and analyzing signals related to the problem, that's an AI (sometimes termed "an AI system"). You've probably used an AI, even if you didn't know it. Online radios like Spotify and Pandora use AI to recommend songs, and virtual assistants (like Siri) use AI to help you troubleshoot. Factors that help us decide whether a system is AI include the system's sophistication, its versatility, and how able it is to perform complex tasks. Professor Alan Turing was the first to talk about this topic in a scientific manner. Upon studying this subject from both a theoretical and a practical perspective (through the creation of the first modern-day computer,

used to crack the Enigma code in World War II1), he envisioned machines that could think and reason much like humans. One of Professor Turing's most famous thought experiments is now named after him. The Turing test is a simple yet powerful heuristic for determining if a computer is advanced enough to manifest intelligence. This test involves taking either a human or a computer and concealing it with another human. Another human, known as the examiner, then asks each of them a series of questions, without knowing which is which. If the examiner cannot determine from the answers to these questions whether he is speaking with a human or a computer, then the computer is said to have passed the test. This simple test has remained a standard for AI, still adding value to related research in the field in various ways. (Voulgaris & Bulut, 2018, p. 1)

- **Big Data:**

Data is created constantly, and at an ever-increasing rate. Mobile phones, social media, imaging technologies to determine a medical diagnosis-all these and more create new data, and that must be stored somewhere for some purpose. Devices and sensors automatically generate diagnostic information that needs to be stored and processed in real time. Merely keeping up with this huge influx of data is difficult, but substantially more challenging is analyzing vast amounts of it, especially when it does not conform to traditional notions of data structure, to identify meaningful patterns and extract useful information. These challenges of the data deluge present the opportunity to transform business, government, science, and everyday life. Several industries have led the way in developing their ability to gather and exploit data:

• Credit card companies monitor every purchase their customers make and can identify fraudulent purchases with a high degree of accuracy using rules derived by processing billions of transactions.

• Mobile phone companies analyze subscribers' calling patterns to determine, for example, whether a caller's frequent contacts are on a rival network. If that rival network is offering an attractive promotion that might cause the subscriber to defect, the mobile phone company can proactively offer the subscriber an incentive to remain in her contract.

• For companies such as LinkedIn and Facebook, data itself is their primary product. The valuations of these companies are heavily derived from the data they gather and host, which contains more and more intrinsic value as the data grows.

Three attributes stand out as defining Big Data characteristics:

• Huge volume of data: Rather than thousands or millions of rows, Big Data can be billions of rows and millions of columns.

• Complexity of data types and structures: Big Data reflects the variety of new data sources, formats, and structures, including digital traces being left on the web and other digital repositories for subsequent analysis.

• Speed of new data creation and growth: Big Data can describe high velocity data, with rapid data ingestion and near real time analysis.

Although the volume of Big Data tends to attract the most attention, generally the variety and velocity of the data provide a more apt definition of Big Data. (Big Data is sometimes described as having 3 Vs: volume, variety, and velocity.) Due to its size or structure, Big Data cannot be efficiently analyzed using only traditional databases or methods. Big Data problems require new tools and technologies to store, manage, and realize the business benefit. These new tools and technologies enable creation, manipulation, and management of large datasets and the storage environments that house them. Another definition of Big Data comes from the McKinsey Global

report from 2011: 'Big Data is data whose scale, distribution, diversity, and/or timeliness require the use of new technical architectures and analytics to enable insights that unlock new sources of business value.' McKinsey's definition of Big Data implies that organizations will need new data architectures and analytic sandboxes, new tools, new analytical methods, and an integration of multiple skills into the new role of the data scientist. (Dietrich, Heller, & Yang, 2015, p. 2)

- **Blockchain:**

Satoshi Nakamoto is a name reference to an unknown person or group of people, who in 2008 created the frst reference implementation specifcation that theorized the design of a distributed database made of records called “blocks” or “blockchains”, each block of which contains a timestamp and is linked to previous block. A key feature is that data is distributed across the whole network of blocks making its almost impossible to attack, as a there is no central point that hackers might exploit, therefore the data stored in the blockchain is regarded to be incorruptible. (Skilton & Hovsepian, 2018, p. 49)

According to Gartner (2018), blockchain is defined as value exchange transactions, recorded in a distributed ledger, which are sequentially stored into blocks. Each block is linked to the previous block, which builds the chain. This creates an immutable peer-to-peer network, based on cryptography and consensus mechanisms. The blockchain network’s behaviour is possible to customise to suit different implementations. (KARMEHAG & LÖFNERTZ, 2018, p. 31). And It is not just a system for financial transactions but as a system for assurance of potentially any transactions that require ‘smart contracts” of exchange. Examples include:

- Utilities: Blockchain technology is used to develop smart digital grids that include consumers being able to buy and sell solar energy peer-to-peer P2P trading. Trials are already underway in business-to-business B2B energy trading using blockchain technology between Utility conglomerates and other utilities. Blockchain can also be used to authenticate and manage utility billing processes for Electric Vehicle charging stations. Tis together with smart contracts to manage cost savings across the utility industry.

- Healthcare: Blockchain could transform electronic patient records enabling interoperability between diferent providers and the patient and carer parties more efciently. It could also drive personal data management to enable personal records to be accessed and managed securely by the public.

- Land Registry: Land registry control could be automated through blockchain technology simplifying the processes of registration and governance.

- Real estate: Properties and exchange of sale could be managed through blockchain technology. (Skilton & Hovsepian, 2018, p. 51.52)

- **Cloud computing:**

Cloud services are applications or services offered by means of cloud computing. Therefore, by adopting cloud services, business managers are considering to take advantage of the economic benefits offered by maintaining parts of its IT resources and tasks by a cloud service provider. Nowadays, nearly all large software companies, such as Google, Microsoft, and Oracle, are providing cloud services. Besides, cloud computing has revolutionized the standard model of service provisioning, allowing delivery over the Internet of virtualized services that can scale up and down in terms of processing power and storage. Cloud computing also provides strong storage, computation, and distributed capability to support Big Data processing. In order to

achieve the full potential of Big Data, it is required to adopt both new data analysis algorithms and new approaches to handle the dramatic data growth and needs of massive scale analytics. As a result, one of the underlying advantages of deploying services on the cloud is the economy of scale. By using the cloud infrastructure, a service provider can offer better, cheaper, and more reliable services. The high-level architecture of the cloud computing business model is shown in Figure (3) The architecture depicts four levels of the stack: client layer, service layer, platform layer, and infrastructure layer. Service providers deploy their services (Software as a Service level (SaaS)) on a cloud computing environment that can be used or consumed by customers or other applications on the client layer. The consumption of the available services is formalized by a service level agreement (SLA) that is arranged between the customer and the provider of the service. In the SaaS level, the customers do not have control over the hardware- and softwarelevel configurations of the consumed service. In practice, the interaction between the customers and the service is limited to the service interface and customers' input parameters.

Alternatively, customers may also hire the second level of the stack (Platform as a Service (PaaS)), which is a development platform that facilitates the development of cloud services by the customers. This platform usually includes frameworks, developing and testing tools, configuration management, and abstraction of hardwarelevel resources. Lastly, customers can hire hardware-level resources available in the Infrastructure as a Service (IaaS) cloud. Virtualization is extensively used in IaaS cloud in order to integrate/decompose physical resources in an ad hoc manner to meet growing or shrinking resource demand from cloud consumers. Regardlessof the level of the cloud stack that is consumed by the customers, the consumed resources (either physical or virtual) are usually delivered using a predefined payper-use model.

A cloud database is a database that is hosted on a cloud computing environment. In practice, the access to a cloud database can be performed using a database management system (DBMS) that runs over a virtual machine or via a database service interface. In the latter case, usually named Database as a Service (DBaaS), the database installation, maintenance, and accessibility interface are provided by a database service provider. The adoption of DBaaS is an effective approach to cloudbased applications and services as part of the Software as a Service business model. Among the main characteristics of a DBaaS, there are cloud portability, scalability, and high availability. These characteristics are provided by using cloud computing capabilities, such as hardware provisioning and service redundancy. (Trovati, Hill, Anjum, Liu, & Zhu, 2015, p. 6.7)

Figure 3: High-level cloud computing stack "Source: *(Trovati, Hill, Anjum, Liu, & Zhu, 2015, p. 7)***"**

- **3D Printing:**

3D-printing as a concept is rather straightforward. A three-dimensional object is “printed” through iterations of adding layers of material, in the same way as a brick wall is built. The term additive manufacturing is often used interchangeably to 3D-printing.

The technique can be found in nature, as for example when seashells and sandstone are being produced. When sandstone erodes by rain or wind, material is subtracted from the object. In a similar way, 3D-printing often add more material than needed, why some have to be removed afterwards to form the object. The concept of 3D-printing is really nothing new, but a modern and digital adaption of nature’s own process. Gartner (2018) defines 3D-printing as an additive technique that uses a device to create physical objects from a digital model.

A modern 3D-printer starts off with a computer model of the object to be printed, in many cases CAD-files (Computer-Aided-Design). The model controls a robotic device that places the layers of the material accordingly. There are generally three methods of additive manufacturing: using powder, using a vat of liquid or using filament such as plastic.

The filament-version is the simplest one and this method only places material where it is needed. The powder-version can be used for more complex designs as well as metallic constructions. Current 3D-printing techniques take at least a few hours to print simple objects. (KARMEHAG & LÖFNERTZ, 2018, p. 37)

- **Augmented, mixed and virtual reality:**

Augmented reality (AR) is an alternate reality technology that provides an enhanced version of the real-world by overlaying our existing reality with an additional layer of digital information, which can be viewed through a (connected) technological device—such as smartphones or Augmented Reality Smart Glasses (ARSGs).

While Virtual reality (VR) is an alternate reality technology that is characterized by generating real-time, immersive and interactive multi-sensory experiences situated in, and artificially induced by, a responsive three-dimensional computer-generated virtual environment—usually paired with advanced input and output devices. (Jung & Dieck, 2019, p. 19)

In 1968, Ivan Sutherland with the help of his student, Bob Sproull, created the world’s frst virtual reality and augmented reality head-mounted display system (HMD), which he afectionately named the “Sword of Damocles” after an ode to the threat of power everywhere.

The notion of virtual worlds modelled by software as three-dimensional representations can be seen within the ideas of virtual reality (VR) that aim to immerse the human user in images, sounds and other data that represents the real physical environment or an imaginary setting.

By the 1980s the ideas of VR were becoming mainstream by pioneers such as the company VPL Research in 1984 by Jaron Lanier, a futurist who popularized Virtual Reality impact on Society and introduce early VR technol.ogy concepts. The 1990s saw the frst commercial VR headsets including Sega-VR, and Nintendo stereoscope 3D projection game “virtual boy” in the video gaming market. Full PC powered VR gaming and industrial usages followed in the 2000s and 2010s from medical imaging, advanced engineering design and simulation; digital building architecture and geospatial mapping systems (GIS). Today, VR technology provides complete immersive headsets, or stereoscopic glasses, for use in systems that can include fully render wall, foor, ceiling to complete 360-degree room with 4K photorealistic environments.

As for Mixed reality (MR) has now become the latest mainstream idea of blending physical and digital objects co-existing and interacting in real-time. Tis requires “digital twining” as a concept from Cyber-Physical Systems (CPS) that was frst defined as a term by Paul Milgram, Haruo Takemura, Akira Utsumi and Fumio Kishino from ATR Communications Systems Research Laboratories, Japan in 1994 as “Virtuality continuum” of combined physical and virtual reality (Skilton & Hovsepian, 2018, p. 38.39).

1.3 The contribution of Digital Transformation in Procurement and Supply Chain Management:

In order to survive in a modern business environment, enterprises have explored innovative technologies and business strategies to sustain a competitive advantage, as well as trying to build stronger relationships with suppliers and customers to improve quality and fexibility in meeting increasing requirements.

The linkage of firms with their suppliers will rely more on the supply chain, especially when product manufacturing is complicated and is heavily dependent on supply chains, such as in the automotive industry. Therefore, the unit of competition is moving from individual companies to supply chains. (Wu, 2019, p. 3.4)

In this section, the role of each technology in Supply Chain Management and Procurement will be explained. Additionally, the benefits of using these technologies will be discussed.

1.3.1 Digital technologies in “plan” and “source" processes:

Planning and sourcing are being transformed by the emergence of digital innovations and Tools such as business data analytics (BDA), digital twins, e-procurement, supplier collaboration portals.

Firstly, Digital technologies in planning processes It provides two basic examples BDA and Digital twins.

- **Big Data Analytics:**

BDA has been undoubtedly the most elaborated area of digital technologies application to SCM over the last decade. Johnson et al. (2016) and Simchi-Levi and Wu (2018) analyzed the application of BDA in retail. Retailers must continuously strive to grow their revenue, margins, and market share. One method for doing this is price optimization models, which calculate the variance of demand as price levels rise or fall, and then combine this information with the relevant cost and inventory data to recommend prices that could maximize revenue and profits. Nguyen et al. (2017) showed that optimization is the most popular approach in the prescriptive analytics application to logistics and transportation.

BDA applications to SCM can also be seen in procurement processes, manufacturing shop floors, promotion actions in the omnichannel model, routing optimization, real-time traffic operation monitoring, and proactive safety management Nguyen et al. (2017) identified some areas where BDA can be applied to SCM in the near future. These areas include quality control in manufacturing, dynamic vehicle routing, and in-transit inventory management in logistics/transportation, order picking, and inventory control systems in warehousing. Niesen et al. (2016) and Papadopoulos et al. (2017) pointed out that BDA can help in improving SC risk management and disaster-resistance. Kinra et al. (2017) analyzed computer aided textual analysis within BDA with applications to logistics transportation systems.

(Ivanov, Tsipoulanidis, & Schönberger, 2019, p. 494.495)

- **Digital twins :**

One objective of the principle of the digital twin is to identify product errors at an early stage, to learn about and improve the product, and to check the performance of the product during its usage. The digital twin can therefore be used for condition monitoring and constant assessment of the status of the good while it is in operation and when it collects the generated data.

In other words, the digital and the real product form the twins which exist in parallel from the early stage of the idea, throughout the design and production simulation or production planning, until the product is physically created and further during its usage, and until its maintenance and repair or until its removal from production. Thus, the digital twin has a huge potential for the improvement of engineering, manufacturing, and for maintenance processes. The insights generated throughout the entire product life cycle and the lessons learned from beginning to end help companies to continuously improve their products and to offer additional services Siemens (2017) summarized the characteristics of the digital twin in the following way: “The digital twin is the epitome of the digitalization of plants and machinery— the virtual copy of a real machine or system. And the twin is indeed increasingly proving that it can help ensure optimized machine design, efficient commissioning, short changeover times, and smooth operation.” This means that the digital twin provides valuable inputs for the creation of the next generation of the product and the concept of the digital twin offers the potential for new business models or services that are, for example, based on BDA . (Ivanov, Tsipoulanidis, & Schönberger, 2019, p. 496)

Beyond the planning insights, several digital tools directly empower sourcing processes:

- **eProcurement:**

E-catalogues, e-invoicing, or e-auctions can facilitate sourcing activities. Not new, but still valid is the fact that eProcurement is a core process within eSCM since it uses Internet Technology (IT) to facilitate purchasing processes.

eProcurement supports companies in improving transparency concerning the supplier base, negotiations, the alignment within the company, or supporting cost-intensive and long-lasting sourcing tasks through a better information exchange. Furthermore, information technology helps to obtain more accurate, fast, and up-to-date information regarding customer needs and business processes. It also provides an overview on market changes and supports better planning, coordination, and controlling. Importantly, information technology better connects companies, suppliers, and customers and at the same time provides early warning indications. To sum up, eProcurement helps companies to reduce costs, increase sourcing security, reduce sourcing throughput times, increase flexibility and quality, and improve the relationship between the involved parties. In addition to the aforementioned factors, Chopra and Meindl saw the following aspects as important trends that will impact IT in SCM: The growth in software as a service (SaaS); Increased availability of real-time data; and Increased use of mobile technology.

They also stated that “the increased use of mobile technology coupled with realtime information offers some supply chains an opportunity to better match demand to supply using differential pricing. (Ivanov, Tsipoulanidis, & Schönberger, 2019, p. 497)

- **Supplier Collaboration portals:**

SCPs are successful solutions for efficiently connecting suppliers, service providers, and customers via a platform that supports transparent supplier processes.

Generally, a SCP supports the management processes via a steering cockpit. This serves the forecasting, planning, and monitoring of the value adding activities and provides transparency and visibility of SCM activities. Furthermore, the project management processes during product development [advanced product quality planning (APQP)] can be managed to secure the smooth start of the project. The fundamental sourcing processes [e.g., quotation requests (RFQ)] are supported by the platform to provide production (status of goods received, on-time availability of materials) with the necessary materials. Delivery [dispatch and advanced shipment notification (ASN)] of the items is handled via the SCP.

To manage SC performance, the related key performance indicators (KPIs) are tracked and allow the SCM manager to identify deviations or problems and take corrective actions. The SCP can be seen as a repository of data and information, so that processes can also be analyzed retrospectively. Overall, the SCP helps to connect the involved parties in SCM in real-time and to improve the transparent flow of information, SCM visibility, and to enable collaboration using "what-if" scenarios for better decision making. The portals also support flexibility and proactivity, leading to improved SCM performance. (Ivanov, Tsipoulanidis, & Schönberger, 2019, p. 498.499)

- **Blockchain:**

The Blockchain is a technology that cannot be manipulated. Participating organizations benefit from high visibility through a secure data sharing mechanism, enabling them to plan with a greater certainty. Blockchains store the data about the location of assets at any point in time, the ownership or the custodianship of assets, and their transactional status.

The Blockchain, a relatively simple technology, is expected to be used extensively in sourcing processes, e.g., for contract management, archiving of customs documents, certificates at deliveries, or for patent management. Contracts in SCs often involve multi-party agreements, with regulatory and logistical constraints. Further complexities may arise from operations in different jurisdictions, as well as dynamic features embedded in the contracts. The flow of information in an SC plays a critical role in the efficiency of the operations. Regulatory processes (e.g., customs) can be expedited using Blockchain by improving confidence in documentations. This, in turn, can result in reductions in wastage, risk and insurance premiums. (Ivanov, Tsipoulanidis, & Schönberger, 2019, p. 500)

- **Robotic Process Automation and Artificial Intelligence:**

Generally, repetitive, or administrative tasks can be automated in procurement. This could be clerical activities in classical direct, as well as indirect, procurement. Processes in indirect procurement should also be assessed with regards to their potential to be electronically supported, which might reduce uncoordinated purchasing. Often the purchasing of indirect materials (such as buying external maintenance or repair services, travel booking, sourcing of office furniture, or buying indirect materials like office supplies etc.) can be digitalized or automated. The transaction costs for indirect materials are generally high, because of the difficulty of selecting goods: the requests are more randomly placed, and firms do not have one system for indirect materials.

When individual procurement activities are done by departments in isolation, i.e. without a structured approach, it is referred to as maverick buying; a huge potential is expected if maverick buying can be limited by appropriate technology. (Ivanov, Tsipoulanidis, & Schönberger, 2019, p. 501)

Additionally, these technologies, along with new sourcing technologies aimed at achieving excellence in procurement, are considered to have significant future potential. Digitalization is likely to be the key success factor for efficient task sourcing. The following digital technologies are particularly relevant for sourcing.

• **Augmented Reality** (e.g. to be used for the visit of suppliers)

• **Data and Text Mining** helps to analyze texts and data using algorithms.

• **Digital Data Management** recognizes mistakes and errors, sorts, and excludes inactive datasets.

• **Enhanced Procurement Platforms** can be used for the sourcing processes of personnel or technical services.

• **Identification of Sourcing Synergies** using software or artificial intelligence

• **Artificial Intelligence** for the imitation of human interfaces within the sourcing processes (e.g. for the reading, analysis, and evaluation of PDFs or Excel-Tables)

• **SCM Security** Rating as assessed and evaluated by artificial intelligence

• **Smart-Contracts** to support automated contract adjustments in case of changing parameters (Ivanov, Tsipoulanidis, & Schönberger, 2019, p. 499)

1.3.2 Digital Technology in “Make” Processes:

These technologies focus on physical value-adding processes but can also be applied to other areas of supply chain management (SCM), even outside technologically advanced environments.

- **3D Printing and Additive Manufacturing:**

Khajavi et al. (2014), Holmström and Gutowski (2017), Feldmann and Pumpe (2017), Li et al. (2017) described the applications of AM to operations and SCM.’ Those applications reach from spare part logistics to redesigning global SC production and sourcing strategies. The core of AM applications to SCM is the use of 3D printers at different stages in the SC to increase manufacturing flexibility, achieve shorter lead times, increase product individualization, and reduce inventory The advantages of such a project are numerous. Storage of finished goods becomes less important and even unnecessary since the Speedfactory, which is local and fast, can produce the exact number of shoes that is actually sold. In addition, personalized models can be delivered much more easily and quickly to customers because of the short distances. Another economic advantage of the Speedfactory is an increase in efficiency because of the ongoing work of the machines. It is important to mention that AM allows the creation of structures in ways which were never possible using traditional production techniques. Furthermore, AM allows the simplification of structures to create completely new component geometries, reduce the number of parts, and combine multiple parts into one. AM also is a key technology for reducing the weight of the components through geometry, which also helps to reduce the amount of material needed. (Ivanov, Tsipoulanidis, & Schönberger, 2019, p. 502.503)

- **Virtual Reality and Augmented Reality:**

The user enters this virtual environment be either wearing VR-glasses or similar devices like a head-mounted display. In the industrial environment and often in the early stages of product development, the user enters a 3D cinema which is a so called CAVE.

The CAVE is used when products are designed and the engineers, planners, and operators want to assess functionalities, tolerances, and accessibility or even check assembly processes. The CAVE is used for example in the automotive, railway, aircraft or turbine industries. VR-glasses are used for training purposes for logistical processes. The operator wears the VR-glasses and carries hand-held controlling devices. What is shown through the glasses is a completely virtual world, and the user can practice picking and kitting processes.

AR is already being used in production today, where operating instructions are displayed in the logical sequence of the assembly processes or to enhance maintenance processes, where a service operator receives instructions about what to replace in which sequence by looking at the defective component. AR is also used within logistical processes, where the pick worker or forklift truck driver receives enhanced information by looking through a device (like an AR glass) which shows which shelf to pick for which item in which quantity. The expression “smart glasses” is used for an AR device that is worn like a pair of eye glasses. In the medical field, AR is used to educate future medical doctors for surgery, for example. For SCOM, the technology of Augmented Reality surely contributes to the generation of competitive advantage while value adding transformation processes take place. (Ivanov, Tsipoulanidis, & Schönberger, 2019, p. 504.505)

- **Robots:**

According to Robot Institute of America “A robot is a reprogrammable, multifunctional manipulator designed to move material, parts, tools, or specialized devices through various programmed motions for the performance of a variety of tasks”

A typical and classical example is the production and assembly robot. The robots integrate strength and flexibility to assist in production sites for electronics, metal and machinery, rubber and plastics, food and beverage industries as well as the pharmaceutical and cosmetics industry. Historically very these robots are fixed and immobile installations, but in the future moving robots in the shape of snakes or spiders will be developed, so they can be very flexibly used, e.g. a crawling robot to conduct welding processes in aircraft production.

Another example is the assisting robot in a car garage. Such a robot would bring wheels, bolts, and tools to the operator. The non-value adding and heavy work of searching, motion and movement, bringing, and lifting is done by the machine, while the value adding tasks of positioning, fitting, fixing, and checking are performed by the skilled operator who can perform the task under much better and more ergonomic working conditions. (Ivanov, Tsipoulanidis, & Schönberger, 2019, p. 505.506)

1.2.3 Digital Technology in “Delivery” Processes:

By leveraging digital technology and data analytics, companies can use tracking and analytics to optimize their processes. However, it can be a burden to accept returns. This section will examine technologies in delivery processes.

- **Drones or Unmanned Aerial Vehicles:**

A drone is a flying robot, or an unmanned airplane or aircraft that can be remotely controlled or reach a destination autonomously under using software, known geographic coordinates, embedded sensors, and GPS data. Formally, drones are unmanned aerial vehicles (UAV) or unmanned aircraft systems (UAS). With regards to SCOM, drones can also be used for the transportation of goods and packages. This might be to deliver goods to areas that are difficult to reach and to ship ordered packages to customers to secure last-mile delivery. In 2017, drones were

tested by UPS to carry packages from the delivery truck to the house of the customer. Amazon tested the delivery of their goods from a flying warehouse to the customers by drone.

Drones can also assist in conducting cycle counting or checking inventory. For this, the flying robots are equipped with an RFID reading device.

- **Smart Driverless Transportation Systems:**

Driverless transportation systems (DTS) are mainly used in intralogistics and the warehousing. Such DTS increase safety during loading and unloading of materials and finished goods. These devices assist operators in every step from goods receipt and storage to order picking and preparation for shipment. In addition to the classical driverless transportation devices have been used decades, smart features are related to their precise positioning, guiding, route optimization, machine diagnostics, or real-time condition or loading monitoring abilities. DTS can operate individually or be coupled and connected. (Ivanov, Tsipoulanidis, & Schönberger, 2019, p. 508)

- **Smart Forklifts, Pallet Movers, and Cranes:**

Using a communication technology, the control system assigns certain pick orders and sends them to the closest forklift, which can then be maneuvered by the operator.

In the case of fully automated, or smart, forklifts, the operations are performed completely autonomously, i.e. without an operator. The Auto Pallet Movers (APM) are examples of such smart forklifts. In principle, they are an automated, reliable, and efficient solution for vertical order picking.

According to the producer Jungheinrich, their APM ERC215a has a lifting capacity of 1.5 tons. APMs contribute to eliminating errors in picking and improved safety. Smart cranes have a broad set of applications, ranging from large warehouses to ports, yards, and the (un-) loading of various heavy freights. Examples for the use of (smart) cranes are related to the movement of steel coils or for paper roll handling.

However, they are also used in shipbuilding, train production, and container handling, i.e. in metals processing. (Ivanov, Tsipoulanidis, & Schönberger, 2019, p. 509).

Conclusion of the first Chapter:

The first chapter, titled "Theoretical Framework," lays the groundwork for understanding the relationship between digital transformation and procurement and supply chain management. It begins by establishing the core concepts of both procurement and supply chain management, highlighting their essential elements and their interconnectedness. Following this foundation, the chapter dives into the concept of digital transformation, defining it and outlining the five key domains it encompasses (customer, competition, data, innovation and value) . It then delves into the technological aspects that weave together this digital transformation tapestry like big data, internet of things, Robotics and Ai.

Finally, the chapter explores how digital transformation specifically contributes to advancements in procurement and supply chain management, examining how digital technologies can be leveraged throughout the various stages of these processes, including planning (big data and digital twins), sourcing (eprocurement, Supplier Collaboration portals, blockchain, robotic process and AI), making (3d printing, robots , AR and VR), and delivery (Smart Driverless Transportation Systems, Drones, Smart Forklifts, Pallet Movers, and Crane.

The next chapter will examine real-world data from three companies: Naftal fuel branch -Tiaret-, Algeria Telecom -Tiaret-, ETUS Tiaret and Sonelgaz -Tiaret-.

1. Practical part:

The practical part of this thesis is necessary to prove the hypotheses. By carefully examining real-world data and case studies, this chapter provides strong evidence on the topic. Using specific methods developed for the research questions, the study aims to reveal patterns, relationships and causal mechanisms that explain the role of digital transformation in procurement and supply chain management.

This chapter is structered into three sections.

2.1 Methodology

2.1.1 Research Design

2.1.2 Data Collection

2.1.3 Data Analysis

2.2 Empirical Findings

2.2.1 Naftal Fuel Branch Tiaret 614

2.2.2 Algeria Telecom - Tiaret-

2.2.3 The Urban and Suburban Transport Public Company

2.2.4 Sonelgaz Tiaret

2.3 Analysis/Discussion

2.3.1 Digitizing the company supply chain for transformative growth

2.3.2 E-Procurement Adoption and Perceived Benefits

2.3.3 Unlocking value through transformation

2.1 Methodology:

In this section we will explain the methodology of this research by providing a detailed roadmap of the research design, data collection, and analysis methods employed to address the research questions.

2.1.1 Research Design:

The research design strategies of this study include the descriptive research, qualitative, and case study approach to explore the role of digital transformation in Procurement and Supply Chain Management.

Descriptive research:

The object of descriptive research is 'to portray an accurate profile of persons, events or situations'. This may be an extension of, or a forerunner to, a piece of exploratory research or a piece of explanatory research. It is necessary to have a clear picture of the phenomena on which you wish to collect data prior to the collection of the data.

Description in management and business research has a very clear place. However, it should be thought of as a means to an end rather than an end in itself. (Saundres, Lewis, & Thornhill, 2007, p. 134)

This study uses descriptive research to investigate the role of digital transformation in procurement and supply chain management through Three selected companies. The purpose of this design is to provide a comprehensive view of the current digital technologies and its role in different parts of the supply chain process.

Qualitative Approach:

This study uses a qualitative approach focusing on semi-structured interviews. Qualitative methods allow us to stay close to the empirical world.

They are designed to ensure a close fit between the data and what people actually say and do. By observing people in their everyday lives, listening to them talk about what is on their minds, and looking at the documents they produce, the qualitative researcher obtains firsthand knowledge of social life unfiltered through operational definitions or rating scales. (Taylor, Bogdan, & Devault, 2016, p. 10)

This approach enables for gathering rich and detailed information from participants about their experiences of digital transformation in their specific roles in the supply chain through qualitative analysis.

According to Gorbin & Strauss (2008): "Qualitative analysis is A process of examining and interpreting data in order to elicit meaning, gain understanding, and develop empirical knowledge". (Gorbin & Strauss, 2008, p. 47)

Case Study Approach:

Case study research shares many characteristics with other forms of qualitative research, such as narrative, oral history, life history, ethnography, in-depth interview, and observational studies that utilize qualitative methods. However, its focus, purpose, and origins, in educational research at least, are a little different. The focus is clearly the study of the singular. The purpose is to portray an in-depth view of the quality and complexity of social/educational programs or policies as they are implemented in specific sociopolitical contexts. What makes it qualitative is its emphasis on subjective ways of knowing, particlarly the experiential, practical, and presentational rather than the propositional to comprehend and communicate what transpired in the case. (Leavy, 2014, p. 458)

This research applies a multiple-case study approach to examine the digital transformation role in procurement and supply chain management.

This approach allows for detailed analysis of four companies, enabling a nuanced understanding of how digital transformation is changing traditional procurement and SCM.

2.1.2 Data Collection:

Data collection describes the nature of the data you will collect and your recording methods. Participant observers generally record their data as field notes; interviewers prepare transcripts based on either tape recordings or notes taken during the interviews. (Taylor, Bogdan, & Devault, 2016)

In this study we will collect data through semi-structured interviews, according to Monette et al. (1986), “an interview involves an interviewer reading questions to respondents and recording their answers”.

In addition, Burns (1997) defined it as “a verbal interchange, often face to face, though the telephone may be used, in which an interviewer tries to elicit information, beliefs or opinions from another person”. Any person-to-person interaction, either face to face or otherwise, between two or more individuals with a specific purpose in mind is called an interview. (Kumar, 2011, p. 137)

Whereby interviewes interviews may be categorised as one of:

- structured interviews;
- semi-structured interviews;
- unstructured or in-depth interviews.

In semi-structured interviews we will have a list of themes and questions to be covered, although these may vary from interview to interview. This means that we may omit some questions in particular interviews, given a specific organisational context that is encountered in relation to the research topic. The order of questions may also be varied depending on the flow of the conversation. On the other hand, additional questions may be required to explore our research question and objectives given the nature of events within particular organisations. (Saundres, Lewis, & Thornhill, 2007)

Interview Protocol Development:

A semi-structured interview protocol will be developed to ensure a smooth and efficient interview process for all participants, we developed detailed interview protocols. These protocols included:

Background Information:

A brief overview of the research topic was provided to familiarize interviewees with the context of the interview.

Scheduling Flexibility:

Interviewees were offered options regarding the interview time and platform (e.g., phone, video call) to accommodate their preferences.

Preliminary Questions:

Protocol will include key questions related to:

* The current state of digital transformation within the company's procurement and supply chain functions.

* Digital technologies implemented in the company (e.g., cloud computing, AI, blockchain).

* Benifits associated with digital transformation in these areas.

Data collection process:

The following describes the data collection process, including sampling method and data collection procedures.

Sampling:

Sampling is the process of selecting a few (a sample) from a bigger group (the sampling population) to become the basis for estimating or predicting the prevalence of an unknown piece of information, situation or outcome regarding the bigger group and a sample is a subgroup of the population you are interested in. (Kumar, 2011, p. 177)

For this study, key participants were selected from each chosen company, representing different functional departments such as procurement, inventory, and sales. The following table presents the number of interviews conducted per company:

Company	Naftal	Algeria Telecom	Etus Tiaret	**Sonelgaz Tiaret**
Sample Size	**6**	**4**	**3**	**3**
Total	**16**			

Table 5: Sample size number (Source: Elaborated by the researcher)

Data Collection Procedures:

A semi-structured interviews will be conducted with each participant following informed consent procedures. Interviews will be recorded with permission and transcribed verbatim for further analysis.

Operationalisation :

To understand the role of digital transformation on procurement and supply chain management practices, we will explore various aspects categorized in the following table:

Sub-themes	Description	Questions
A. **Respondent Information**	Confirmation of job title.	Q1
B. **Current state of digital transformation**	Exusting level of digital transformtion in each stage of supply chain.	Q2
C. **Implementation of digital technologies in supply chain stages**	Specific digital technologies adopted by the company.	Q3, Q4, Q5, Q6
D. **Benifits**	Adventages associated with digital transformation in each stage of supply chain.	Q7, Q8, Q9, Q10
E. **Future outlook**	Preceptions on the future of digital transformation in each stage in supply chain.	Q11

Table 6: Operationalisation Table (Source: Elaborated by the researcher)

Ethical considerations :

Ethics refers to the appropriateness of your behaviour in relation to the rights of those who become the subject of your work, or are affected by it. Blumberg et al. (2005:92) define ethics as the 'moral principles, norms or standards of behaviour that guide moral choices about our behaviour and our relationships with others'. Research ethics therefore relates to questions about how we formulate and clarify our research topic, design our research and gain access, collect data, process and store our data, analyse data and write up our research findings in a moral and responsible way. (Saundres, Lewis, & Thornhill, 2007, p. 178)

Ensuring ethical treatment was a top priority throughout this study.

We secured informed consent from all participants prior to conducting interviews, affirming their understanding and voluntary engagement.

Furthermore, we will safeguard the privacy of participants by maintaining anonymity and confidentiality of their responses throughout the entire research process, including the final reporting of the findings.

2.1.3 Data Analysis:

Thematic analysis is chosen for this study because it allows us to:

- Identify and examine recurring patterns in the context of the research question.

- Draw meaningful conclusions from the data (Haque, Koohi, & Waqar, 2023)

This method allows for capturing the participants' perspectives on the role of digital transformation in their specific supply chain roles.

Thematic analysis can be inductive or deductive; so, for this study, thematic analytic induction will be chosen it consists of six phases as shown in figure (4)

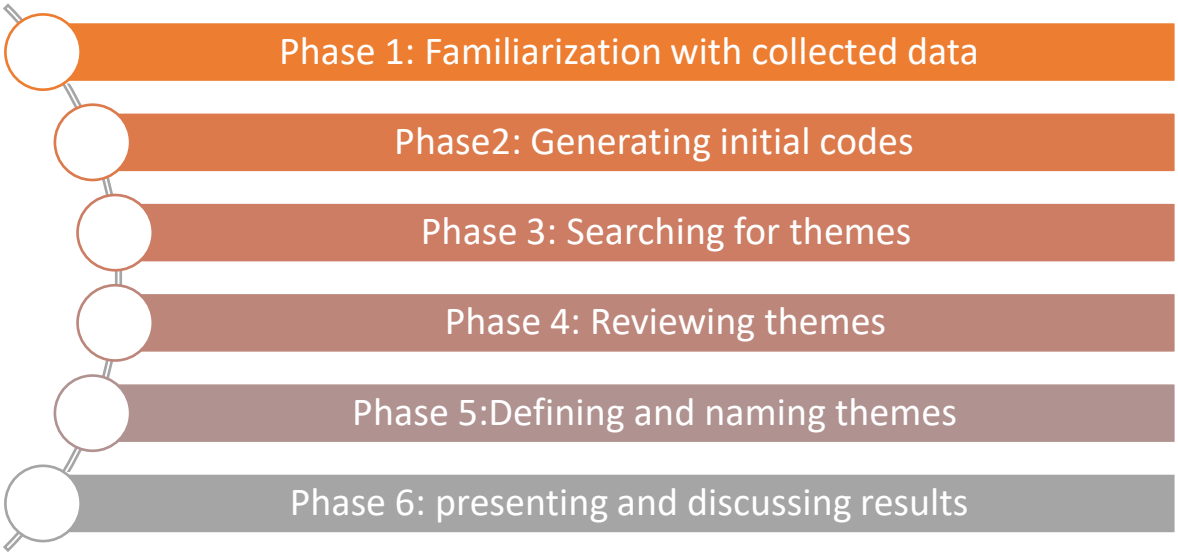

Figure 4: Thematic Analysis Steps "Source: *(Haque, Koohi, & Waqar, 2023, p. 20)*"

Coding:

Once the interview transcripts are finalized, the next step is coding.

In qualitative research, coding is a way of developing and refining inter-pretations of the data. The coding process involves bringing together and analyzing all the data bearing on major themes, ideas, concepts, interpretations, and propositions. It provides a way of storing data so that they are easily retrieved as the researcher works out analysis and later presents them, with appropriate supporting material (Taylor, Bogdan, & Devault, 2016)in this study we used :

Open Coding (Initial coding):

Open coding is the first stage of coding and usu-ally involves close scrutiny of data. If the data are in the form of written documentation or verbatim or near-verbatim interview transcripts, then this may be done line-by-line or even word-by-word. The idea is to capture certain key aspects of the data, reducing the complexity by providing a smaller number of more abstract terms. (Leavy, 2014, p. 130)

Axial Coding:

which involves finding patterns in the data by comparing coding categories within and across cases (e.g., different accounts of the same incident by different participants, different points in time for a single participant), relating larger categories to subcategories, and establishing connections between categories. (mackey & Gass, 2012, p. 191)

Selective Coding:

Lastly, under this conception and stage of coding, researchers will be ensuring their final and significant categories according to the primary research concepts providing and defining the relationship between them and making connections to the research questions and dynamic capabilities theory (Haque, Koohi, & Waqar, 2023, p. 21.22)

Stage	Coding	Description
Open Coding	Breack down interview details.	This is where we take interview answers and turn them into smaller ideas. For example, someone might say "The online system makes requesting supplies faster," which gets coded as "**Faster request process**".
Open Coding	Find more ideas.	We keep looking for new ideas in the interviews. Maybe someone mentioned "Automatic approvals mean purchase orders don't get stuck," which gets coded as "**Automatic purchase order approvals**"
Axial Coding	Connect the ideas.	Now we see how these smaller ideas fit together. Both faster requests and automatic approvals contribute to a bigger idea: "**Improved efficiency in E-procurement workflows**"
Axial Coding	Dig deeper into the big idea.	Explore how this idea affects other aspects. Efficiency in e-procurement means "**Increased employee productivity**".
Selective Coding	Find the main idea.	Finally, we pick the most important idea that explains all the changes. In this case, it might be "**Digital tools improve procurement in companies** ".

Table 7: Coding Examples (Source: Elaborated by the researcher)

2.2 Empirical Findings:

This section presents relevant data obtained from interviews with representatives of Naftal Fuel Branch Tiaret, Algeria Telecom, ETUS Tiaret, and Sonelgaz Tiaret.

2.2.1 Naftal Fuel Branch Tiaret 614:

Naftal, Algeria's national company for distributing petroleum products, operates as a commercial enterprise, It sells gas and LPG and has three branches: a commercial branch, a fuel branch, and a gas branch.

Naftal operates in a variety of sectors, including:

- LPG bottling: Naftal fills and distributes LPG cylinders for domestic and commercial use.

- Bitumen formulation: Naftal produces and supplies bitumen for road construction and other applications.

- **Distribution, storage, and marketing of fuels, LPG, lubricants, bitumen, tires, LPG/fuel, and special products:** Naftal has a nationwide network of depots and service stations that distribute a wide range of petroleum products to consumers and businesses.

- Transportation of petroleum products: Naftal utilizes various modes of transportation to ensure the availability of products throughout the country:

* Coastal shipping and pipelines: These are used to supply depots from refineries.

* Rail: This is used to transport products from depots to storage facilities.

* Road: This is used to deliver products to customers and to supply depots that are not serviced by rail.

Naftal's Transportation Network: Naftal's transportation network plays a vital role in ensuring the smooth supply of petroleum products to its customers. The company's fleet of trucks, tankers, and barges covers all parts of Algeria, ensuring that products are always within reach of consumers and businesses.

Naftal's commitment to efficient and reliable transportation has made it a leading provider of petroleum products in Algeria. The company's extensive network and experienced personnel ensure that customers receive their products on time and in good condition. (Naftal, s.d.)

A case study of the digital transformation of the procurement and supply chain management was in the fuel branch of Tiaret 614.

To gain a comprehensive understanding of the digital transformation tools in supply chain from procurement to delivery, interviews were conducted with six employees from the information systems, finance, and Trade departments.

1. Procurement Stage:

Naftal utilizes the SDCOM system to automate various processes, such as purchase requests and contract management.

This system enables Naftal to reduce risks, improve product and service quality, and streamline procurement operations.

2. Inventory Stage:

Naftal leverages the SDCOM system to ensure efficient inventory management throughout its supply chain. This system enables Naftal to improve inventory levels, and ensuring they have enough product to meet customer demand.

3. Financial Stage:

NAFT COMPTA and SDCOM systems are used to manage accounting and finance as the interviewee said: “In accounting and finance, we take information from SDCOM about purchases, transfers and put it in NAFT COMPTA, which performs accounting operations automatically." This reduces manual data entry errors, and streamlines financial operations, saving times and resources.

3. Distribution and Delivery Stage:

Naftal uses mobile application “Naftal KHADAMAT”, Naftal Card to improve clients service.

Naftal khadamat:

It is used to provide customers with product information for example, if a customer needs fuel, he will use this application which show the nearest fuel station to him.

This application enables Naftal to improve customer service, increase engagement, and build brand loyalty.

Naftal card:

A platform for information about e-payment cards, Naftal has launched a smart card for electronic fuel payments at its service stations. This electronic card is currently intended for corporate managers, with plans to expand its use in the future. However, topping up the cards' balance is not possible remotely and must be done in person at Naftal offices by presenting a check.

And for delivery GPS tracking systems are used to track the location of vehicles transporting products to customers. These systems enable Naftal to improve delivery efficiency and reduce delivery times.

By using these digital transformation tools, Naftal can streamline its operations, improve efficiency, and enhance customer satisfaction throughout the supply chain and its supporting function. An interviewee explained: "We use a platform in each department. If we combine these platforms into a single platform, it will be ERP, which may be implemented in the future.”

Stage	Tool	Role
Procurement	SDCOM system	Manages supplier relationships, procurement processes, and sales activities.
Inventory	SDCOM system	Ensure efficient inventory management, improve inventory levels, and enhance customer service.
Distribution	Naftal Khadamat	Provides customers with product information.
Delivery	GPS tracking system	Tracks delivery vehicles and improves efficiency.

Table 8: Naftal's Digital tools (Source: Elaborated by the researcher)

2.2.2 Algeria Telecom -Tiaret- :

Algeria Telecom is a major telecommunications company providing various services including internet, fixed-line, and mobile communications. (Algérie Télécom, s.d.)

Interviews were conducted with four employees from the procurement, information systems, sales, and finance departments to gather information about the technologies employed by Algeria Telecom.

1. Procurement Phase:

Algeria Telecom uses Oracle's procurement management platform to automate various processes, such as purchase requests and contract management.

This automation streamlines procurement operations, improves efficiency, and enhances transparency.

2. Inventory Phase:

Algeria Telecom uses Oracle's inventory management platform to effectively track Inventory levels and optimize storage operations.

The information is centralized on the oracle platform, allowing for better coordination like an interviewee explained "Information passes through several departments, and all of it is recorded on the Oracle platform."

3. Finance Phase:

Oracle's platform is also utilized in the finance phase, enabling the automatic retrieval of financial data. This automation streamlines financial processes and reduces manual data entry errors. As an interviewee said: "All the operations we need in finance are performed automatically through the Oracle platform, which helps us avoid errors."

4. Distribution Phase:

Algeria Telecom uses mobile application “myidoom” and “idoom market platform

- Myidoom e-Payment Application:

Algeria Telecom uses Myidoom e-payment application to empower its customers with secure and convenient online payment options for their purchases. This e-payment solution streamlines the payment process, and enhances customer experience. As stated by an interviewee:” The percentage of e-paiment is increasing every month, more and more customers are using our application, this shift to digital payments is streamlining customer service by saving both time and money.”

This application integrates several Algeria telecom services such as:

Customer Area: Access your personal account and manage your services.

E-Payment: Pay your bills and recharge your account online.

Increase Internet Speed: Upgrade your internet plan to a higher speed.

Emergency Recharge "IDOOMLY": Recharge your account even if you have no credit.

Check and Track Phone Usage: Monitor your phone usage and data consumption.

View Unpaid Bills: See a list of your outstanding bills.

View Payment History: Review your past payments, including internet recharges and payments made by CIB and EDAHABIA cards.

Download Phone Bills in PDF Format: Save your phone bills as PDFs for your records.

Report a Phone or Internet Outage: Notify Algérie Télécom of any problems you are experiencing with your phone or internet service.

- Idoom market:

Idoom Market platform is used as e-commerce marketplace. This platform allows customers to easily purchase goods from Algeria Telecom.

It offers its customers a wide range of products and solutions divided into categories such as telecommunications, information technology, professional solutions, e-learning, and much more.

In addition, online payment is available to avoid the need to go to the commercial agency.

As for delivery, it is available in 58 states, which means that customers can receive their orders directly to their homes, which increases the convenience of online shopping.

Stage	Tool	Role
Procurement	Oracle procurement management Platform	- Automate purchase requests. -Manage contracts.
Inventory	Oracle inventory management platform	- Track inventory levels. -optimize storage operations.
Distribution	- Myidoom e-paiment application. - Idoom Market platform	- Secure and convenient online payments for customers. - E-commerce marketplace for customer purchase.

Table 9: Digital tools in Algeria Telecom (Source: Elaborated by the researcher)

2.2.3 The Urban and Suburban Transport Public Company -Tiaret- :

ETUS, the Urban and Suburban Transport Public Company, is a state-owned company responsible for providing public transportation services in Algeria.

It plays a vital role in facilitating the daily commute for Algerians, contributing to traffic decongestion, and supporting the national economy through job creation and goods transportation.

It offers a wide range of services:

- Quick Repair Workshop:

- Provides a comprehensive range of services for all types of light and heavy vehicles.

- Equipped with advanced tools and equipment.

- Uses high-quality oils and filters.

- Employs a qualified and experienced team of technicians.

- Vehicle Service Station (Washing and Lubrication):

- Offers a variety of car washing and lubrication services, including:

* Complete interior and exterior car washing

* Engine washing

* Oil and filter changes

- Urban and Suburban Transport:

- ETUS Tiaret operates a fleet of buses that provide regular and reliable transportation services to residents of Tiaret and its surrounding areas.

- The bus network covers a wide range of destinations, including schools, hospitals, and shopping centers.

- Tickets are affordable and can be purchased on board or at designated bus stops.

- Technical Vehicle Inspection:

- ETUS Tiaret has established a technical vehicle inspection agency to ensure the safety of vehicles on the road.

- The agency operates two inspection lines: for heavy and light vehicles.

- Inspections are conducted by qualified technicians using the latest equipment. (ETUS Tiaret, s.d.)

In order to study the role of digital technologies in ETUS Tiaret three interviews were conducted with employees from procurement, inventory, and information systems departments.

While it still employs traditional methods in its procurement and inventory management, it has significantly enhanced its customer service through the development of several applications and systems:

- Tiaret bus application:

This application allows customers to track the location and arrival time of buses using GPS systems.

- Etuspay:

Etuspay is an application that has QR code-based payment system to streamline the bus fare payment process for ETUS customers.

It makes it easier to get around on buses without having to think about money. It makes travel much faster than paper tickets, as all the customer needs to do is "swipe their Bus Card or Bus Application on smartphones" on the designated conductor's phone inside the bus to deduct the fare from the balance on the Bus Card or Bus Application.

The Bus App for electronic ticketing is more convenient and flexible and provides a guarantee of travel at all times, even if the customer does not have enough cash as long as they have enough balance on their Bus Card or Bus App on their smartphone it will allow them to travel on buses, as there is no time limit for the balance to expire.

If the balance runs out, the controller or conductor will refill it in person. It cannot be refilled remotely.

This innovative e-payment solution eliminates the need for cash transactions, enhancing convenience and reducing the risk of misplacing or losing cash.

According to an interviewee, "The company began developing its services after the COVID-19 pandemic, as the situation necessitated the provision of electronic services to avoid overcrowding at bus stops or while boarding buses, which could lead to the spread of the disease. Thus, the company programmed the tiaret bus and etuspay apps."

Additionally, ETUS Tiaret is currently working on developing a new customer application that will allow passengers to:

- Select their desired destination and receive information on the buses they can take to reach their chosen location.

- Access information about tourist attractions if the passenger is a tourist.

- File complaints in case of any issues with the bus by specifying the bus number, time, and the location.

As stated by another interviewee, "The company is working to develop customer service through a new application that will allow them to identify the buses they can use, find tourist attractions, and file complaints."

- Contrôleur App:

The Contrôleur app serves as a tool for controllers , not as an automated system. Controllers, typically employees who ride the buses, utilize the app to monitor and evaluate the performance of bus drivers and conductor. They input observations and feedback directly into the app, providing valuable insights into operational efficiency and passenger satisfaction,

according to the interviewee: “ this application has helped us reduce costs by making the work of the supervisor easier and eliminating the need for a large number of supervisors.

Previously, before this application existed, each bus had its own supervisor. For example, if there were 30 buses, there would be 30 supervisors, and this due to the difficulties of working whith papers record in the past”

The functionalities of this app are:

- It does not operate automatically. Supervisors actively enter data and feedback based on their observations.

- The Controler app is designed for supervisors, not for general passengers. Supervisors are responsible for monitoring and evaluating bus operations.

- The app allows supervisors to assess both driver and conductor performance, addressing various aspects of their work.

- Controllers can use the app to report incidents, such as passenger complaints, safety concerns, or mechanical issues.

By embracing technology and prioritizing customer experience, ETUS Tiaret demonstrates its commitment to providing efficient and convenient public transportation services to the people of Tiaret.

Stage	Tool	Role
Customer Service	Tiaret bus application	Maintains and updates the Tiaret Bus App to ensure accurate bus tracking and arrival information.
	ETUSPAY application	Maintains and updates the Etuspay App to ensure a smooth and secure e-payment experience.
	New customer application (under development)	Assists customers with using the new customer app and answers questions about trip planning, tourist attractions, and complaint filing.
Operations management	Contrôleur application	Maintains and updates the Contrôleur App to provide supervisors with efficient tools for monitoring and reporting.

Table 10: Digital tools in ETUS Tiaret (Source: Elaborated by the researcher)

2.2.4 Sonelgaz Tiaret:

Sonelgaz Group is the historical operator in the field of electricity and gas supply in Algeria. Established in 1969, the company has been providing Algerians with energy for half a century. Following the enactment of the law on electricity and gas distribution by pipelines, Sonelgaz became a holding company responsible for managing a multi-company and multi-profession group. Sonelgaz Group has played a role in the country's economic and social development. (Sonelgaz, s.d.)

It offers a wide range of services:

- Operating, maintaining and developing the electricity and gas network in its jurisdiction.

- Developing its electricity and gas networks.

- Marketing electricity and gas while working on the quality and efficiency of service.

- Ensuring the continuity of service at reasonable prices.

- Issuing and collecting energy consumption bills.

This case study examines the digital transformation in Procurement and Supply Chain Management at Sonelgaz Tiaret, a subsidiary of Sonelgaz Group. This involved interviewing three employees from finance, inventory, and information systems departments.

The study found that there is no procurement platform at Sonelgaz Tiaret due to the existence of a single source for electricity and gas. However, the company has developed an inventory management platform and an electronic payment site to improve efficiency and customer service.

- Atad Equipment Platform: This platform is used for inventory management. In case of equipment shortage, equipment requests are recorded and transferred from other Sonelgaz branches. The latter is responsible for purchasing according to one of the interviewees: "There is no purchasing in our branch, but there are other branches responsible for purchasing. Here, we only transfer inventory from these branches."

- E-payment website: This website is used to improve customer service by allowing electronic payment of bills. However, it takes 3 days for the payment process to be confirmed by the company. The interviewww states: " we have just one website for e-paiment and it takes three days to be confirmed by the company".

Stage	Tools	Role
Inventory	Atad Platform.	Managing inventory levels and recording equipments requests.
Client service	E-paiment website.	Customer service representive.

Table 11: Digital tools in Sonelgaz Tiaret (Source: Elaborated by the researcher)

2.3 Analysis/Discussion:

This section uses a combination of theoretical and empirical findings, this is achieved through the employment of a comprehensive conceptual framework to understand the significance of digital transformation in procurement and supply management.

2.3.1 Digitizing the company supply chain for transformative growth:

Algerian companies are embarking on a journey of digital transformation in their procurement and supply chain management functions. While they are still in the early stages of this journey, their initial digitization efforts have already yielded positive results in terms of cost reduction, efficiency, and transparency.

The pursuit of efficiency remains a universal driver for digital transformation in Procurement and supply chain management, and Algerian companies are no exception. They face constant pressure to reduce costs, streamline processes, and improve responsiveness to customer demands. Manual tasks introduce inefficiencies, prompting companies to seek solutions that automate tasks, optimize inventory management, and enhance visibility across the supply chain.

This pursuit of efficiency aligns with the findings of (Chauhan, et al., 2022) who emphasize the role of digital technologies in achieving sustainable supply chain management practices. Their PRISM framework highlights the importance of automation, data analytics, and collaboration in reducing costs and improving efficiency.

Similarly, (Alabdali & Salam, 2022) explores the positive impact of digital transformation on supply chain procurement for creating a competitive advantage. This study aligns with the observed focus on efficiency improvements in Algerian companies.

The case studies provide evidence of this trend, with companies implementing digital tools like SDCOM (Naftal), Oracle platforms (Algeria Telecom), and inventory management systems (Sonelgaz Tiaret) to address these inefficiencies. These tools automate processes, improve data accessibility, and contribute to a more efficient Procurement and supply chain management process.

While efficiency is a primary trigger, other factors can also propel companies towards digital transformation in PSCM. These include:

Market Dynamics:

Increased competition in a globalized marketplace can pressure companies to adopt digital technologies to keep pace. While not explicitly mentioned in the case studies, it's a factor worth considering, especially for companies like Algeria Telecom in the competitive telecommunications industry.

Regulatory Compliance:

Government regulations or industry standards mandating the use of digital technologies for specific tasks (e.g., e-invoicing) can act as a trigger. This is less likely for Algerian companies at this stage but remains a potential future consideration.

Technological Advancements:

The constant evolution of digital technologies like artificial intelligence (AI), blockchain, and the Internet of Things (IoT) can create new opportunities for innovation and efficiency in Procurement and supply chain management. Algerian companies should stay updated on these advancements to inform their future digital strategy.

Internal Pressures:

Internal issues like siloed data, lack of collaboration, or outdated systems can hinder efficiency and decision-making. A desire to overcome these challenges might motivate companies to embrace digital transformation. Further research could explore these internal pressures through interviews with company personnel.

By considering these multifaceted triggers, we gain a more comprehensive understanding of the forces driving digital transformation in Algerian Procurement and supply chain management.

While Algerian companies haven't fully achieved digital transformation, their initial digitization efforts suggest progress. The initial triggers for these efforts likely stemmed from a desire for efficiency improvements and potentially the need for strategic supplier management.

Early Digitization has yielded some benefits:

Targeted Automation for Streamlining:

Automation of tasks like purchase requests, order processing, and basic inventory management frees up personnel resources and reduces human error, leading to efficiency gains (e.g., Naftal and Sonelgaz Tiaret).

Improved Visibility with Standalone Tools:

Even without a fully integrated platform, standalone digital tools offer some level of data consolidation, enabling better decision-making on sourcing strategies and inventory management.

Reduced Paperwork and Administrative Costs:

Digital tools facilitate electronic document management, eliminating paper-based processes and associated storage costs.

However, challenges remain in the early Stages of Digitization:

Limited Integration and Information Silos:

The use of standalone tools creates information silos, limiting data analysis and hindering further cost-saving opportunities.

Focus on Basic Needs vs. Advanced Capabilities:

The initial focus is on addressing basic needs through automation and improved visibility within specific functions, neglecting collaboration features and advanced analytics.

Addressing Implementation Costs:

The initial investment in digital solutions can be a barrier, particularly for state-owned enterprises.

Change Management and Training Needs:

Shifting to digital processes necessitates changes in employee behavior and requires training programs for user adoption and proficiency.

Algerian companies are in the early stages of digital transformation in PSCM. While the adoption of basic digital tools has demonstrated positive impact, further progress requires moving beyond standalone tools. To fully realize the potential of digital PSCM, Algerian companies need to:

- Develop a more integrated digital PSCM ecosystem to address information silos and limited functionalities.

- Implement advanced features for greater cost savings and collaboration.

- Invest in change management and user training to ensure successful adoption of digital tools.

By addressing these challenges and leveraging the identified triggers, Algerian companies can unlock the true potential of digital technologies to achieve significant efficiency gains, optimize sourcing strategies, and gain a competitive edge in the marketplace.

2.3.2 E-Procurement Adoption and Perceived Benefits:

Theme 2 delves deeper into the specific elements of e-procurement being adopted by Algerian companies and the perceived benefits associated with them, considering the limitations of the early digitization stage in the Algerian PSCM landscape.

While the global trend pushes towards comprehensive e-procurement platforms, Algerian companies are taking a more gradual approach. This section explores the specific elements of e-procurement being adopted and the challenges hindering full implementation:

The interview data suggests some promising initial steps towards data integration, a cornerstone of advanced e-procurement. Examples include:

SDCOM Platform (Naftal):

This platform facilitates communication and information sharing between procurement, logistics, and warehousing departments. While a positive step towards breaking down information silos (Motaung & Sifolo, 2023) highlights similar challenges with siloed data in South African procurement , it doesn't represent a fully integrated ecosystem. Integrating data from other crucial PSCM functions like finance and supplier management is necessary for comprehensive analysis and optimization.

Oracle Platform (Algeria Telecom):

While primarily used for specific procurement functions, it allows for data consolidation on past purchases. This data visibility within a specific function empowers procurement teams to negotiate better contracts based on historical trends. However, the lack of integration with other systems limits the potential for a holistic view of procurement activities and broader cost-saving opportunities.

These examples highlight the ongoing journey towards data integration in Algerian procurement and supply chain management. While companies recognize its importance, achieving a fully integrated platform is a complex undertaking. Challenges include:

Legacy Systems:

Many Algerian companies still rely on older, non-integrated systems. Migrating to new, integrated platforms requires significant investment and technical expertise.

Standardization Issues:

Data standardization across different departments and systems is crucial for seamless integration. Algerian companies might need to address data inconsistencies and establish standardized formats for efficient data exchange.

Change Management and Training:

Shifting to an integrated e-procurement platform necessitates changes in employee behavior and requires training programs to ensure user adoption and proficiency. Effectively managing these changes and providing adequate training will be crucial for maximizing the benefits of data integration.

Collaboration Features:

While some companies mentioned communication with suppliers, there wasn't strong evidence of comprehensive collaboration features within the e-procurement systems discussed. This limited scope restricts the potential for increased transparency and collaboration with suppliers, another key aspect of advanced e-procurement. Here's why collaboration features haven't taken center stage yet:

Focus on Basic Needs:

The initial focus in these companies seems to be on addressing basic needs through digitization, such as automation and improved visibility within specific functions. Collaboration features like supplier portals for real-time communication and joint project management are not yet a major focus. This prioritization of basic functionalities is understandable in the early stages of digital transformation.

Integration Dependency:

Implementing robust collaboration features often relies on a certain level of data integration. Without a unified data platform, creating seamless communication channels with suppliers and managing joint projects effectively becomes challenging.

Despite these limitations, there's a growing awareness of the importance of collaboration. Some companies expressed interest in exploring supplier portals in the future, suggesting a potential shift towards more collaborative e-procurement practices.

Participants mentioned some perceived benefits associated with their current e-procurement efforts:

Improved Communication and Visibility (Within Functions):

The data integration initiatives, even if partial, contribute to improved communication and information visibility within specific PSCM functions (e.g., communication between procurement and logistics in Naftal). This enhanced visibility allows for better coordination and reduced inefficiencies within departments.

Streamlined Workflows (Specific Tasks):

The adoption of features like electronic document management and basic automation helps streamline workflows for specific tasks within procurement functions. This translates to improved efficiency in areas like purchase request processing and basic inventory management.

Efforts like data integration and use of standalone tools for specific functions are underway. However, the early stage of digitization means a fully integrated e-procurement platform with advanced collaboration features remains a future goal.

Despite this, there are some perceived benefits in terms of improved communication and streamlined workflows within specific procurement functions.

Moving beyond standalone tools towards a more integrated platform with collaboration features will be crucial for unlocking the full potential of digital transformation in PSCM. This includes:

Investing in Data Integration:

Efforts to connect disparate systems and create a unified data repository across all Procurement and supply chain management functions are essential for comprehensive data analysis and enhanced decision-making. This can lead to:

Improved Supplier Management:

Integrated data allows for better supplier performance evaluation and identification of cost-saving opportunities through strategic sourcing.

Enhanced Risk Management:

A holistic view of procurement activities enables proactive risk identification and mitigation strategies.

Data-Driven Decision Making:

By leveraging comprehensive data analysis, companies can make informed decisions on procurement strategies, inventory management, and supplier selection.

Implementing Collaboration Features:

Integrating supplier portals and real-time communication tools will foster transparency and collaboration with suppliers, leading to improved efficiency and potentially better pricing negotiations. This can bring about:

Streamlined Communication:

Real-time communication channels with suppliers reduce delays and improve overall collaboration throughout the procurement process.

Enhanced Visibility:

Supplier portals provide visibility into supplier inventory levels and production schedules, allowing for better coordination and reduced disruptions.

Joint Project Management:

Collaboration features can facilitate joint project management with suppliers, leading to improved project execution and on-time delivery.

Addressing Implementation Costs:

Exploring cost-effective solutions and phased implementation strategies can help overcome budgetary limitations and accelerate the development of a more advanced e-procurement ecosystem. This might involve:

Cloud-Based Solutions:

Cloud-based e-procurement platforms offer a cost-effective alternative to on-premise solutions, requiring less upfront investment.

Phased Implementation:

Companies can prioritize integrating critical functions like procurement and finance first, followed by other PSCM departments in subsequent phases.

Leveraging Government Initiatives:

Investigating potential government grants or programs that support digital transformation in Algerian businesses can help ease the financial burden.

By addressing these considerations, Algerian companies can move beyond the limitations of the early digitization stage and fully leverage the benefits of e-procurement. Achieving greater efficiency, transparency, and cost savings in their PSCM functions requires continuous improvement and a commitment to digital transformation. This journey will involve not only technological advancements but also cultural shifts within organizations, embracing data-driven decision making and collaborative partnerships with suppliers. As Algerian companies navigate this path, they will contribute valuable insights to the understanding of e-procurement adoption in emerging economies, demonstrating the potential for digital transformation to reshape the landscape of PSCM on a global scale.

2.3.3 Unlocking value through transformation:

The case studies of Naftal, Algeria Telecom, ETUS Tiaret, and Sonelgaz Tiaret offer a glimpse into the evolving landscape of procurement and supply chain management (PSCM) within Algerian

companies. While they haven't yet reached the pinnacle of digital transformation, their initial forays into digitization hold the promise of unlocking significant value across their entire value chain. Traditionally, cost reduction has been a primary driver for PSCM improvements, as evidenced by research conducted by (Motaung & Sifolo, 2023)**.**

However, digital transformation offers a broader perspective on value creation, one that extends far beyond just slashing expenses.

By streamlining internal processes and leveraging digital tools for customer responsiveness, Algerian companies can achieve faster delivery times, potentially leading to increased customer satisfaction and loyalty. Digital platforms can facilitate these improvements through task automation, real-time data sharing with suppliers, and convenient mobile applications for customer order tracking.

While the case studies don't explicitly mention customer-facing applications, the implementation of mobile apps in some companies suggests an openness to such solutions that can transform customer experiences. The benefits extend beyond customer satisfaction.

Digital platforms can foster stronger relationships and collaboration with suppliers. Seamless communication and information sharing pave the way for collaborative problem-solving, potentially leading to better pricing and delivery terms for Algerian companies. Data-driven strategic sourcing empowered by digital platforms enables Algerian companies to negotiate more favorable contracts with suppliers based on real-time data and market insights. This approach transcends merely finding the cheapest supplier and unlocks significant value by establishing reliable, high-value partnerships throughout the supply chain.

Furthermore, digital transformation empowers companies to become proactive risk managers. Data-driven analytics provide valuable insights into supplier performance and market trends, allowing companies to identify potential disruptions before they occur. Digital transformation equips Algerian companies with data-driven analytics to predict fluctuations in demand and anticipate potential supply chain issues. This proactive approach allows for risk mitigation, optimized sourcing strategies, and a smooth flow of goods and services, ultimately enhancing overall resilience and competitive edge, but unlocking the full potential for value creation through digital transformation requires a strategic approach.

Algerian companies must ensure their digital transformation initiatives are closely aligned with their broader business goals and strategic objectives. Focusing on initiatives that address specific pain points and contribute to measurable value creation will garner greater support from stakeholders and ensure the transformation journey delivers tangible benefits.

Investing in robust data collection, storage, and analytics capabilities is crucial for extracting valuable insights from digital tools and processes. Data is the fuel that powers data-driven decision making, and companies that prioritize building a strong data foundation will be better positioned to leverage digital transformation for maximum value creation. Additionally, fostering a culture of innovation is essential for maximizing the long-term value of digital transformation.

Encouraging collaboration across departments and fostering a culture of data-driven decision making will empower employees at all levels to identify and implement new ways to create value. In such an environment, employees are actively engaged in seeking out new opportunities and leveraging data to optimize processes this fosters innovation that fuels sustainable value creation in the digital age.

The Algerian companies' initial digitization efforts represent a stepping stone towards a more comprehensive digital transformation journey. By embracing the potential for value creation beyond just cost savings, and by implementing a well-defined strategy focused on data, collaboration, and innovation, they can unlock significant value across their entire PSCM function. This will contribute not only to their short-term success but also to their long-term sustainability and competitive advantage in the marketplace. The future of Algerian procurement and supply chain management is bright, and digital transformation holds the key to unlocking a future of enhanced efficiency, stronger relationships, proactive risk management, and ultimately, sustainable value creation for all stakeholders.

Conclusion of the second chapter:

The second chapter, titled "Practical Part", shifts the focus to the practical application of these concepts. It outlines the research methodology employed in the study, detailing the research design, data collection methods, and data analysis techniques used.

Next, the chapter presents the empirical findings gathered from real-world case studies through semi- structured interviews from four specific organizations: Naftal Fuel Branch Tiaret 614, Algeria Telecom, The Urban and Suburban Transport Public Company, and Sonelgaz Tiaret.

Finally, the chapter delves into a comprehensive analysis and discussion of these findings by using a thematic analysis.

This section explores how digitizing a company's supply chain can lead to transformative growth, the adoption of e-procurement and its perceived benefits, and concludes by examining how digital transformation can unlock significant value within an organization.

Conclusion :

The conclusion encompasses a summary of the findings and answers to the research questions formulated earlier in the study, accompanied by theoretical implications derived from these answers.

It also includes practical recommendations for practitioners, and concludes by acknowledging the research limitations and discussing possible directions for future research.

In this research, the role of digital transformation in supply chain management from procurement to delivery was studied, aiming to enhance the supply chain management process.

In addition to the theorical framework a qualitative analysis of 4 companies in Tiaret was conducted through thematic analysis, leading to the following results:

- Some of the digital technologies that can be used in procurement and supply chain management specifically, to improve planning, sourcing, manufacturing, and delivery processes. include big data analytics, digital twins, e-procurement, supplier collaboration portals, blockchain, robotic process automation, artificial intelligence, 3D printing, virtual reality, augmented reality, drones, and smart driverless transportation systems.

- In the planning and sourcing stages, big data analytics is helping businesses optimize processes like pricing and inventory control and, Digital twins allow for early detection of errors and continuous monitoring of performance.

Additionally, eProcurement tools streamline sourcing activities, making it easier to find the right suppliers and manage purchases. Supplier collaboration portals create a more transparent environment, ensuring information flows freely between companies and suppliers.

- Technologies like blockchain and robotic process automation add another layer of security, acting as guardians against risks and manual errors.

- 3D printing allows for on-demand production and customization of products this means businesses can create products exactly when and how their customers need them.

- Virtual reality and augmented reality are lending a helping hand in design, training, and maintenance processes, making them more efficient and accurate. Robots are taking over repetitive tasks, freeing up human workers to focus on more complex activities. This not only boosts overall productivity but also improves safety in the workplace.

-Digital technologies can help improve efficiency and reduce costs in procurement and supply chain management.

- In the delivery process drones are delivering goods to remote or hard-to-reach areas, while smart driverless transportation systems and automated lifting equipment are transforming warehouses into bastions of efficiency and accuracy.

- Algerian companies are in the early stages of digital transformation for PSCM, they've implemented basic digital tools to address inefficiencies and improve visibility within specific functions (e.g., automation, data integration for better decision-making).

- Challenges include limited integration between systems (information silos), focus on basic needs over advanced functionalities, and initial investment costs.

- Digital transformation offers a broader perspective on value creation in PSCM, beyond just cost reduction

- Digital transformation offers potential other benefits include:

* Increased customer satisfaction and loyalty (through faster delivery times and customer-facing applications)

* Stronger relationships and collaboration with suppliers (facilitating better pricing and delivery terms)

* Proactive risk management (identifying potential disruptions and optimizing sourcing strategies)

Hypothesis Testing:

The study's findings confirmed the hypothesis suggesting that digital transformation enhances supply chain efficiency. Additionally, the null hypothesis, which posited no significant improvement in supply chain efficiency due to digital transformation, was rejected.

Morever, the study validated Hypothesis, suggesting that e-procurement drives strategic supplier management and optimizes sourcing strategies, and the null hypothesis was rejected. This signifies that e-procurement plays a significant role in driving strategic supplier management and optimizing sourcing strategies.

Recommendations:

- Develop a more integrated digital PSCM ecosystem to address information silos and limited functionalities.

- Implement advanced features for greater cost savings and collaboration (e.g., supplier portals for real-time communication and joint project management).

- Invest in change management and user training to ensure successful adoption of digital tools.

- Leverage an ERP system to develop a more integrated digital PSCM ecosystem:

Focus on eliminating information silos and limited functionalities within the PSCM domain by integrating relevant modules from the ERP system.

- Implement Online Top-Up for ETUS Pay App:

Facilitate electronic payments by enabling online top-ups for the ETUS Pay application. This will significantly enhance user convenience, encourage wider adoption of the application, reduced workload for bus conductors and controllers and Improved efficiency of payment processes . Users should be able to top up their balance remotely anytime, anywhere,

- Enable Remote Top-Ups for Naftal Cards:

Implement a secure remote top-up feature for Naftal cards, allowing customers to conveniently add balance to their cards from anywhere, anytime this will help to enhanced customer convenience and accessibility, reduced reliance on physical top-up points, Potential increase in card usage and adoption and improved efficiency of payment processes

- Explore Mobile Payment Integration:

Investigate opportunities to integrate Naftal card payments with popular mobile payment platforms this would provide customers with additional payment options and enhance the overall

payment experience. and helps to secure payment experience, wider range of payment options for customers, Potential increase in digital payment adoption and Alignment with the growing trend of mobile payments.

- Expedite Payment Confirmation for Online Payments:

Significantly shorten the payment confirmation timeframe for online Sonelgaz bill payments. Currently, it takes up to 3 days for confirmations, causing inconvenience and potential delays. Aim for near-instantaneous or at least within a few minutes confirmation.

This can help to Improved customer satisfaction and reduced waiting times, enhancetransparency and reassurance for customers, increased efficiency of payment processing and reconciliation and Potential boost in online payment adoption.

Suggestions for future research:

Further research is needed to address the knowledge gap on digital transformation in purchasing and supply chain management.

Firstly, future research efforts should examine how algerian manufacturing firms are embracing 3D printing, VR and AR, robotics and other new technologies.

In addition, in-depth research is needed to understand the opportunities presented by industry 4.0 and 5.0 technologies for Algerian industry.

Furthermore, research on the long-term impact of digital transformation like job displacement and reskilling needs. By examining these areas, researchers can equip policymakers, business leaders and workforce with the knowledge they need to guide the digital transformation journey and ensure a successful future for Algerian companies.

References:

(n.d.). Retrieved from Sonelgaz: https://www.sonelgaz.dz

(n.d.). Retrieved from ETUS Tiaret: https://web.etustiaret.dz/

(n.d.). Retrieved from Algérie Télécom: https://www.algerietelecom.dz

(n.d.). Retrieved from Naftal: https://www.naftal.dz

Hallikas, J., Immonen, M., & Brax , S. (2020). Digitalizing procurement: the impact of data analytics on supply chain performance. *Supply chain managment:an international journal*.

Hess, T. (2022). *Managing the digital transformation A Guide to Successful Organizational change.* Wiesbaden: Springer Gabler.

Jespersen , B., & Skjøtt-Larsen, T. (2005). *Supply Chain Management : - in Theory and Practice.* Copenhagen: Copenhagen Business School Press.

Katinka Paul, K., & Choi, S. (2018). Digital Transformation and Its Effect on Supply Chain Complexity: A Systematic Literature Review (Master thesis). Copenhagen Business School.

Seyedghorban, Z., & Samson, D. (2020). Digitalization opportunities for the procurement function: pathways to maturity. *International journal of operations & production management*.

Skilton, M., & Hovsepian, F. (2018). *The 4th Industrial Revolution Responding to the Impact of Artifcial Intelligence on Business.* Cham: Palgrave Macmillan.

Trovati, M., Hill, R., Anjum, A., Liu, L., & Zhu, S. (2015). *Big-Data Analytics and Cloud Computing Theory, Algorithms and Applications.* Cham: Springer.

Zhang, S., Yu, Q., Wan, S., Cao, H., & Huang, Y. (2024). Digital supply chain: literature review of seven related. *Manufacturing Review*.

Alabdali, M., & Salam, M. (2022). The Impact of Digital Transformation on Supply chain Procurement for Creating Competitive Advantage: An Empirical Study. *Sustainability*.

Almunawar, M., Islam, M., & Pablos, P. (2022). *Digitalisation and organisation design: Knowledge Management in the Asian Digital Economy.* Abingdon,Oxon: Routledge.

BENTALHA, B., HMIOUI , A., & ALLA , L. (2019). The digitalization of the supply chain management of service companies. *Association for Computing Machinery*.

Bienhaus, F., & Haddud, A. (2017). Procurement 4.0: factors influencing the digitisation of procurement and supply chains. *Business process management*.

Capgemini Consulting and Capgemini Business Service. (2016). *Robotic Process Automation - Robots conquer business processes in back offices.*

Chauhan, S., Sing, R., Gehlot, A., Akram, S., Twala, B., & Priyadarshi, N. (2022). Digitalization of Supply Chain Management with Industry 4.0 Enabling Technologies: A Sustainable Perspective. *Processes*.

Crandall, R., Crandall, W., & Chen, C. (2009). *Principles of supply chain management.* Boca Raton: CRC press.

Darr, W. (2020). *fundamental issues of procurement management.* Hamburg: tredition.

Delke, V., Schiele, H., Buchholz, W., & Kelly, S. (2023). Implementing Industry 4.0 technologies: Future roles in purchasing and supply management. *ELSEVIER*.

Dietrich, D., Heller, B., & Yang, B. (2015). *Data Science & Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data.* Indianapolis: John Wiley & Sons, Inc.

Elsagheer, M. (2020). The effect of using Blockchain technology in tracking manufacturing supply chains on activating Inter-organizational Cost management tools and enhancing competitiveness "A fiels study". *مجلة البحوث المالية و التجارية*.

Gorbin, J., & Strauss, A. (2008). *Basics of Qualitative Research : Techniques and Procedures for Developing Grounded Theory.* California: Sage Publications.

Haque, A., Koohi, P., & Waqar, K. (2023). The Significance of Digital Transformation in the Supply Chain Management for Facilitating International Businesses Cases from Emerging Markets (master thesis). LInaeus University, Sweden.

Huang, L., Han, Y., Yuan, A., Xiao, T., Wang, L., Yu, Y., . . . Zhu, H. (2022). New Business Form of Smart Supply Chain Management Based on "Internet of Things + Blockchain. *Mobile Information Systems*, 8.

Ivanov, D., Tsipoulanidis, A., & Schönberger, J. (2019). *Global Supply Chain and Operations Management A Decision-Oriented Introduction to the Creation of Value.* Cham: Springer Nature.

Jung, T., & Dieck, M. (2019). *Augmented reality and virtual reality the power of AR and VR for business.* Cham: Springer Nature.

KARMEHAG, J., & LÖFNERTZ, E. (2018). How Digital Technologies will Impact the Procurement Process and Organisation A study performed in collaboration with SKF Group Purchasing (master thesis). Gothenburg, Department of Technology Management and Economics, CHALMERS UNIVERSITY OF TECHNOLOGY, Sweden.

Karttunen, E., Lintukangas , K., & Hallikas, J. (2023). Digital transformation of the purchasing and supply management process. *International Journal of Physical Distribution & Logistics management*, 686.

Khare, A., W. Baber, W., & Ishikura, H. (2020). *Transforming Japanese business Rising to the Digital Challenge.* Singapore: Springer Nature.

Kumar, R. (2011). *Research methodology: a step-by-step guide for beginners.* London: SAGE Publications.

Leavy, P. (2014). *The oxford Handbook of Qualitative Research.* New York: OXFORD University Press.

Lo, H.-W. (2023). A data-driven decision support system for sustainable supplier evaluation in the Industry 5.0 era: A case study for medical equipment manufacturing. *ELSEVER*.

mackey, A., & Gass, S. (2012). *Researh methods in second Language acquisition A practical guide .* Oxford: Wiley-Blachwell.

Magdalena, L., Hatta, M., & Solikhah, M. (2024, 02 02). The adoption of digital technologies in supply chains in the manufacturing area. *JIST*, p. 464.

MIKHAYLOVA, A., SAKULYEVA, T., SHCHERBINA, T., LEVOSHICH, N., & TRUNTSEVSKY, Y. (2021). Impact of Digitalization on the Efficiency of Supply Chain Management in the Digital Economy. *QUALITY MANAGEMENT*.

Motaung, J., & Sifolo, P. (2023). Benefits and Barriers of Digital Procurement: Lessons from an Airport Company. *Sustainability*.

Ning, L., & Yao, D. (2023). The impact of digital transformation on supply chain capabilities and supply chain competitive performance. *sustainability*, 19.

Paul , K., & Choi, S. (2018). Digital Transformation and Its Effect on Supply Chain Complexity: A Systematic Literature Review (Master thesis). Copenhagen, Copenhagen Business School.

Perkin, N., & Abraham, P. (2017). *Building the agile business through digital transformation.* New York: Kogan Page Limited.

R. Motaung, J., & Pearl Siyanda Sifolo , P. (2009). Benefits and Barriers of Digital Procurement: Lessons from an Airport Company. *Sustainability*, 8.

Raab, M., & Griffin-Cryan, B. (2011). *Digital Transformation of Supply Chains Creating Value – When Digital Meets Physical.* Capgemini.

Rogers, D. (2016). *THE DIGITAL TRANSFORMATION PLAYBOOK Rethink your business for the digital age.* New York: Columbia University Press.

Saundres, M., Lewis, P., & Thornhill, A. (2007). *Research methods for business students.* Essex: Pearson education limited.

Schallmo, D., & Williams, C. (2018). *Digital Transformation Now! Guiding the Successful Digitalization of Your business model.* Cham: Springer Nature.

Schnellbächer, W., & Weise, D. (2020). *Jumpstart to Digital Procurement Pushing the Value Envelope in a New Age.* cham : Springer Nature.

Sollish , F., & Semanik, J. (2012). *The Procurement and Supply Manager's Desk Reference.* New Jersey: John Wiley & Sons, Inc.

Taylor, S., Bogdan, R., & Devault, M. (2016). *Introduction to qualitative research methods A guidebook and resource.* New Jersey: Jhon Wiley & sons, Inc.

Temitayo, B., Olusola, G., Oluyinka, O., Yinka, A., Muyiwa, D., & Yinka, B. (2023). Artificial Intelligence and Service Quality of Telecommunication Firms in Nigeria. *JEFAS*, 204.

Ustundag, A., & Cevikcan, E. (2018). *Industry 4.0: Managing The Digital Transformation.* Cham: Springer International Publishing.

Voulgaris, Z., & Bulut, Y. (2018). *AI for Data science Artifiacial intelligence frameworkes and functionality for deep learning, optimization, and beyond.* New Jersey: ISBN.

Wu, Y. (2019). *Achieving Supply Chain Agility Information System Integration in the Chinese Automotive Industry.* Cham: This Palgrave Macmillan.

Zhang, N., Ye, J., Zhong, Y., & Chen, Z. (2023). Digital Transformation in the Chinese Construction Industry:. *Building*, 2.

Appendices :

Introduction

Thank you for agreeing to participate in this interview. This research aims to understand the role of digital transformation is procurement and supply chain practices within Algerian companies.

Background Information:

1. Briefly describe your role within the company.

Current State of digital transformation:

2. To what extent has your company adopted digital technologies within this stage?

4. Procurement Stage:

3. How does your company utilize digital tools for supplier management and purchase orders?

4. Are there any digital platforms used for collaboration with suppliers?

5. Inventory Stage:

5. Does your company use any digital solutions for inventory management and tracking?

6. How do these solutions help optimize inventory levels and minimize stockouts?

6. Financial Stage:

7. Have there been any digital advancements in how your company manages financial aspects of the supply chain (e.g., payments, invoicing)?

8. How do these digital solutions improve efficiency and accuracy in financial processes?

7. Distribution Stage:

9. Does your company utilize any digital technologies for order fulfillment and delivery tracking?

10. How do these technologies contribute to improving customer service and delivery times?

Future Outlook

11. Are there any specific emerging technologies that you believe will significantly impact the Algerian supply chain landscape?

Closing

Thank you again for your time and valuable insights.

12. Is there anything else you would like to add regarding digital transformation in your company's supply chain?

Appendix 1: Interview guide

Abstract:

This study investigates the role of digital transformation on various stages of the supply chain, from procurement to delivery. We conducted interviews with 16 employees from four Algerian companies: Algeria Telecom, ETUS Tiaret, Naftal fuel branch Tiaret 614 and Sonelgaz Tiaret.

Thematic analysis of the interviews revealed that digital transformation leads to efficiency improvements throughout the supply chain. This is achieved by reducing lead times, minimizing costs through automation and data-driven decision-making, and enhancing transparency across all stages.

Furthermore, the study highlights the importance of e-procurement in driving strategic supplier management and optimizing sourcing strategies. This can be achieved through features like Supplier collaboration portals (SCP) for real-time communication and joint project management.

The study recommended developing a more integrated digital Procurement & Supply Chain Management (PSCM) system to overcome limitations in current systems. Example, leveraging an Enterprise Resource Planning (ERP) system can contribute to a more unified digital PSCM system.

Keywords: Digital Transformation, Supply Chain Management, Digital Technologies, Digital Supply Chain, Digital Procurement, Procurement Management.

المستخلص:

تبحث هذه الدراسة في دور التحول الرقمي في مراحل سلسلة التوريد المختلفة، بدءًا من الشراء حتى التسليم. أجرينا مقابلات مع 16 موظفًا من أربع شركات جزائرية: اتصالات الجزائر، ومؤسسة العمومية للنقل الحضري و الشبه الحضري بتيارت، وفرع وقود نفطال بتيارت 614، وشركة سونلغاز تيارت.

كشف التحليل الموضوعي للمقابلات أن التحول الرقمي يؤدي إلى تحسينات في الكفاءة طوال سلسلة التوريد، و يتحقق ذلك من خلال تقليل زمن التنفيذ، وتقليل التكاليف من خلال الأتمتة واتخاذ القرارات القائمة على البيانات، وتعزيز الشفافية في جميع المراحل.

علاوة على ذلك، تسلط الدراسة الضوء على أهمية المشتريات الإلكترونية في دفع إدارة الموردين الاستراتيجية وتحسين استراتيجيات التوريد، و يمكن تحقيق ذلك من خلال ميزات مثل SCP للاتصال في الوقت الفعلي وإدارة المشاريع المشتركة.

اوصت هذه الدراسة بتطوير نظام متكامل لإدارة المشتريات وسلسلة التوريد (PSCM) للتغلب على قيود الأنظمة الحالية، على سبيل المثال، يمكن أن يساهم الاستفادة من نظام تخطيط موارد المؤسسات (ERP) في إنشاء نظام موحد لإدارة المشتريات وسلسلة التوريد الرقمية.

الكلمات المفتاحية: التحول الرقمي، إدارة سلسلة التوريد، التقنيات الرقمية، سلسلة التوريد الرقمية، المشتريات الرقمية، إدارة المشتريات.