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THE ADOPTION OF DIGITAL TECHNOLOGIES IN SUPPLY CHAINS IN THE MANUFACTURING AREA

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ABSTRACT

The Ongoing COVID pandemic has hampered economic activity; Food is a basic need that must be fulfilled and cannot be postponed. During the current pandemic, business people need to pay attention to the situation and conditions, especially the limitation of economic activity in several regions. However, Digital technologies have been extensively studied in academic research and industry. Moreover, little is known about adopting digital technologies in manufacturing firms at a supply chain level. This paper aims to understand why and how manufacturing firms adopt digital technologies and the impact of the adoption on supply chains. This research includes the design of a Web-based Supply Chain Management application to facilitate inventory management, starting from the process of ordering goods from suppliers and procurement of goods to managing goods to customers. Digital technology in the supply chain in the manufacturing area helps companies to store goods management data, raw materials, inventories, deliveries, and daily deposits, and others that are still using manual systems or not yet computerised to maximise performance and also profits for the company, suppliers, including end customers. The study identifies that technological intelligence and supply chain cooperation are critical factors and proposes two-dimensional levels of adopting digital technologies according to their low-to-high degrees.

Introduction

In the Industrial Revolution 4.0 era, an industry should not be separated from technology in its application to produce a product and collect the latest information. One of the criteria for a successful industrial company is a company that can connect the internal and external environment, such as the distribution supply chain within the company's outer scope (Harsono & Kiswara, 2022). In improving the performance of a series of business processes, a supply chain that can run well is needed because the company can communicate well with its business partners (Stich, Gudergan, & Zeller, 2018). Supply Chain Management manages all process activities from material purchasing, production planning, the transformation process from products still in process to becoming finished products, and delivery of finished products to final consumers through the distribution system; in other words, activities in the supply chain. It is the process of delivering products that were initially still in the form of mountain water into mineral water that is ready to be marketed (Stich, Zeller, Hicking, & Kraut, 2020).

Information technology development is increasing, impacting all aspects, including trade, education, organisation, etc. Directly or indirectly, the rapid growth of information technology affects components in business and industry. Companies must carry out their operational activities effectively and efficiently to compete, so the application of information technology is a primary demand (Merkel et al., 2017).

Supply chain management (SCM) activities in manufacturing companies are carried out manually. These include purchasing raw materials and recording mutations in and out of drinking water products (Akhtar, Khan, Tarba, & Jayawickrama, 2018). Some of these manual activities impact: the raw materials obtained are still obtained by reporting or contacting the raw material supplier for one-day production needs and the supplier scheduling the delivery of raw materials. Inventory is an essential element in the company's operations (Sanders, Elangeswaran, & Wulfsberg, 2016). Without inventory, companies run the risk of not being able to meet customer needs. Decisions regarding how much and when to place an order must be considered in terms of supply, mainly if the need consists of several types of products or parts with different suppliers and a limited budget. Sometimes, companies do not pay attention to the problem of lot size inventory efficiency (Hindayani, Wahyuni, & Amrania, 2022). As a result, companies tend to lack raw materials due to too few and continuous purchases, resulting in increased purchasing costs. There is no information system to manage goods management. Not only that, in product stock management, there is often an excess of stock (upper stock) and a shortage of stock (lower stock). due to a lack of good management of goods.

Smart Manufacturing in Industry 4.0

Modern production is inherently advanced. Current literature presents many studies specialising in how producing SMEs cope and, in several cases, struggle with this complexity. (Riesener, Schuh, Dölle, & Tönnes, 2019) analysed six completely different Dutch SMEs from the subsequent sectors: (a) sheet production, (b) rail-road producing, (c) machine packaging, (d) profile and tube cutting, (e) steel process, (f) copper separation, to spot their strategic orientation towards a shift to “smart manufacturing”. Supported associate degree SMEs’ level of intention and adoption of SM technologies and practices, Nieuwenhuize (Issa, Lucke, & Bauernhansl, 2017) categorised SMEs into 3 phase profiles: (1) dormant, (2) captives, and (3) adapters.

The adoption of digital technology is considerably stricken by technological, organisational, and environmental factors (Jordan, Bernardy, Stroh, Horeis, & Stich, 2017). Therefore, before adopting any technologies, corporations need to know their functions, assess these factors, analyse what may happen within the method, and determine how every technique may affect the provision chain. In other words, corporations have to be compelled to begin with analysing "why" (representing the drivers, functions, and motives), followed by "how" (meaning the processes or methods) and "what" (describing the impacts, outcomes, or results). Despite the growing analysis interests within the space, the present understanding of those 3 layers (i.e., why, however, and what) of adopting digital technologies in the provide chain remains restricted. Managers still face challenges positioning their implementation processes with drivers to

realise the expected outcomes of adopting digital technologies. Therefore, this paper aims {to investigate|to analyse |to analyse} this development by respondents to the subsequent 3 research queries (RQ). RQ1: Why do makers adopt digital technologies in supply chains? RQ2: However, do makers adopt digital technologies to provide chains? RQ3: What is the impact of digital technology adoption on provide chains?

According to (Urbach & Röglinger, 2018) digital transformation is arranging technology, business models, and processes to guarantee new values for patrons and workers in a perpetually dynamic and developing digital economy. The speed of digital transformation is determined in terms of consumers' demands. The period from product style to manufacturing is reduced, the market entry amount is shortened, and products vary quickly. Fulfilling consumers' demands becomes doable with optimum and quicker call processes supported by numeric knowledge in every production step. This method provides productivity growth for operations and lowers their prices. Classic business models are disappearing and being substituted for business models that are versatile, changeable instantly, have a period to respond to consumers' habits, and are knowledge-based. Once the changes in the business world as a result of trade four.0 are reviewed, it has drawn attention that the producing and producing methods become sensible, the offer chain is best, the value of energy and infrastructure decreases, less human resources are needed, the qualified force will increase, financial gain and profit level is up (Peillon & Dubruc, 2019). Today, the United Nations agencies are ready to be afloat in the fast-growing digital era, with individuals and operations maintaining the technology era.

Industry 4.0 refers to recent technological advances where the internet and supporting technologies are the backbone to integrate physical objects, human workers, intelligent machines, and production processes across organisational boundaries to form new types of agile intelligence, networks, and value chains. Thus, in Industry 4.0, physical facilities are supported by virtual representations to increase automation, flexibility, and product diversity by having better-integrated manufacturing processes and systems, as shown in Figure 2. Kagermann et al. (Sunder, Ganesh, & Marathe, 2019) define Industry 4.0 as the technical integration of CPS into manufacturing, logistics, and IoT in industrial processes that will have implications for value creation, business models, downstream services, and work organisation.

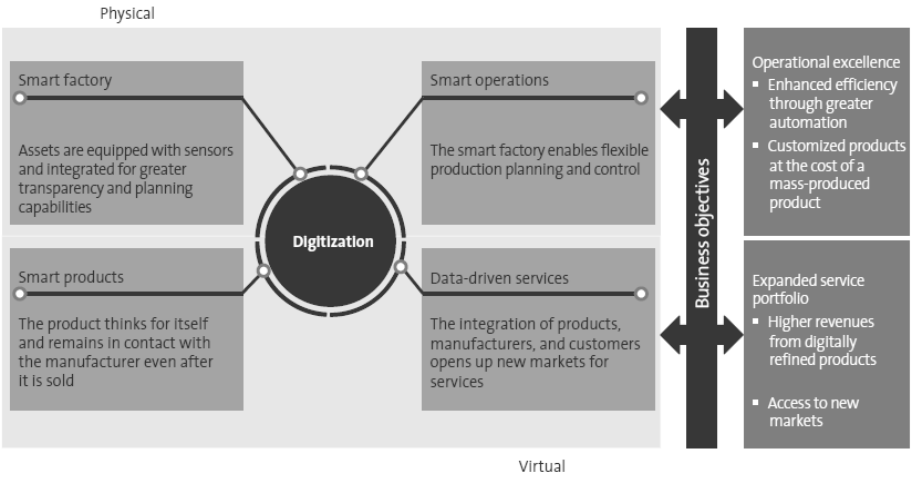

Figure 1 Industry 4.0 Concept (Lichtblau et al., 2015)

Models for implementing SM

Industry 4.0: info technologies and trade square measure gathered. In the fourth historical period, it is expected that the production method will be digitised, machines will be directly connected to every alternative, and customised producing is feasible; besides that, the atmosphere is a smaller amount impure as a result of productivity growth, avoiding excessive use of energy and water sources. As producing becomes versatile with digital factories, making less and private product demand becomes potential. A substantial amount of energy saving is additionally provided. According to their study [10], businesses will produce building blocks to realise integrated SM systems. Building blocks square measure the fundamental standard units (i.e., technologies and best practices), which will be sorted to make a coherent (intelligent) system. The framework considers 'intelligence' and 'automation' at 3 utterly different capability levels [10]. Automation capabilities square measure mirrored at the (a) machine, (b) method, and (c) plant levels, and Intelligence capabilities square measure mirrored at (x) management, (y) integration, and (z) intelligence levels. A store floor with automation capabilities at 'c) plant level' and intelligence capabilities at 'z) intelligence level' was called "Industry 4.0".

Supply Chain Management (SCM)

Supply Chain Management (SCM) was first proposed by Oliver & Weber in 1982 (Pujawan, 2010: 7). If the supply chain is a physical network, namely companies that are involved in supplying raw materials, producing goods, or sending them to end users, Supply Chain Management (SCM) is a method, tool, or approach to its management. However, it should be emphasised that supply chain management (SCM) requires an integrated approach or process based on the spirit of collaboration. According to Pujawan and Mahendrawati (Roßmann, Canzaniello, von der Gracht, & Hartmann, 2018), a supply chain is a network of companies that work together to create and deliver a product to end users. These companies usually include suppliers, manufacturers, distributors, stores, retailers, and supporting companies such as logistics service companies.

Supply Chain Management Cycle

Activities in Supply Chain Management include the facilities where raw materials, semi-finished goods, and finished goods are obtained, processed, converted, and sold. Some of these facilities are connected by transportation networks that allow the flow of materials and products. Ideally, a combination of Supply Chain Management from several moving companies as the supply chain of a moving company, with clarity and accurate information. The supply chain management process can be seen in Figure 2.

Figure 2 Siklus Supply Chain Management

Digital Supply Chain

Digital Supply Chain: DSC 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. DSC aims to achieve speed, flexibility, global connectivity, real-time inventory, transparency, intelligence, scalability, innovation, proactive, and eco-friendliness (Schoenherr & Speier-Pero, 2015).

E-Supply Chain Management

Electronic Supply Chain Management is a management concept that utilises information technology to integrate all the business people involved in the supply chain. Electronic supply chain management makes the relationship between suppliers, distributors, and customers easier to share information. In carrying out the design of the existing e-Supply Chain Management, several modules must be considered, namely [12]: Several things must be considered in the design of e-Supply Chain Management [12], namely:

1. Customer and Service Management Customer relationships provide a way to build customer relationships. Customer service allows customers to place orders online, providing sources for customer information such as product availability, delivery date, and status ordering
2. Manufacturing and Supply Chain Planning Before using SCM, the manufacturing process of producing goods uses historical forecasting. SCM currently manufactures goods based on customer needs so that the procurement of goods becomes more effective and efficient.
3. Supplier Relationship Management SRM is a process a company deals with with the supplier.

4. Logistics Resource Management With the e-SCM, moving goods and services between manufacturers, distributors, and suppliers to end consumers is more accessible.

Research Methods

This research was conducted on the drinking water industry in its production process, using a survey approach in a case study [18], primary data in the form of 30 employees in the production division for data processing. Employees were selected by purposive sampling with the following criteria: a minimum of three years of work involved in the company's simulation process and related to the production process. The data source used is secondary data obtained from the Observation of the drinking water production process in 220 ml and 19 L cups at the Water Company.
Drink by the Quality Control (QC).

Results and Discussion

System implementation is the stage of software creation or implementation of the system design stage that has been done previously. The implementation stage discusses what system requirements are needed, the program implementation stage, and the appearance of the software that has been made. This supply chain management information system is built to make it easier for parties related to drinking water distribution to order transactions based on the amount of stock available and the quantity demand for goods. This information system can be used by people who are already registered with the system. System This information can provide information on the supply needed to make booking more accessible for customers. This system has four types of users with different tasks: admin, leader, and user. The technological intelligence level represents the degree of intelligence of the digital technologies adopted in operations and provides chains [16]. The low level refers to the digital technologies with very little intelligence, like the standard data management systems (e.g., ERP, MRP), information assortment, visualisation, and processing techniques for descriptive functions. The high level refers to digital technologies with brilliant functions, like period information assortment through sensible sensors and predictive and prescriptive analysis. These functions support the market prediction of maintenance and period supply planning. Advanced intelligent technologies might help companies establish the underlying business worth from a massive volume of knowledge and create data-driven choices.

This abstract framework contains 2 main messages. First, the framework consists of 3 layers. It illustrates the drivers (why) and method (how) of producing corporations adopting digital technologies in offer chains, as well as the impact (what) of the adoption. The primary layer presents the drivers. In the main, the interior drivers derive from the operational issues and strategic directions, and the external drivers come back from customers, providers, or different offer chain partners and competition. The second layer depicts the adoption method and the adoption activities and levels. The adoption activities consult with the actions of applying digital technologies (e.g., descriptive, prescriptive,

and pre-scripting functions) in numerous stages of offer chain processes (e.g., procurement, production, logistics) to support various supply chain functions (e.g., supplier section, demand forecasting). These activities result in different levels of adopting digital technologies. We proposed a two-dimensional model based on the degrees of technological intelligence (low to high) and supply chain cooperation (low to high). This model represents four different levels of adopting digital technologies in manufacturing firms (Levels A to D shown in Fig. 5). The third layer illustrates the impact of the adoption on supply chains, including supply chain efficiency, supply chain structure, sustainability, and innovation. Second, the framework demonstrates that the drivers, process, and impact square measure are interrelated to every alternative. Above all, the literature analysis indicates that different drivers have distinct influences on adoption activities, so on adoption levels, the adoption levels might affect the impact of providing chain potency, chain structure, property, and innovation. We tend to analyse the patterns and their potential relationships and project 2 propositions as below.

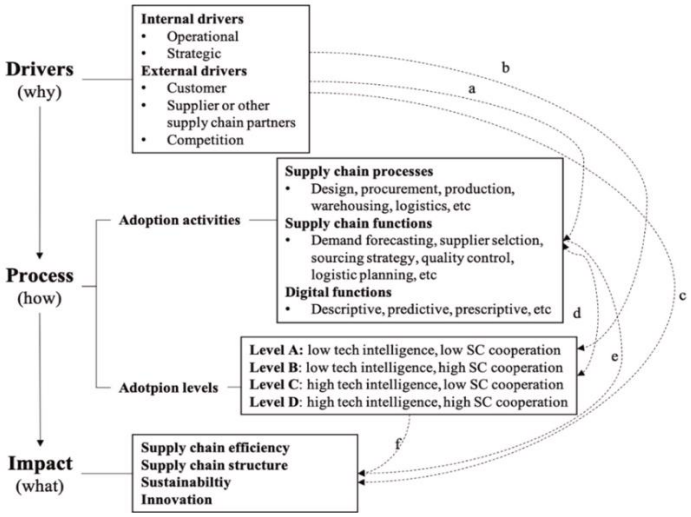

Figure 3
Conceptual framework of digital technology adoption in supply chains

The four adoption levels indicate completely different digital transformation levels in producing companies. Though there is no fastened, best pathway for adopting digital technologies, literature has shown some patterns of potential pathways (e.g., from Level A to B or A to C) and, therefore, the abstract style of future pathways (e.g., from B to D, or C to D, or A to D). Thus, the four levels and potential pathways may facilitate companies to strategically style pathways to rework from one level to another. Several digital transformations are unsuccessful in application because of the disconnection between strategy formulation and implementation [3]. It is vital to analyse the drivers, the method, and the potential impact before transitioning to a different level. It conjointly needs companies to revise the process and perpetually examine firms' current conditions, likewise because of the enablers and barriers of the transformation. The digitisation of the whole supply chain can not be achieved by any firm alone. It needs robust collaboration amongst multiple stakeholders on the provision chain. Multi-stakeholder initiatives play

a necessary role during this transformation, particularly within the transit from an occasional level of provide chain cooperation to a better level (e.g., from Level A to B or C to D). The dominant company, the World Health Organization, has more substantial cut-price power and may take the initiative to facilitate different chain partners in developing digitalisation pathways by providing learning platforms and coaching mechanisms. Driven by these powerful companies, other stakeholders must adapt and answer their digital innovation, keep cooperating with them, and upgrade the supply chain to avoid being weedless.

Practical Implication

In practice, most manufacturing firms are still at an early stage of adopting advanced digital technologies. It is challenging for managers to decide what digital technologies they should adopt, how to adopt them, and how they might affect supply chain structure and performance. This study guides the adoption of digital technology in practice. It can help managers understand the potential impact of digital technologies on supply chains and support managers in developing appropriate business strategies at different distribution and utilisation levels. Below, for example, is the design of a web-based supply chain management application to facilitate inventory management.

A. Implementation of User Program Display This page contains menus of information about the company that the user can access. User Main Page Display Form (Home) The initial form displayed when opening the Supply Chain Management application that the user can access is a glimpse of Fresh. There are other menus.

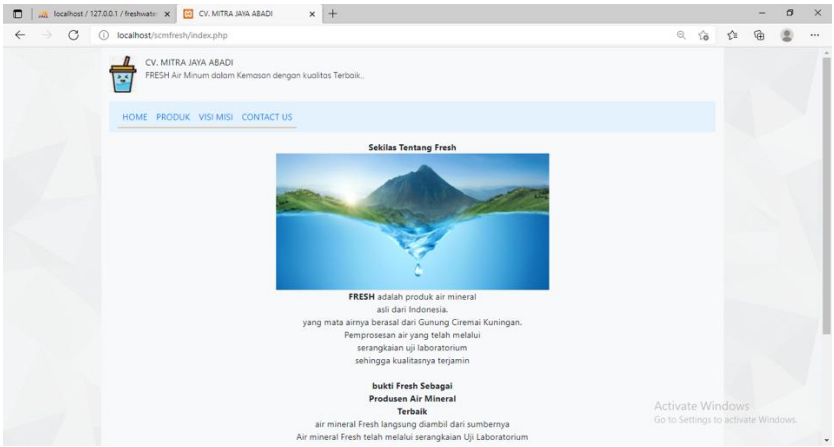

Figure 4 User main display

B. Product Menu Page Display Form This form contains product information and product prices sold by the company.

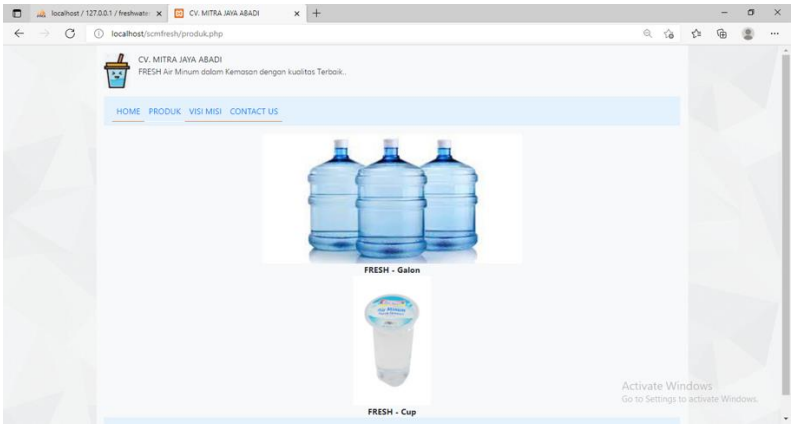

Figure 5 Product menu page display

C. Raw Material Data Menu Display Form The raw material data menu form is information on the supplier's name and the goods supplied to the CV. Mitra Jaya Abadi. Data management in the raw material data form, such as deleting data. The raw material data form can be seen in Figure 6.

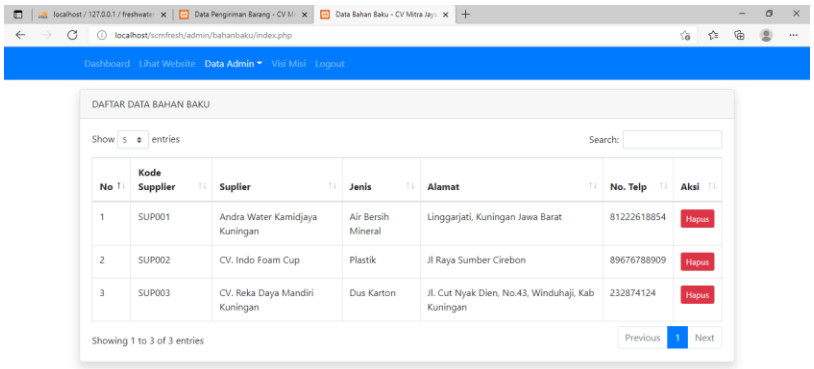

Figure 6 Raw Material data menu form

D. Raw Material Report Form The following is a raw material report from Admin data. Leaders can view information on raw material data and print raw material transcripts

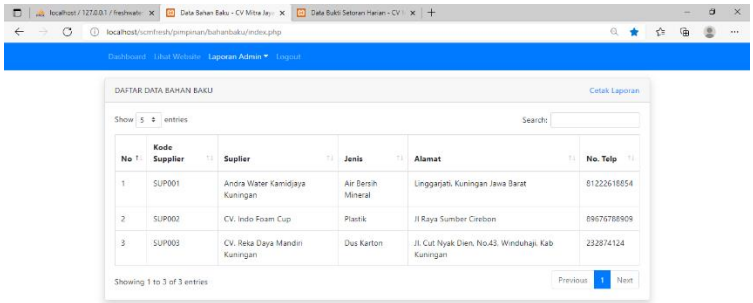

Figure 7 Raw Material Report Form

Conclusion

The test carried out is a test functionality using the black box method. Method black box is where testing is emphasised on input and output patterns that match the scenario. The test is carried out by referring to the use cases explained in the chapter on system analysis and design Based on the results of tests carried out on respondents, namely the CV. Mitra Jaya Abadi, it is known that all existing functional requirements have been running correctly in the scenario.

This paper investigated why producing corporations adopt digital technologies. However, they assume the impact of the adoption on the provision chains. We tended to use a scientific literature review of fifty-five peer-reviewed journal publications. We developed an abstract framework for digital technology adoption in provide chains, consisting of 3 parts: drivers (why), adoption processes (how), and impact (what). We tend to know that the inner drivers chiefly derive from operational issues and strategic directions. Therefore, external drivers return from customers, suppliers, chain partners, and competitors. We tend to investigate the adoption method, incorporating the adoption activities and levels. The adoption activities talk over the actions of applying digital technologies (e.g., descriptive, prescriptive, and prescriptive functions) in numerous stages of provide chain processes (e.g., procurance, production, logistics) to support varied provide chain functions (e.g., provider section, demand forecasting). These activities end in completely different levels of adopting digital technologies. We then tend to develop a two-dimensional model supported by the degrees of technological intelligence and, therefore, provide chain cooperation. Finally, we tend to analyse the most impact of the adoption of digital technologies on provide chains and synthesise them into four dimensions: provide chain efficiency, provide chain structure, property, and innovation. This analysis contributes to the fields of digital technology and includes chain management. The planned framework, above all, the two-dimensional adoption levels of digital technologies, area unit novel to the prevailing literature. Every one of the three components of the framework and their interrelationships pave the way for additional empirical testing. This study additionally provides a steering of digital technology adoption in application. It will help managers perceive the potential impact of digital technologies on supply chains and support managers in developing acceptable business methods at completely different medical care levels. Therefore, this paper lays a foundation for future analysis within the rising field of digital technologies in supply chain management.

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