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Implementing Effective Supply Chain Management to Improve Hospital Productivity Using Digital Communication

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Abstract

Purpose: Supply chain management is a key aspect in improving the productivity of military hospitals. Hospitals currently distribute commodities (medicines) and services digitally. The purpose of this study is to investigate the direct and indirect effects of digital communication on hospital productivity through supply chain management. **Research design, data and methodology:** This study uses the Structural Equation Modeling (SEM) analysis approach in conjunction with the SmartPLS tool. The primary data used in this study came from the delivery of digital questionnaires to 209 medical personnel at a military hospital. **Results:** According to the findings of this study, digital communication can help hospitals enhance the distribution of goods (medicines) and services via Supply Chain Management. The study also examines the impact of digital communication and supply chain management on productivity in military hospitals. **Conclusions:** The establishment of effective and efficient supply chain management in hospitals will boost productivity. According to this study, supply chain management has the most direct impact on productivity in military hospitals. This study also demonstrates that digital communication has a direct and indirect impact on productivity through supply chain management. As a result, this study demonstrates that supply chain management-based product and service distribution in hospitals has the potential to increase corporate productivity.

Keywords : Supply Chain Management, Productivity, Digital Communication

JEL Classification Code: D30, E20, L10, L23

1. Introduction

Military hospital productivity differs from that of private hospitals in general. The differentiating element is related to the distribution of products and services that follow distinct methods. Supply chain management can be defined as the efficient design and operation of the distribution flow of items or services that are fundamentally vital to an

organization or firm (Stevens, 1989). SCM has become such a popular topic that it is impossible to find a journal on manufacturing, distribution, marketing, customer management, or transportation that does not have an article or a topic relevant to SCM (Mentzer et al., 2001).

There has been minimal empirical research on how supply chain management (SCM) affects hospital productivity. There is only one study that focuses on supply

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chain management research and productivity (Bakar et al., 2010). Furthermore, the study focuses on hospital laboratories rather than hospitals themselves. However, there has been extensive literature research on SCM and productivity (Moons et al., 2019). Most of the research focuses on empirical investigations on SCM performance in healthcare (Supeekit et al., 2016; Yoon et al., 2016). Productivity differs from performance. In military hospitals, productivity is measured by how many patients can be served in an efficient amount of time.

The distribution of products or services provided by hospitals to patients is the focus of research on hospital productivity. Patient wait times in military hospitals prompt many patients to complain, resulting in a patient backlog (Piper, 1989). This issue appears to have existed before the 1990s, and military hospitals in Indonesia are still dealing with it today. Due to the difficulty of doing research in military hospitals, few empirical studies have been developed, particularly on productivity.

Digital logistics can also help military hospitals become more productive. Digital logistics will enhance distribution networks. Enchanted digital logistics expands the value-creation functions of traditional logistics (Burroughs & Burroughs, 2020). Military hospitals in Jakarta, Indonesia, still mostly use traditional (hardcopy) administrative systems. Not just from an administrative standpoint, but service efforts and drug product provision are still not digitally based.

Digital media is commonly referred to as "social media" or "new media." Traditional digital communication methods include corporate television, corporate magazines sent via email, one-way broadcasts, and social media (external). Internal social media, specifically business-integrated social media applications, is divided into six categories: collaborative projects, blogs, content communities, social networking sites, virtual gaming worlds, and virtual social worlds (Maarit Lipiäinen et al., 2014). Internal use of social media can assist hospitals in giving information, knowledge, and the process of distributing services and products to all stakeholders.

Digital communication has emerged as a phenomenon in the era of the Fourth Industrial Revolution, causing disruption in a variety of areas (Kovaitè et al., 2020). Previous research has also demonstrated a link between digital communication characteristics and productivity (Clampitt & Downs, 1993; Majumdar, 1997; Shahnazi, 2021; Viollaz, 2019). Digital communication encompasses not just the use of internal social media, but also the use of appropriate online communication channels to facilitate information diffusion. The use of digital communication in business is extremely important today. The supply chain management process can function more efficiently if digital communication is implemented properly. This term is

commonly known as digital supply chain management (Pyun & Rha, 2021). Several prior research found that digital communication can improve supply chain management (Bentalha et al., 2020; Dehgani & Jafari Navimipour, 2019; Ram et al., 2023).

Military hospitals are in desperate need of reliable digital connectivity. Ineffective digital communication will result in disruptions to the supply chain distribution process (Kanike, 2023). The root reason for supply chain management and productivity issues in military hospitals is a lack of resources, particularly the adoption of a primitive operating system. There has been no research on the use of digital communication via supply chain management to increase productivity in military hospitals. Thus, the contribution of this empirical research aims to increase the productivity of military hospitals. The goal of this study is to stimulate better productivity in military hospitals using predictors such as digital communication and supply chain management.

2. Literature Review

2.1. Productivity

Productivity (efficiency and effectiveness) can be expressed as output units per working hour or output units per shift (Banya, 2017). Several other experts believe that productivity should be measured in terms of tasks or targets that must be met, rather than hours or days. Labor productivity examines employment concerns and demonstrates that a shortage of work has little effect on production. Productivity is the number of goods and services produced by a worker during a given period (Ongaki & Otuindo, 2015). Increasing productivity has been one of the most significant trading goals for many firms. This is because increased employee productivity helps both the firm and its personnel. For example, increasing productivity will result in good economic growth, increased profitability, and better social advancement (Wolfeld, 2010). Increased productivity tends to optimize an organization's competitive advantage by lowering expenses and producing higher-quality output. In hospitals, productivity is determined by the ratio of outputs to inputs. Hospital outputs include health-care goods and services, whereas inputs include labor, capital, and production elements such as supply chain management and digital communication (Ali et al., 2019).

2.2. Supply Chain Management

Many companies have tried to optimize their production and distribution networks individually, but this approach limits any potential profit increase (Park, 2005). The

distribution system method, known as supply chain management, boosts firm productivity. As a result, during the 1990s, a series of structural and institutional reforms have been implemented, whose major aims were to meet the growing demand for health services and increase the efficiency and productivity of the health system in general, and hospitals in particular (Pham, 2011). However, the direct impacts of impediments and difficulties at supply chain interfaces on a company's productivity have not been examined (Allmayer et al., 2014). Interaction between supply chain partners in delivering products and services is critical for increasing firm productivity. (Volland et al., 2017) shows that supply chain management is very important in hospitals, especially in relation to logistics. Several prior research have found a positive correlation between supply chain and production (Eltantawy et al., 2015; Ugoani & Ugoani, 2018; Zare Mehrjerdi, 2010).

Supply Chain Management includes the planning and management of all activities related to sourcing and procurement, conversion, and all logistics management activities (Eltantawy et al., 2015). It is also important to coordinate and collaborate with channel partners, which might include suppliers, middlemen, third-party service providers, and customers. The SCM philosophy focuses on how organizations use their suppliers' procedures, technology, and capabilities to create competitive advantage, as well as the coordination of an organization's manufacturing, logistics, materials, distribution, and transportation functions (Tan, 2002). There are several contradictory research results that show the influence of supply chain management on productivity. (Allmayer et al., 2014) research shows that several factors of the supply chain do not have a positive impact on productivity. These factors include system problems in the flow of materials from suppliers to end consumers.

SCM concentrating on procurement, for example, may seek to lower the costs of delivering a specific set of inbound commodities. Supply chain management in hospitals in Singapore has been shown to increase productivity related to cost efficiency (Chikul et al., 2017). They may also strive to strengthen supply security. Distribution programs may seek to lower the expenses of moving finished items from a set stock level to the ultimate client, while preserving customer satisfaction above a certain threshold (Otto & Kotzab Friedrich-Alexander, 2003). This is why hospitals need SCM to reduce patient wait times.

H1: SCM has a significant positive impact on productivity.

2.3. Digital Communication

The process of communicating is one part of distribution that is required in business. The distribution of efficient workplace communication is crucial to success and

professionalism. Companies that can successfully disseminate information throughout the workplace are more likely to avoid issues with daily routines. Communication including receiving, processing, storing, and producing messages, is essential for human connection and participation (McLeod, 2018).

Distribution communication as a transaction evolves into a more intricate and practical approach to communication. Several previous studies have demonstrated that digital communication has a significant impact on productivity (Alyammahi et al., 2020; Ferinia, 2015; Thongdonmai & Sujittavanich, 2021). The employment of unskilled personnel and the sluggish adoption of information and communication technology (ICT) were discovered to be the key factors for such low productivity (Hasan et al., 2018). (Kim et al., 2021) showed that the implementation of digital communication focused on ICT did not significantly increase productivity in developing countries. It is difficult to find previous studies that show the same results as this study, with a company analysis unit.

Information and communication technology, sometimes known as digital communication, has continued to progress since the early 2000s, but measured productivity growth has slowed significantly (Fulgenzi et al., 2024). The use of digital communication in hospitals is currently known as Healthcare sector 4.0 / H4.0 (Tortorella et al., 2021).

Communication and collaboration through digital methods and technologies, and the ensuing impact of a worldwide automotive industry on people's productivity (Bolton et al., 2020). Both traditional media (e.g., TV, radio, print publications) and digital media (e.g., apps, widgets, RSS feeds, websites, social media, and mobile devices) can be used to communicate risk, crisis, and catastrophe information. Websites, blogs, and social media are "controlled" by organizations (Mason et al., 2019). Each hospital has a separate digital communication system, so the productivity of each hospital will differ.

H2: Digital communication has a significant positive impact on productivity.

Emerging digital supply chains use corporate digital awareness to work within an ecosystem that iteratively guides digital transformation (Ishfaq et al., 2022). One of the terminologies for digital communication is commonly referred to as big data. As supply chain performance is heavily reliant on information, the use of Big Data Analytics appears to be beneficial in an SCM setting (Kache & Seuring, 2017). When a hospital or organization has a lot of data, it helps with supply chain management. Contrary to previous research results, (Nurmilaakso, 2009) showed that ICT systems or those related to digital communication did not have a significant impact on improving supply chain management.

Several previous research have found that digital communication has an impact on supply chain management (Aćimović & Stajić, 2019; Dehgani & Jafari Navimipour, 2019; Nowicka, 2019). ICTs can be viewed as a valuable tool for improving communication and collaboration among supply chain stakeholders. Digital communication for SCM defines interlaced pathways in which resources, knowledge, competencies, and capacities are merged to boost the productivity of both individual and collective SMEs (Scuotto et al., 2017). According to (Dehgani & Jafari, 2019), information technology improvements, particularly digital communication systems, will improve supply chain management and increase productivity.

H3: Digital communication has a significant positive influence on supply chain management.

H4: Digital communication has a significant positive impact on productivity through supply chain management.

2.4. Research Framework

Based on the theoretical study offered, the following is the research framework (Figure 1):

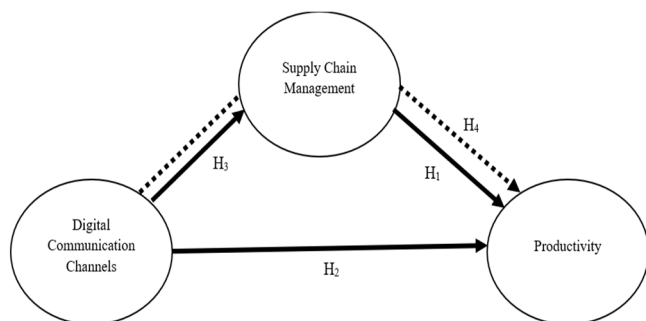


Figure 1: Research Framework

According to Figure 1, this study evaluates four hypotheses, with hypotheses 1-3 investigating direct

relationships between variables. Meanwhile, hypothesis 4 analyzes indirect implications (shown by the dotted arrows in the illustration).

3. Research Methods and Materials

The research design is quantitative and associative. So, this study investigates the impact of characteristics such as digital communication and supply chain management on productivity. The distribution of hospital products and services (SCM) to patients will run smoothly when digital communication is effective and encourages productivity. This study focuses on the largest military hospital in Indonesia. With this research model, four hypotheses are generated and will be tested. This study's analytical method is Structural Equation Modeling (SEM) analysis with the SmartPLS tool.

3.1. Data Source and Sample Frame

The participants in this study were medical personnel from military hospitals from Indonesia. In this study, homogeneity was examined using the following criteria: being a medical personnel from military hospitals and having worked as a medical personnel for at least three years. A total of 265 questionnaires were distributed, only 209 questionnaires were declared valid according to the criteria (minimum work experience of more than 3 years). By using purposive random sampling with these criteria, the number of respondents was 209 medical personnel who were declared to be in accordance with the criteria.

3.2. Measures

This study measured the variables using data from supporting research studies that were deemed appropriate. The following is a variable measurement table in this study:

Table 1: Measurement Variable

Variables	Code	Items	Supporting Research
Productivity (PD)	PD01	I do a lot of work every day.	(Hanaysha, 2016; Wolfeld, 2010)
	PD02	I finish work swiftly and efficiently.	
	PD03	I have high expectations for completing assignments.	
	PD04	My work yields top quality.	
	PD05	I always exceed our team's objectives.	
	PD06	I am productive at work.	
Supply Chain Management (SCM)	SCM01	Hospitals have IT capabilities for implementing services.	(Jacobs et al., 2016; Maqbool et al., 2014)
	SCM02	Hospitals possess adequate e-supply chain capabilities.	
	SCM03	Stable procurement through the network of our key suppliers	
	SCM04	Enterprise application integration amongst internal operations has proved beneficial.	
	SCM05	Real-time search for logistics-related operating data	

Variables	Code	Items	Supporting Research
	SCM06	Real-time integration and linkage of all internal activities, from raw material management to production, shipping, and sales	(Hernández et al., 2023; Karjaluoto et al., 2015)
	SCM07	The extent of computerization for our main customers' orders	
Digital Communication (DC)	DC01	The hospital uses digital communication that is known by patients.	
	DC02	The interaction between digital communication inside and internationally has been beneficial.	
	DC03	Content regarding digital communication is simple to understand.	
	DC04	I believe the hospital employs wireless networks for laptops, cell phones, and other mobile devices.	
	DC05	I believe the hospital has an internal data network in operational areas.	

4. Results and Discussion

4.1. Measurement Model

This study's PLS-SEM testing stage will include a measurement model test. The measuring model in this study will demonstrate the existence of a first and a final model. The final model happens when the loading factor is less than 0.7 (Bongso & Hartoyo, 2022). The values of the digital communication loading factor include DC01 (0.747), DC02 (0.700), DC03 (0.736), DC04 (0.733), and DC05 (0.714). All loading factors in digital communications (DC) have values above 0.7. While DC02 has a value exactly at 0.700, which means it is still acceptable. The values of the supply chain management loading factor include, SCM01 (0.724), SCM02 (0.735), SCM03 (0.737), SCM04 (0.715), SCM05 (0.710), SCM06 (0.712) and SCM07 (0.755). So the supply chain management variable also has a loading factor value above 0.7. The values of the productivity loading factor include, PD01 (0.729), PD02 (0.751), PD03 (0.734), PD04 (0.740), PD05 (0.731) and PD06 (0.726). So that all productivity variable loading factors are also declared valid.

The reliability of the research will be assessed using Cronbach's alpha and composite reliability. Cronbach's alpha and composite reliability levels must exceed 0.7. Digital communication has a cronbach's alpha of 0.776 and a composite reliability of 0.848. The digital communication variable has cronbach's alpha and composite reliability values of more than 0.700, indicating reliabel. The cronbach's alpha score for supply chain management is 0.851, with a composite reliability of 0.887 (higher than ≥ 0.700), indicating its reliabel. Productivity has a cronbach's alpha score of 0.830 and composite reliability of 0.876, indicating reliabel (higher than or equal to ≥ 0.700).

When the average variance is extracted (AVE), the convergent validity test on AVE is pronounced valid. The AVE values for digital communication are 0.528, supply chain management is 0.529, and productivity is 0.541. This value is more than or equal to 0.500. Here is a summary of the measurement model table for this study:

Table 2: Measurement Models

Items	Outer Model Evaluation			
	Factor Loading	Cronbach's Alpha	Composite Reliability (CR)	Average Variance Extracted (AVE)
DC01	0.747	0.776	0.848	0.528
DC02	0.700			
DC03	0.736			
DC04	0.733			
DC05	0.714			
SCM01	0.724	0.851	0.887	0.529
SCM02	0.735			
SCM03	0.737			
SCM04	0.715			
SCM05	0.710			
SCM06	0.712			
SCM07	0.755			
PD01	0.729	0.830	0.876	0.541
PD02	0.751			
PD03	0.734			
PD04	0.740			
PD05	0.731			
PD06	0.726			

4.2. Discriminant Validity Evaluation

The discriminant validity will be evaluated using a cross-loading test. The cross-loading value used to measure the variable must be greater than the other variables. The following is a cross-loading test for this study:

Table 3: Cross-loading (Discriminant Validity)

Code	DC	PD	SCM
DC01	0.747	0.627	0.589
DC02	0.700	0.542	0.637
DC03	0.736	0.587	0.643
DC04	0.733	0.583	0.617
DC05	0.714	0.550	0.634
PD01	0.604	0.729	0.631

Code	DC	PD	SCM
PD02	0.570	0.751	0.631
PD03	0.560	0.734	0.587
PD04	0.602	0.740	0.602
PD05	0.616	0.731	0.613
PD06	0.555	0.726	0.607
SCM01	0.624	0.613	0.724
SCM02	0.664	0.581	0.735
SCM03	0.615	0.617	0.737
SCM04	0.655	0.605	0.715
SCM05	0.585	0.566	0.710
SCM06	0.539	0.627	0.712
SCM07	0.680	0.628	0.755

Based on Table 3, all manifest variables have measured latent variables greater than the other variables (marked in bold for simplicity).

4.3. Structural Model (Hypothesis)

Following the assessment of the outside model, this study will test the inner model, also known as the structural model. Table 4 and Figure 2 show results from testing the structural model. In hypothesis testing, the p-value must be less than 5% or 0.05, at which point the hypothesis is considered accepted and the t-count exceeds the t-table (1.960).

The findings of this study indicate that supply chain management has a considerable impact on productivity (H1). Data analysis revealed that supply chain management had a significant impact on productivity (t-value 8.392 > 1.960, p-value 0.000 < 0.050). Productivity is defined as the efficient use of innovation and resources to raise the value-added content of products and services (Kumar et al., 2016). The efficiency with which a person, machine, factory, or system converts inputs into valuable outputs. This efficiency will be achieved when the hospital can effectively control the distribution flow of products and services from upstream to downstream for patients. Health workers believe that military hospitals have integrated IT capabilities to deliver the greatest care to patients. This study is shown in SCM01, which has the greatest average regarding supply chain management in military hospitals. To give the finest service possible, military hospitals prioritize the use of modern technologies when providing patient care.

Digital communication has an impact on productivity (H2). Data analysis revealed a significant impact of communication on productivity, with a t-value of 4.552 > 1.960 and a p-value of 0.000 < 0.50. Digital communication among employees will help them understand each other, allowing them to work well together and achieve great production. Other research conducted by Ne'Matullah et al., (2021) demonstrates that communication will have an impact on the work productivity of Malaysian construction staff.

Digital communication is a strategic aspect because most construction problems are triggered by violations or poor communication among team members. Digital communication will speed up patient productivity, such as medical approval from doctors for nurses, administrative approval for nurse service processes, and others. Experts anticipate that digitization will result in a 32% improvement in productivity by 2025 (Jeske et al., 2019). This boost in productivity is made possible by more efficient data gathering, distribution, analysis, and utilization. Furthermore, the effects on human factors and the prerequisites for achieving the intended advantages were investigated and reported in this work. Experts anticipate that digitization will result in a 32% improvement in productivity by 2025. This increase in productivity is made possible by more efficient data gathering, distribution, analysis, and utilization. Digital communication about military hospital nurses' productivity is as if they were serving nurses; Of course, they are required to avoid bureaucracy so that communication is fluid and quick. High bureaucracy causes message delays and disrupts communication between employees or divisions. This is what can lead to low productivity. However, hospitals not only need to consider the technological aspect to serve, but also communicate digitally.

Digital communication has a strong impact on supply chain management (H3). The t-value for digital communication on supply chain management was 45.614 > 1.960, with a p-value of 0.000 < 0.050. Currently developments in all industries recognize the term smart supply chain manager. Smart supply chain management is driven by the existence of adequate wireless communication systems (Yuvaraj & Sangeetha, 2016). So, by focusing on digital communication, it will speed up the distribution of goods or services that occur in military hospitals. Proper supply chain management (SCM) has been proven to be critical for an organization's competitiveness since it assures supply effectiveness and proper coordination between suppliers, intermediaries, and market demands. The use of digital communication in the SCM has proven to have a good influence in companies that have used it, especially in terms of procurement, because this increases collaboration, enhancing the quality of information shared between suppliers and buyers (Colin et al., 2016).

One of the study's notable findings is evidence of the indirect impact of digital communication on productivity in supply chain management. The study demonstrates that digital communication has a considerable beneficial indirect effect on productivity via supply chain management (H4). Very few studies address the three links between these study variables. According to (Pfohl & Müller, 2015) study, the importance of digital communication in the contemporary period drives the logistics system (order processing, transportation, packaging, warehousing, stock holding, and

value-added services). This logistics system is related to SCM and will eventually boost customer productivity in a

variety of ways (service, after-sales, and faster distribution of goods and services).

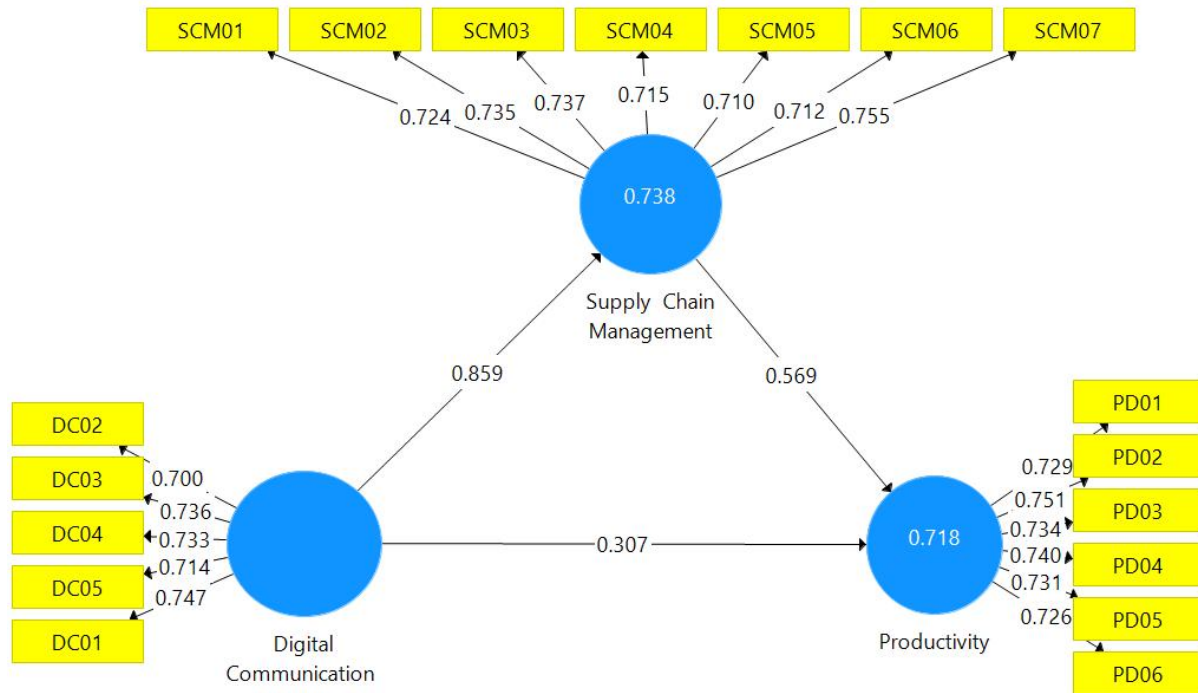


Figure 2: Research Results using SmartPLS (Final iteration)

Table 4: Path analysis & P Values

Hypothesis	Path Analysis	Original Sample (O)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values
H1	Supply Chain Management -> Productivity	0.569	0.068	8.392	0.000
H2	Digital Communication -> Productivity	0.307	0.067	4.552	0.000
H3	Digital Communication -> Supply Chain Management	0.859	0.019	45.614	0.000
H4	Digital Communication -> Supply Chain Management -> Productivity	0.489	0.059	8.290	0.000

5. Conclusions

The productivity of military hospitals is a serious phenomenon. The interest of patients in getting services in military hospitals is very high. The productivity of health workers' services is very necessary and fast. This study shows that to focus on increasing the productivity of military hospitals, it must focus on supply chain management. Supply chain management in military hospitals is related to the distribution of services and products (medicines) to patients. The implementation of effective supply chain management can be recognized by efforts to streamline the process (LSCM) that is not effective in the distribution of services and goods in hospitals. The healthcare business is focused on cost reduction and improving service quality,

and LSCM deployment could be an efficient way to help military hospitals achieve these goals. Military hospitals can apply the LSCM concept to provide services and medicines quickly to patients.

The findings of this study also show the very important role of digital communication in productivity. In military hospitals, the application of ICT is indeed not difficult. However, the application of ICT must be balanced with the loss of hierarchical democracy so that digital communication content or information is more effective. When the digital communication process runs effectively, it will increase the productivity of military hospitals. Health workers will be able to track and act quickly if they get approval from leaders or stakeholders who are related digitally. This digital communication system is what needs

to be considered so that hospital productivity will increase and reduce patient waiting time.

Fast distribution of services and products will occur if the company's supply chain management runs efficiently. The relationship between digital communication and supply chain management can be seen in this study. Digital communication will increase the effectiveness and efficiency of supply chain management. Digital communication will encourage health workers to be able to act more quickly to serve patients. Distribution of services and drugs to patients will be effective when this digital communication runs from top to bottom. Hospital stakeholders will tend to know or be able to monitor the system distribution process. So that it will make it easier for medical personnel to track and accelerate services.

Digital communication plays a very important role in supply chain management. This role also encourages productivity directly and indirectly. Digital communication in hospitals not only facilitates the communication process but can build engagement with all stakeholders. They can communicate quickly, share information and knowledge so that decisions are made quickly. This speed will encourage high productivity and accelerate the distribution of services and medicines to patients. The contribution of this research is related to testing indirect digital communication on productivity through supply chain management in military hospitals. This study also has limitations related to the potential for data collection, it is very difficult to obtain research permits at other military hospitals. So that future researchers can also replicate or compare research results to different industries or private hospitals. It is hoped that this research can also be conducted in other developing countries.

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