Asia Pacific Journal of Advanced Business and Social Studies
ISBN (eBook): 978 0 9943656 7 5 | ISSN : 2205-6033
Year: 2023, Volume: 8, Issue: 1

ASSESSMENT ON IMPROVEMENT OPPORTUNITY OF INTERNET-OF-THINGS IN SUPPORTING THE SUPPLY CHAIN MANAGEMENT OF PT. CIPTA ADHYABUSANA (DUST)

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Abstract

As a result of the present trend toward digitization, corporate adaptability has become one of the most important components in assuring industrial sustainability. The fashion sector is not an exception, as severe rivalry on a local and worldwide scale indirectly drives the demand for sophisticated, business-effective technology. As a practitioner in the Indonesian fashion industry, PT. Cipta Adhyabusana (DUST) is committed to implementing internet-of-things in their internal management for the sake of corporate competitiveness. Certainly, every business has its own issues and/or obstacles, and DUST is no exception. The internal management of this fashion company continues to struggle with data entry and production timeliness. DUST has implemented internet-of-things-based apps that effectively control multiple aspects of their supply chain management. However, the management is indirectly hindered by the software's inability to handle the remaining components. Consequently, this research focuses on an evaluation of the internet-of-things' potential for development that can be applied effectively to management in order to eliminate impediments and raise the company's efficiency and production effectiveness. The research is backed by primary data collected through interviews with key stakeholders and secondary data gained through a review of the literature. The analytical process completed by the Grounded Theory Analysis will generate substantive theories that will be proposed as part of an implementation strategy. The outcome of the research is to upgrade the current applications with Cyber Physical Systems (CPS).

Keywords: Supply Chain, Internet, Internal Management, Production Effectiveness.

1. Introduction

Entering the age of digitalization, the fashion industry worldwide develops comprehensively. The practicality of communication technology and social media stimulate many entrepreneurs to seize the opportunity and use the convenience of online marketing and sales to develop their brands. Not only old, conservative players who have been in the industry for years that consider this opportunity, new ventures are also starting to make their fortune in this potential industry. Specifically in Indonesia, driven by the help of governmental regulations that encourage the society to be entrepreneurs and build their own Small and Medium Enterprises (SMEs), many new fashion brands are starting to emerge and compete in the open market. Although the situation can be such a huge potential to develop business, this can be a threat to convenient industries who have rooted corporate culture.

Corporate agility and the practical shrewdness of technology and tools are two of the most essential things that a corporation should have to increase its productivity (Ooi, 2019).

Conservative brand businesses who have been used to sell their products directly to the department stores and outlets should reconsider their business strategy, reckoning the online business utility platform that starts to grow popular among the people, namely the potential customers due to their convenience and accessibility. Many of these platforms enable not only existing brands which have been registered under the law of Indonesia to market their products online, but also individuals who may want to initiate a new business opportunity. Therefore, an agility and savviness of technology might be a beneficial force to empower an established corporation to sustain in the industry by restructuring their marketing method. But how about the production management system?

A good Supply Chain Management (SCM) that is agile and innovative being implemented in a company might give the company the ability to deal with uncertainties in the environment, which improves the company's flexibility and responsiveness towards the dynamic market demand (Abdallah et al., 2021). A study states that the implementation of information technology towards the SCM system lessens challenges associated with poor distribution networks, less advanced production, and low manufacturing skills. Therefore, it may be concluded that the relationship between innovation capability, namely materialized through the use of technology implementation with the SCM may propel one firm's performance (Singhry, 2015). Then, the next task will rely on how technology implementation may support the SCM system, and what is the parameter being conducted to review the utilization of the technology itself towards the performance of the supply chain, especially in an established fashion brand company that has not implemented any technological support in their SCM system.

The use of IoT, especially in conjunction with the industrial trend of 4.0 that focused on not only digitization but also automation is undoubtedly impactable towards the practicality of SCM. The use of IoT in supporting the SCM may cover some aspects such as information linkage, obtaining real-time progress data, inventory tracking, joint ordering, real-time maintenance, and other similar subjects. Although convenient and promising, the main problem why many companies still hesitate to invest in IoT implementation is because of the prejudicial impression of insidiousness, pervasive, and ubiquitous. To be simply-put, the lack of proof from practitioners who have tried in advance to implement IoT in SCM halt the spreading process of the innovation. Therefore, the main objective to be solved will be about highlighting and conceptualizing the abstract idea of IoT implementation into various ways of connecting all channel partners anywhere and anytime, improving practicality (Vass et al., 2020).

Locally, research data collected by Asia IoT Business Platform (AIBP) states that less than 10% of companies in Indonesia have utilized the use of IoT. The exact number of 8,9%, which is positioned below neighboring countries such as Thailand (with the exact number of 10,7%) indicates that digital transformation of IoT needs to be pushed further in supporting the quality of local enterprises. The need is highly supported by another data gained from the same surveyor, which shows a number of 78,5% respondent agree that all companies should start adopting digital transformation of IoT (CNN Indonesia, 2019).This research is also align to another research conducted by a giant consulting company, Boston Consulting Group (BCG) which estimates that Indonesia's cloud public market is projected to grow 25% annually by 2023, showing the potential improvement of IoT implementation (ASEAN, 2022).

2. Problem Statement

Considering the need to embrace digitization holistically in all sectors of the company, PT. Cipta Adhyabusana (DUST) had initiated some managerial shifts in alignment with the current technology. As an enterprise that operates in more than 20 cities all across the country, currently there are some lingering hindrances regarding data inputs and production punctuality. While so far DUST has been performing adequately fine, any improvements that can be implemented to solve the hindrance can be beneficial to the company. Regarding the data input

problem, currently any data being inputted from each distribution center was done manually. While DUST currently has maintained the gap between actual and imputed product stocks to be lower than 1% of the monthly total sales, usually in the average range of 0.3% to 0.4%, any methodological breakthrough that can be implemented to lower the gap should be conducted to minimize the error. When being imparted with the lean six sigma standard, the current condition that has been maintained by DUST has only reached the range of sigma level 4. Currently on average, DUST has been able to sell about 30.000 to 40.000 items in a month, that a 0.3% gap (that is between the average range of monthly gap between the actual and imputed stocks) may be counted as 90 to 120 items considered as missing. If the average price of each product is Rp120.000 (this measure is taken using the standard price of DUST's shirt product), the possible monthly profit can decrease from about Rp11 million to Rp15 million, which is about 4-5% of the total monthly income. An automated real-time data input should be considered to resolve the hindrance.

Aside from the data input problem, another problem that inhibits DUST's overall operations management is the quality controlling problem in procurement. As DUST fully control and carry their own manufacturing process on the on-site factory, material sourcing, procurement, and manufacturing is a complex supply chain sequence to be maintained consistently. The owner and CEO of DUST, Matthew Aldo Susabda stated that their factory's machines should always operate at the minimum of 80% capacity in order to avoid additional expenses that may occur when some production lines are not operating maximally. The punctuality problem usually relies on the manual quality control checking, which usually takes time as every roll of fabrics should be laid out open completely, checked by the assigned persons to mark every defect, assess the severity of the defects, and assign it to the computer program for designing patterns, before the fabric is then processed into apparels. When this whole process is laid back, the production will also be delayed and the machines cannot operate at the minimum capacity.

For companies that operate in the digital platform to control regional-scaled omni-channel operations, an adequate cloud based IoT system should be done to accommodate an integrated management system that will still be available for future development in response to potential changes. Currently, DUST adopted a simple customized Enterprise Resource Planning (ERP) Software which covers supply chain functions to the extent of inventory management, distribution, and retail/sales. The benchmark of the custom ERP that DUST developed is the simplification of the well known German multinational ERP-based software product Systemanalyse Programmentwicklung (SAP), adapting main functionalities that are useful to support daily operations. To be expected further, as the ERP software developed by DUST currently has not been able to resolve some lingering hindrances, and it will be better if the ERP software can be developed further to cover detailed product sourcing and manufacturing processes which will can integrated with Radio Frequency Identification (RFID) technology.

In conclusion, this study will assess how far is the IoT implementation that PT. Cipta Adhyabusana (DUST) is currently used in their Supply Chain Management (SCM) system. Since the utilization of IoT is convenient and prospectable, it may benefit the company by improving their SCM quality and ease many existing inhibitions when being applied properly to its full extent. Identifying the gap between the current condition, in comparison to similar enterprises which have successfully implemented the IoT in their SCM and analyzing the deficiency in the manufacturing problem will result in a methodology recommendation for DUST, which is intended to ensure a sustainable product operation for the company's longevity.

3. Business Exploration and Opportunity Analysis

Every improvement, no matter how insignificant it may seem, has always been driven by either urgent issues or potential opportunities. Mainstream issues in PT. Cipta Adhyabusana (DUST) such as data input and quality control problems can be improved further through the use of

technology, which can be done through upgrading the coverage and performance of Enterprise Resource Planning (ERP) that have been implemented by DUST to adapt technologies such as RFID and sensors. This is beneficial especially in consideration of manual data input and material checking that tends to cause inhibitions. For instance, the laborious manual process of material checking can be merged and conducted simultaneously using sensors which send information on the defects and determine the most efficient layout that maximizes the material used. While so far the company can cope up with the lengthy manual checking process, this opportunity can save much time and cost expenses due to laid back productions.

The Fishbone Diagram (or Ishikawa Diagram) may be used as a tool in analyzing General Purpose Technology (GPT), which can be defined as a technology that has much scope for improvements to be widely used (Coccia, 2017). In order to support the research, the main identification source that is used for the mapping relies on the data gained through the interview with the CEO, head of production, and head of sales and operation of DUST. There are four factors that serve a role in determining the corporate's readiness to improve their IoT implementation, which are Man, Machine, Method, and Material. 'Man', as a simplified term of human resource, should be aware of the opportunities and the readiness to embrace changes, and 'Machine' should be sufficiently and evenly prepared to provide the platform needed. 'Method' or more specifically the corporate culture and adaptability of the company as a whole, should be discussed and elaborated thoroughly to all DUST's distribution centers all across Indonesia, in alignment with their main office and production factory. Also undeniably, proper adjustment of current 'Material' will contribute to the fruitfulness of a new implementation.

Corporate loyalty attributes strongly to the man factor, as the implementation of new technology usually requires some amount of training time in addition to the supporting skills of technology-savviness. Therefore, the trained personnel should be able to develop a database mindset, which allows data to be evaluated and reviewed to propose the operation flow, while adapting to the conformity between the previous manual process and semi-digitized. Then, proper material should be installed as a software to support the new technology implementation, which at least provides a channel for multi-device connection and is integrated to the cloud based ecosystem for data storing. Finally for the hardware which is the machines, purchasing several machines that can be customized to the IoT ecosystem is mandatory, which also considering the designated production capacity.

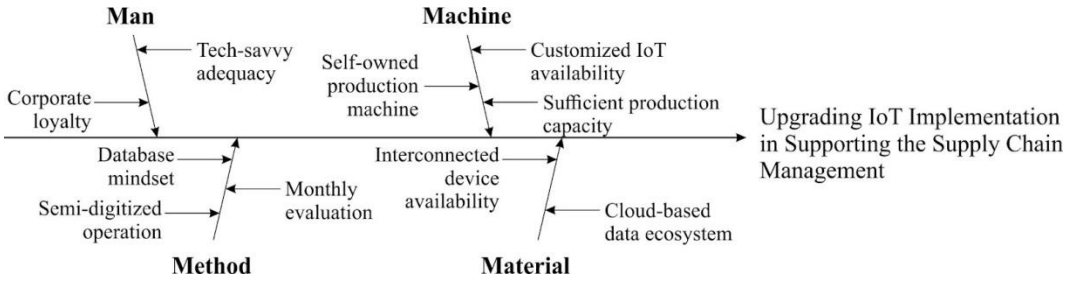

Figure 1: Opportunity Mapping using Ishikawa Diagram

As an alternative to SWOT analysis, NOISE analysis can be used to analyze the opportunity based on a solution-focused approach (Cardus, 2017). The NOISE analysis acronym stands for Needs, Opportunities, Improvements, Strengths, and Exceptions. Opposed to the SWOT analysis that mainly focused on determining one's capabilities without mapping the issues and solutions, the NOISE analysis is more suitable in supporting a strategic analysis that is focused on building improvements. When being socialized to the team, NOISE analysis tends to be more acceptable as it proposes the positive mindset of "What do we need?" in contrast with the common mindset of "What are our challenges?" (Cuofano, 2022).

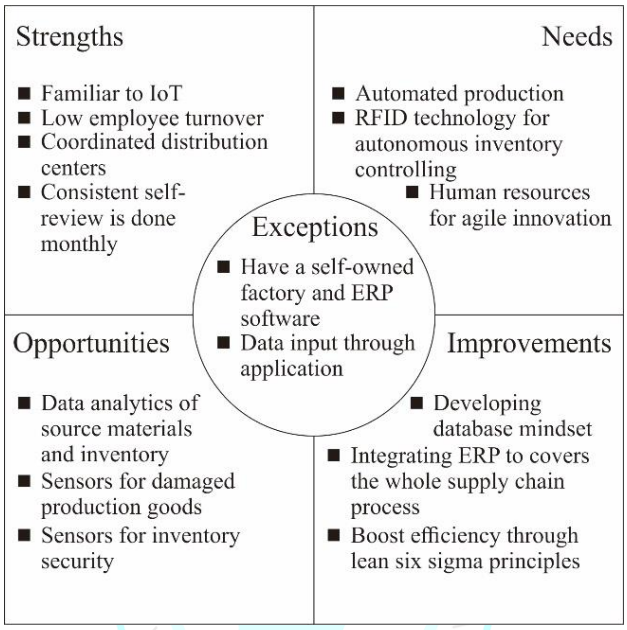

Figure 2: Opportunity Analysis using NOISE Framework

4. Research Flowchart

The research framework flow starts from problem identification. This initial step describes the kind of issues or hindrances that lingers in the operation management of PT. Cipta Adhyabusana (DUST). Then, detailed description of each issue or hindrances will be explored afterwards in detailed narratives, which includes the effect of the problem stated previously towards the company and proposing hypothetical solutions through the consideration of technological improvements which utilizes the IoT. By conveying the thorough picture of the issue, assessing the business situation will be the next measure to the research. Essentially, the business situation exploration considers the industrial environment and growth potential of the industry and enterprise. Therefore, stakeholders analysis and opportunity mapping are noteworthy factors that should be conducted throughout the phase to define the proper opportunities that may solve the lingering issues.

After perceiving the issues and the whole business context that relates to it, data collection will be conducted through interviews toward related stakeholders. Simultaneously, as this research itself corresponds to several preceding research, literature review will elaborate relevant information regarding the details of each theories and hypotheses proposed throughout the assessment. Then, the data gained through both phases will be synthesized and analyzed through Grounded Theory Analysis by utilizing coding methods, which generate several findings to be defined as a substantive theory that proposes a recommendation to upgrade the existing IoT implementation. Towards the end of the research, the recommendations will be reviewed by

the CEO of DUST to earn justification that the result may be beneficial towards the company. Therefore, an implementation plan can be generated to acquire the final management results, which throughout the process will also be evaluated to ensure the originality and integrity of the research for publication.

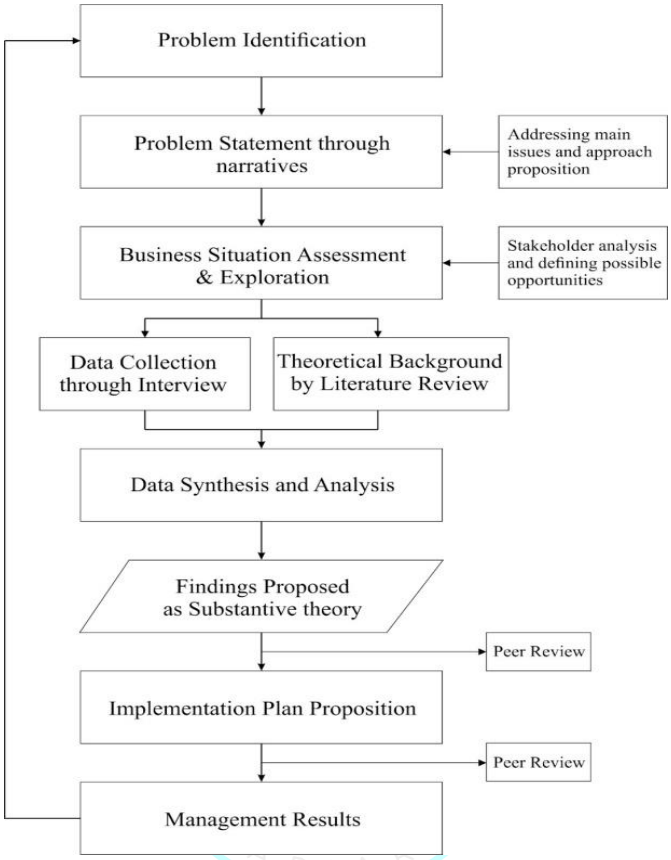

Figure 3: Flowchart for Research Design

5. Descriptive Coding Analysis

While the Grounded Theory Analysis describes the three stages of the analytical process, preliminary or initial coding introduction should be first conducted towards the raw data gained from the interview. In this case, descriptive coding aims to trim any unused or widened conversation in the interview transcript, that may be irrelevant in contributing to the analysis result. In this case, although there are several choices of initial coding methods, descriptive coding can be used as consideration towards multiple interview spokespeople of the same research theme. In short, descriptive coding is used to summarize the data by using a single word or noun that expresses the wholeness of the theme, which is useful to direct the flow of analysis in the next cycle (Crosley et al., 2020; Lim & Rasul, 2022; Lim et al., 2022). The result of the descriptive coding analysis can be seen towards one example of the text fragment in the interview towards the CEO of DUST.

Question : So, considering the achievement gained by DUST this far, how is DUST currently prepared to embrace the adoption of new technologies? For example from the perspective of corporate culture or budgeting, as well as the human resources and adaptability, since it is also important.

Answer : The most important thing is our employee should have a database mindset, which means that they prioritize data gained from external information and also

field experience and facts upon developing and executing a strategy, which is more specific. If we don't have any data, or if we put aside the data as some people might consider it as too bothersome, we will only do everything by hunch and feelings. It is a culture that is essential to be shaped into a mindset. Also in the form of work structure, we prepare our team more specifically, for example in every region we put people that can support in the decision making, which we called them as inventory controller and data analyst for providing other division real time data and strategy proposition and direction.

Code : Mindset

As there are three respondents which the interview was being addressed to, which is the CEO of DUST, the Head of Production, and the Head of Sales and Operation, the initial coding process analyzes the theme of each question to be identified as the description of the corresponding response from each source towards the corresponding questions. From the CEO of DUST, the codes are "Retail", "Divisions", "Coordination", "Coordinators", "Existence", "Satisfaction", "Mindset". From the Head of Production, the codes are "Inputs", "Adaptation", "Benchmark", "Challenges", "Deficiency", "Limitation". From the Head of Sales and Operation, the codes are "Balancing", "Mindset", "Consistency", and "Consideration". These codes, also called as labels will be analyzed further in the second cycle, which is the three steps coding process.

6. Three Steps Coding Analysis

The three steps codification process which is conducted in the practical usage of Grounded Theory Analysis. The first step is open coding, and as its name would imply, is used to identify theoretical possibilities in the qualitative data (Arifin, 2022). Since the responses to every question have been labeled and can be identified as a theme, the open coding will identify details of the response in cautious consideration of the theme, which result in the listing of sub-idea. One example of the sub-idea listing process can be seen towards the same question being asked previously in the descriptive coding.

Code : Mindset

Answer : The most important thing is our employee should have a **database mindset**, which means that they **prioritize** data gained from external information and also field experience and facts upon developing and executing a strategy, which is more specific. If we don't have any data, or if we put aside the data as some people might consider it as too bothersome, we will only do everything by hunch and feelings. It is a **culture** that is essential to be shaped into a mindset. Also in the form of **work structure**, we prepare our team more specifically, for example in every region we put people that can support in the **decision making**, which we called them as inventory controller and data analyst for providing other division real time data and strategy proposition and direction.

Sub-idea : Database mindset, priority, culture, work structure, decision making

The next step is axial coding. Axial coding succeeded open coding in terms of organizing data and information. But opposed to open coding which distributes the themes into sub-ideas, axial coding aims to draw the connection between sub-ideas, while identifying which ideas are the most important and relevant in consideration of the research questions and objectives (Limpaecher, 2021). Axial coding will collect all data gained from open coding, and then regroup it into subcategories in order to find the outline of the whole interview process. Unused codes or

Sub-Ideas that are collected altogether will be discarded when it does not have any direct relation to the categories. The whole process of axial coding can be seen on Figure 4.

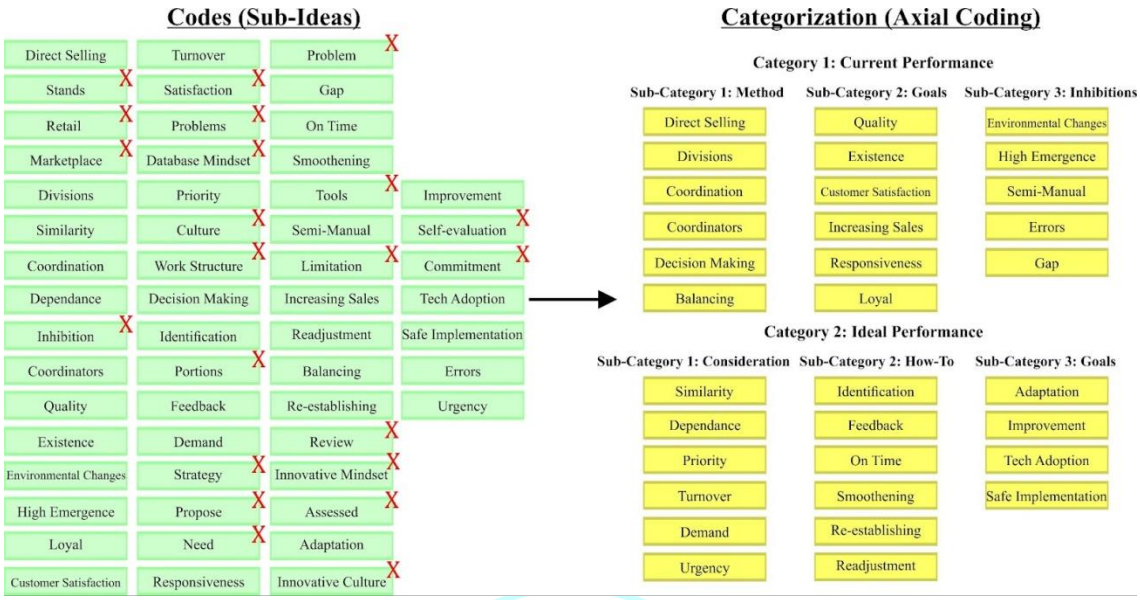

Figure 4: Axial coding analysis

The axial coding process categorized all of the codes into two categories, that is the current performance (of DUST) and the ideal performance, which this research aims to propose. The first category, the current performance, is divided into three sub-categories, which is 'method, goals, and inhibitions'. Method is the current application and concern that DUST focused in implementing their business, goals is the current general target that DUST endeavored to maintain especially during the last pandemic, and inhibitions are all of the things that causes deficiency to DUST's business operations. The second category, the ideal performance, is divided into three subcategories as well, which is 'consideration, how-to, and goals'. Consideration is the things that DUST should consider in preserving their business for future sustainability, how-to is the practical application of how DUST should do in order to preserve their business operation, and goals, quite distinct from the first category, is the future target that DUST should achieve and implement particularly to improve their supply chain management performance.

In the left section of Figure 4, several codes or labels are discarded from the list to be included in the axial coding. In order to fit into the categories, codes that do not have any direct relationship or that are too general will not be inputted to the axial coding categorization. For example, codes such as innovative mindset, database mindset, work structure, and culture do not have any direct relationship with the current performance or ideal performance, as those describe the internal company's state of mind, and codes such as limitation, strategy, problem, and tools can be considered as too general that barely shows any information to any subcategories.

The final step of the Grounded Theory Analysis is selective coding. While axial coding categorizes all of the labels gained from open coding into categories and sub-categories, selective coding defines a core categories that is resulted as a derivation between the link of the categories and subcategories, which is to define a new theory or modify the current theory (DelveTool, 2020). In other words, selective coding creates the path for a "story line" that describes the

interrelationships between categories in high consideration of the research questions (Schwartz, 2021). The analysis can be seen on Figure 5.

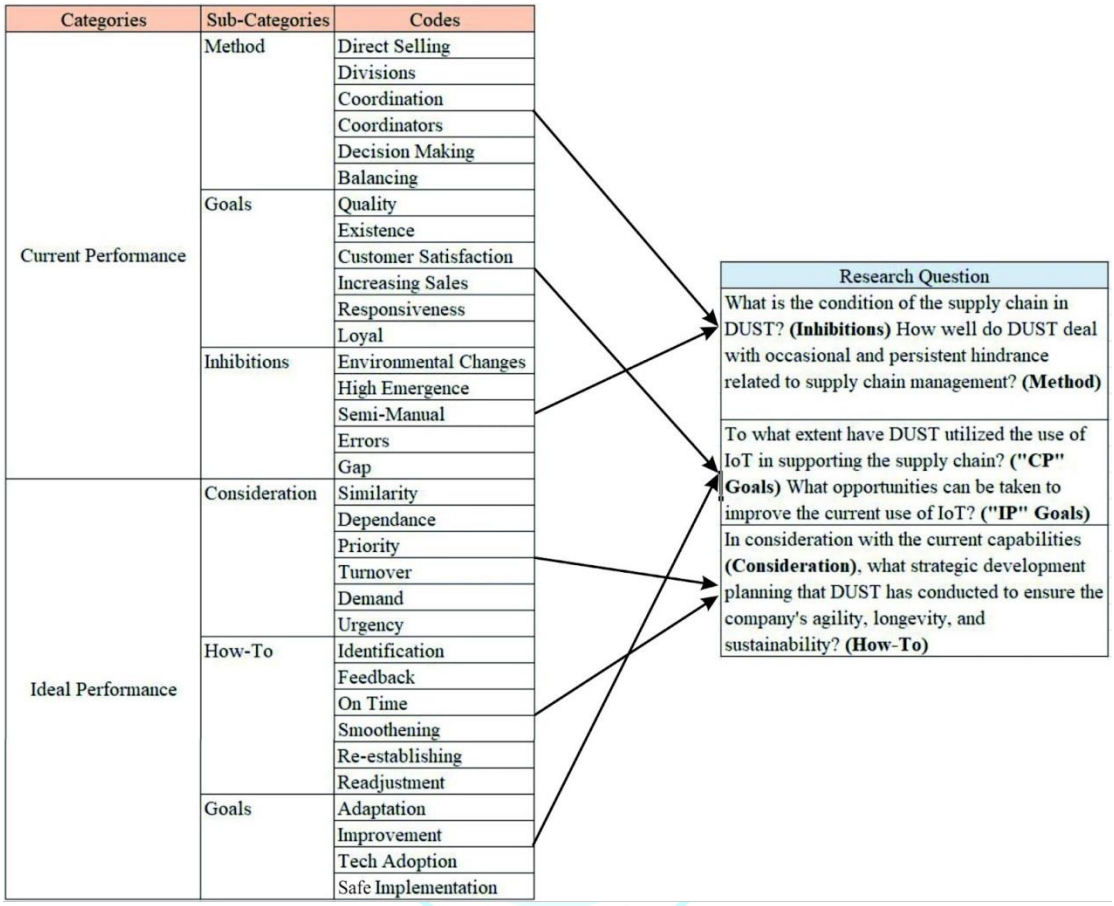

Figure 5: Selective coding analysis

The subcategories of current performance category, specifically the method and inhibitions contribute to answer the first research question, which inhibitions describes the current condition of the supply chain, and method describes how DUST deals with the hindrances (or inhibitions) that lingers in DUST's supply chain. Then, the second research question highly considers the goal of the current and future conditions of DUST. The current performance goal describes how far has DUST accomplished the utilization of IoT in supporting their supply chain management, and the ideal performance goal describes what opportunity concerns that can be adopted in order to improve DUST's supply chain in the future. Finally, the last research question requires the identification of DUST's current capabilities to improve, in which the codes of consideration can be used in response to the question, and strategic development planning asserts the "how-to" that DUST will be going to apply in improving their supply chain management.

7. Findings

The final coding process, which is selective coding, generates six main points in response to the corresponding research question (two points for each research question). When being modified into parts of a "story line", the six points can be elaborated as follows:

1. The current supply chain condition of DUST has been going well, but there are some external factors which inhibit the performance, such as (business) environmental changes and high emergence of competitors, and internal factors such as semi-manual operations, errors, and count gaps.
2. To cope up with those inhibitions, DUST utilizes a direct selling method to their customer, which is conducted through their operational divisions that coordinate with one another and is led by their corresponding coordinators from the main office, and direct their decision making strategy to balance their sales evenly between onsite outlets and marketplace.
3. Specifically in the scope of supply chain management, DUST has utilized their self developed ERP system which ensures the supervised service quality and responsiveness between their main office and the outlets. To stay existent in the recent pandemic, customer satisfaction and loyalty becomes the goal to be served by the ERP IoT implementation.
4. As the pandemic has calmed down, DUST devoted themself upgrading their current ERP system to adapt to the fluctuating market demand and to improve consistently, which includes new technologies adoption into the current ERP system such as automated in-store stock checking feature while preparing the safety factor for further implementation.
5. In the preparation of improvement, DUST has to consider some elements. Operation method similarity (uniformity) between outlets and reducing dependency towards the main office (autonomy) are two things to be prioritized, and while consistently assessing the urgency of particular market demands.
6. To ensure sustainability and longevity, a proper brand re-establishing and readjustment in the supply chain should be done in order to smoothen the overall supply chain. The readjustment can cover practical things such as punctuality, consistent problem identification, and customer inputs.

In order to weave all points together and create a proper "story line" holistically, the essence or substance of the narratives should be generated as a substantive theory. As one of the outcomes of grounded theorizing, substantive theory can be constructed through the enhancement of understanding in identifying similarities and differences of contextualized narratives (Adelman, 2010). In this research, the substantive theory can be constructed and proposed as a direct response towards the six point narratives, which settle the concerns listed above. The weaving results, which is the substantive theory, can be written as follows:

"Considering the inhibitions which come from external and internal, a strategy should be implemented in order to balance DUST's sales. The strategy which specifically aimed at the supply chain management is to utilize the current ERP system in maintaining the service quality, while potentially upgrading it for the company to improve consistently. The improvement has to consider the aspects of uniformity and autonomy, and delivering smoothness in the supply chain".

To answer the substantive theory, Cyber Physical Systems (CPS) can be implemented in the existing ERP system to cover the hole in the supply chain, which is still being conducted semi-manually as the opportunity to be taken. Inhibitions such as errors and gaps will also resolve through the implementation. By definition, the Cyber Physical Systems (CPS) is the integration of computer and physical facilities of a system, in this case is the supply chain of DUST, which is monitored by computer and interconnected to the internet (Ramaiah & Satyanarayana, 2020). The practical application of CPS will cover the production process, which will identify the defects during the quality control process and increase punctuality, and also the retail, which implements barcode technology in every product that is being distributed from the main office to every outlet. To be put simply, it will enhance the current ERP system.

In the production process, sensors can be adapted into the cloth material processing machine in order to scan the location of the defects, and the severity of it. The scanned data will be processed and connected to the computer, which will automatically develop the planned product pattern which avoids the defects, and maximize the material usage and increase material effectiveness. On the other hand, the barcode technology implemented in all of the products will increase efficiency and accuracy, as every single product will be listed in the database that is interconnected to every retail store. This way, all storekeepers and coordinators can check product availability throughout all of their outlets accurately in the real-time.

8. Conclusion

In order to stay in the middle of the fierce competition and business environmental incidents such as pandemic, PT. Cipta Adhyabusana (DUST) should reconsider the condition of their company, especially in the scope of supply chain. Through the research, it can be concluded that the condition of DUST's supply chain has been going well, although there are some inhibitions such as product gap count and punctuality that makes the operation not optimal. In order to deal with these inhibitions, both external and internal, DUST has conducted a direct selling method to their customers through their outlets and marketplaces in order to minimize complexity in the selling process, which is managed by head divisions from the main office. Then, the self-developed ERP system called Fortis is the practical IoT usage that is being used by DUST that has covered the inventory management, distribution, and sales, which so far has been contributing in maintaining responsiveness and preserving customer satisfaction. Furthermore, new technologies adoption into the existing ERP system such as automated in-store checking features and also the Cyber Physical Systems (CPS) can serve as a considerable improvement that completes the current ERP usage. Finally, the company's agility, longevity, and sustainability depends on various strategies such as uniformity and autonomy, and also readjustment to the current work structure, especially upon the introduction of new technology adoption should it be needed.

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