International Conference on Business Research
University of Moratuwa, Sri Lanka
December 04, 2023

https://doi.org/10.31705/ICBR.2023.7

A PROCESS ARCHITECTURE APPROACH FOR DEVELOPING STANDARD OPERATING PROCEDURES FOR MANUFACTURING ORGANIZATION

R.A. Delpagoda*, P.D.E. Anjana, M.K.S. Kavindi, and A.S.D. Weeraman

Department of Management of Technology, University of Moratuwa, Sri Lanka
*delpagodara.19@uom.lk**

ABSTRACT

To obtain any authority or certification, such as the International Organization for Standardization (ISO), an organization must have standard documentation of the activities occurring on that premises or network. Having standard operating procedures (SOP) enables the company to perform its work to a standard. This paper focuses on developing SOPs for one of the Fast-Moving Consumer Goods (FMCG) organizations in Sri Lanka. This study is expected to help obtain the ISO 9001-2015 certification, which was a problem for the concerned Company. The main topic of this research includes process identification and standard operating procedure development for production, warehouse, and procurement processes. The value-added activities are identified through the impact matrix. The process architecture approach has been used to develop the much-needed operational SOP. Using the process architecture approach is the innovative approach in this study. Data collection for the study was done by using interviews, observations, and company records. By having a good interaction between researchers and participants, it is possible to follow the qualitative methodology. This provides a deeper understanding of the subjective aspects of the research questions. After the identification of critical processes, the qualitative attributes required by them for ISO 9001 - 2015 were recognized and the SOPs related to the existing three processes were developed in this study.

Keywords: Landscape model, Process architecture approach, Standard operating procedures

1. Introduction

The reference company is in the Fast-Moving Consumer Goods (FMCG) industry, and they are aiming to obtain ISO 9001: 2015 quality certification. This study aims to develop SOPs for procurement, warehouse, and manufacturing processes related to two production lines of the manufacturing company, enhancing customer satisfaction and compliance with specific quality management system requirements.

This study focuses on the development and use of standard operating procedures (SOPs) in procurement, warehouse, and manufacturing processes, highlighting their importance in a successful quality system, and ensuring consistent quality and integrity. The base

company faces issues with operational SOPs not complying with ISO 9001 standards. To address these issues, a process architecture approach, taught in Business Process Management, is being explored. This research aims to develop SOPs for procurement, warehousing, and manufacturing processes to enhance quality and improve processes, ensuring the company obtains ISO 9001:2015 quality certification. This approach is unique and innovative.

This study aims to develop a comprehensive set of SOPs for ISO 9001: 2015 quality certification, utilizing business process management knowledge to bridge the gap with the process architecture framework. Three research questions were identified in the study. They are, "What are the existing process architecture frameworks for production procurement and warehouse processes," "What are the existing processes in the organization in comparison with the process architecture framework," and "How to standardize the process using the process architecture framework"? Our first objective can be identified through the existing processes and process architecture framework literature review. Then, the processes of the company are procurement, warehouse, and production identified in the process architecture framework. The objectives are to identify core and supportive processes, compare existing processes with the process architecture framework, and develop a complete set of SOP documents. This study focuses on creating Standard Operating Procedures (SOPs) for procurement, warehouse, and manufacturing to bridge the operational gap and achieve ISO 9001: 2015 quality certificates. It uses a Business Process Management perspective to map processes and scope, enhancing overall performance and sustainable development initiatives for the reference company.

2. Literature Review

2.1. What is the process?

Processes in a company involve activities that add value and yield outputs. ISO 9001:2015 requires creating SOPs for these processes, emphasizing the importance of identifying and prioritizing them based on their business value (Lambert, 2008).

2.2. What is business process architecture?

Organizations use frameworks like Porter's value chain in business process architecture to categorize their processes into core, supportive, and management processes. Core processes are vital for sustainability, and support one's aid core activities, and management processes provide strategic oversight (M. Dumas, 2018). These categorized processes are organized hierarchically (level 01, level 02, level 03) to create a blueprint for resource management, documentation, and performance measurement (Leonardo, 2020).

2.3. Applications of process architecture framework

The process architecture framework is a versatile tool utilized across multiple industries for process enhancement (Li, Fang, & Liang, 2023). In the apparel sector, it improved

manufacturing by addressing function, information, and dynamics. In IT, it categorized activities into core and support functions, resulting in 43 new business implementations that boosted IT service management efficiency (Jayaraman). Telecommunications also found value in the framework by integrating core functions into the value chain for product development (IT in Business, 2017). Additionally, some organizations have innovatively used this framework to achieve ISO 9001 documentation and simplify macro process development into five levels (Barros, 2007).

2.4. Nature of manufacturing, procurement, and warehousing process in a manufacturing organization

The manufacturing process encompasses various activities, from collecting raw materials to delivering finished products, including production, research, customer service, and distribution (Manufacturing principles and processes, 2010). Batch production, a focus of this research, involves converting limited inputs into finished products over a fixed time frame, commonly found in chemical plants (J. Semrau, 2021 June). Batch processes are characterized by low instrumentation, variable production volumes, and order-dependent planning.

Procurement is the comprehensive process of acquiring goods and services through various means, vital for achieving organizational goals. Over time, it has evolved from traditional methods to a sophisticated function, driven by the need to enhance supply chain quality and reduce costs (R. Shimelmitz, 2020).

Warehousing is a critical component in supply chain management, playing a pivotal role in storing raw materials and finished products for production and distribution. It exerts a substantial impact on the entire supply chain, influencing efficiency and effectiveness. Beyond storage, warehousing involves a range of activities facilitating the movement of materials within an organization (McGinnis, n.d.). The evolution of warehousing concepts has aligned with industrial advancements, from Warehouse 1.0 in the Industrial 1.0 era to Warehouse 4.0 in the Industrial 4.0 era. Key warehousing processes include storage, receiving, putting away, order picking, and shipping (E. Krauth, n.d.).

2.5. The importance of standard operating procedures in ISO 9001

ISO 9001's primary purpose is to establish quality management system requirements, which are essential for companies to attain their goals effectively (Petrigna, 2022). Developing standard operating procedures (SOPs) within this framework offers numerous advantages, including risk reduction, process consistency, cost savings, and improved quality (Fonseca, 2018). ISO 9001 certification yields external benefits like enhanced corporate image and customer relations, along with internal benefits such as reduced nonconformities, clarified personnel roles, fewer customer complaints, and increased staff motivation (Sampaio, 2008).

2.6. Methods used while developing operation procedures according to ISO 9001

Adopting ISO 9001:2015 standards involve structured documentation of processes, procedures, and work instructions. The Belgian Red Cross appointed a Quality Coordinator, provided team-wide training, and emphasized continuous improvement. (Borra) PT Sejahtera used interviews and surveys with department heads, along with an ISO 9001:2015 checklist, to establish procedures and assess compliance. These approaches emphasize systematic adherence to ISO 9001:2015 for effective quality management (iso-9001-2015-requirements., n.d.). When a company documents its QMS to meet the requirements of ISO 9001:2015, it must clearly and concisely identify its processes, procedures, and work instructions. When documenting a QMS, a company should always have a basic understanding of how to efficiently categorize the functionality of their management system. Simply put, process, procedure, and work instruction. process is what needs to be done and why. The procedure is how the process needs to be done. Work instruction explains how to carry out the procedure (iso-9001-2015-requirements., n.d.). The leader of each department that is currently operating in the company completes the questionnaire. HRD, Marketing, Procurement, Inventory, Production, PPIC, IT, QC, and QA are the departments involved. The outcome of employing the ISO 9001: 2015 requirement-based checklist to implement PT Sejahtera's gap analysis. The rating is based on the responses to the questionnaire that the company's department heads completed (Ahmudi, Purwanggono, & Handayani, 2018).

2.7. ISO 9001 barriers to operating procedure development

Implementing ISO 9001 involves correcting process inconsistencies, but barriers like poor communication and coordination across departments, insufficient top management commitment, and regional challenges like employee resistance and resource constraints can hinder success (Bounabri, 2017). To achieve successful organizational change, good change management is important to ensure that desired results are achieved. When implementing change to achieve desired results, communication is essential. Barriers such as scarcity, lack of top management commitment, misunderstanding of the objectives and process of change, and resistance are always involved. This change has to be done in order to achieve ISO 9001. Therefore, it can be said that this obstacle can come (Bounabri, 2017). The obstacles include understanding ISO certification, quality audits, documentation, data control, and resource limitations for small businesses. Auditor knowledge gaps and high implementation costs are also concerns (Mitchell, 2022). These were found when studying further barriers, lack of communication, Lack of top-management commitment and Lack of coordination between departments. Lack of communication is Lack of coordination across departments as a result of poor internal communication between departments can be a significant obstacle to the adoption of QMS. Lack of top-management commitment is Lack of top-management commitment can result from a number of factors, including a lack of knowledge and training, resistance to change, and reluctance to start reform initiatives. Lack of coordination between departments is Lack of coordination across departments as a result of poor internal communication between departments can be a significant obstacle to the adoption of QMS (Talib & Rahman, 2015).

3. Methodology

The methodology of this study follows the techniques of the first three phases of the Business Process Life Cycle. This study first requires identifying the critical operations, and then discovering those processes before mapping them. The team did also a part of the process analysis.

3.1. Process identification

It is difficult to analyze all existing processes. Therefore, the team uses rationalization to select several processes by analyzing them. Through that rationalization, the team addresses several questions and Only processes that successfully address those issues will be used going forward. The impact matrix is prepared using the selected processes.

- Is it a process?
- Can the process be controlled?
- Is the process important enough to manage?
- Is the scope of the processes not too big?
- Is the scope of the process not too small?

When identifying the process, we should consider the fact that the above-mentioned and if processes satisfy the above questions, those processes are included in the impact matrix. Identifying the processes that add value to the business process from the processes we have to identify under “process identification” by using an impact matrix.

The process architecture model is used for process identification. Here, the processes that we have to identify are categorized into 4 several levels, in the below example of four levels.

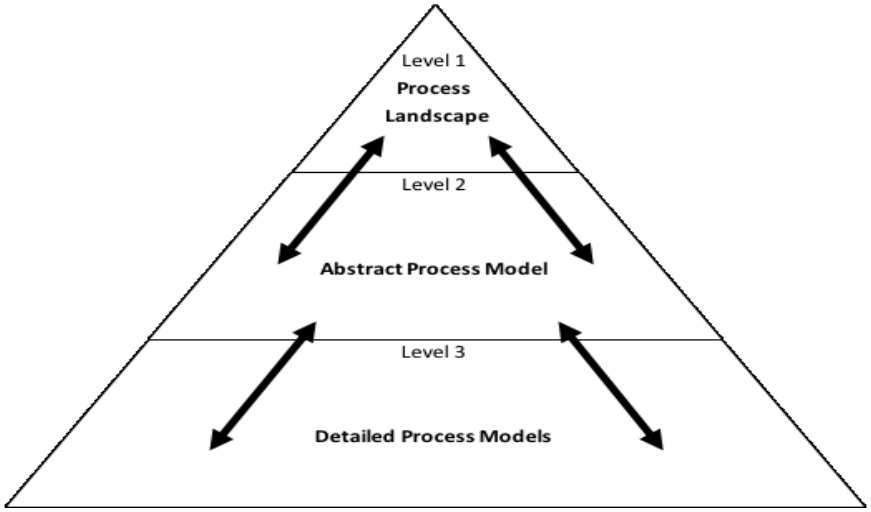


Figure 1. Process architecture framework.

3.2. Flow of methodology

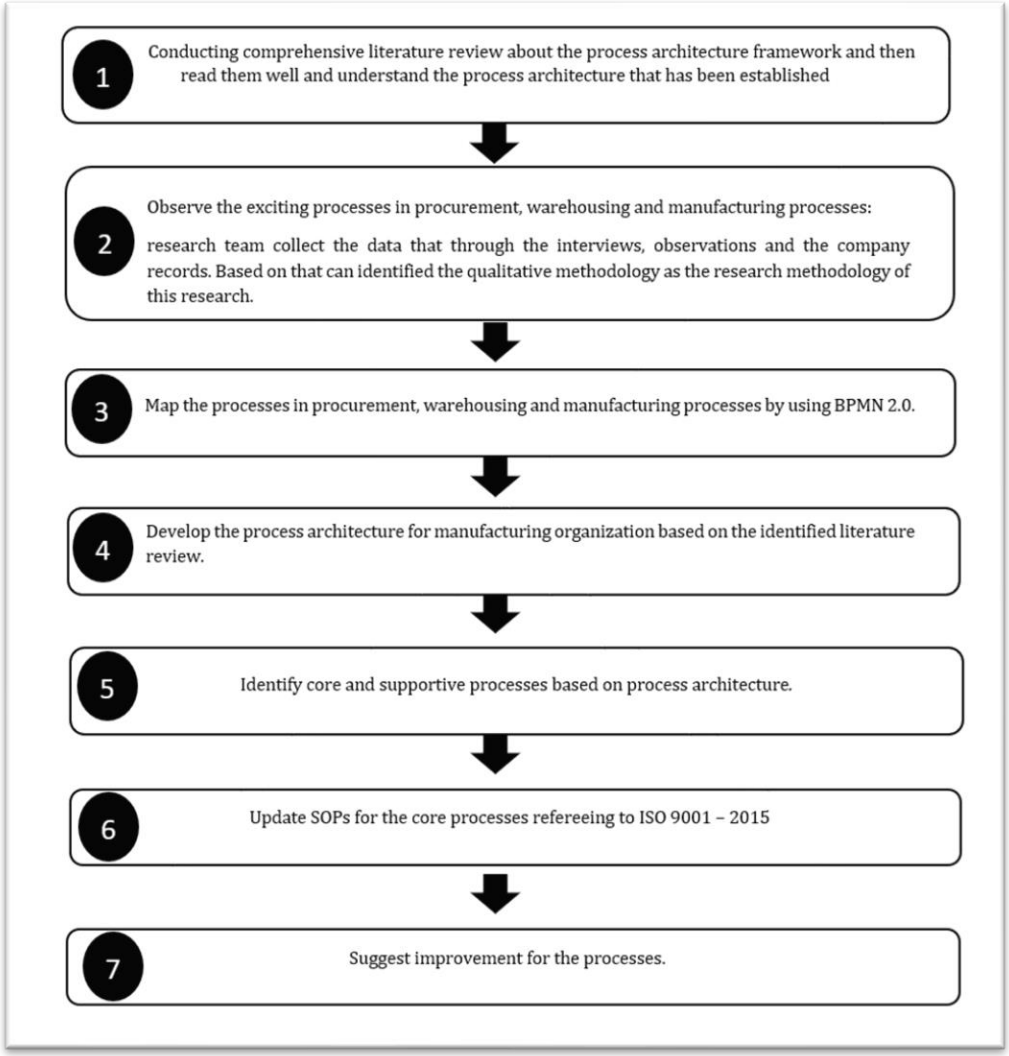


Figure 2. Flow of methodology.

Here, as the final step, there are suggested improvements for the processes. Here we are only suggesting some work instructions because that company does not have work instructions. But we do not go to the level of developing work instructions because it is not in our scope.

4. Results/Analysis and Discussion

4.1. Identify and discover all the processes in the manufacturing organization

In this study, we have established the objective of identifying the established process architecture framework for manufacturing, warehousing, and procurement, discovering the existing processes at the manufacturing organization, and identifying the critical processes and sub-processes. This research identifies and analyses all the company processes. Here we consider the Processes that create value and the Strategic Relevance Processes. That create value means the series of actions and stages taken to enhance the value of a good or service known as value-creating processes.

Here, we only consider the value-added step for the processes. We use four key value drivers related to strategic relevance. After the discussion with the company's management team, we came across the given value drivers.

"Maintain required quality standards," "reduce operational costs," "On-time delivery," and "Ensure regulatory compliance." The selection of processes used to identify the most usable Processes in the company's procurement, Warehouse, and manufacturing processes. We use this format for the process ranking. Here we get the "level as level 1, level 2, level 3, and level 4". Furthermore, we get the four key value drivers. Researchers try to rank the key drivers through the processes' steps 1, 2, and 3. Also, we are going to identify the priority of the key drivers.

Here, the most important key driver ranks in the highest percentage, and the least important key driver ranks in the lowest percentage. "Maintain required quality standards – 40%, Reduce operational cost – 20%, On-time delivery – 10%, Ensure regulatory compliance – 30%". The process step with the "highest impact rank as number 1". "Rank number 3 is the process step that gives the least impact". "Rank number 2 is the process step that gives an average impact."

By ranking in this way, the impact can be identified. After that "average value has to be obtained", Finally, the process priority value has to be obtained. When we do the process priority part, there are some considerations. We get the process priority value considering factors such as "process complexity, criticality, risk, or strategic alignment." We are going to categorize all the processes as high impact – 2, low impact – 0, and medium impact – 1. We select the processes that have a high impact for further mapping purposes. We extract the process impact matrix for that particular manufacturing organization by considering everything.

Process				Value drivers					
Level 01	Level 02	Level 03	Level 04	Maintain required quality standards (40%)	Reduce operational cost (20%)	On time delivering (10%)	Ensure regulatory compliance (30%)	Average	RED

Figure 3. The basic format of impact matrix.

4.2. Process discovery

4.2.1. Process mapping

Here, we identify the core process, the subprocess, the related database, and the document. A separate model is developed for the procurement, warehouse, and manufacturing processes. The mapping is going to be done by using BPMN 2.0 and is expected to represent the relevant parties better. The process mapping expected from the research is done here. Levels 2 and 3 in the process architecture model are represented here.

4.2.2. Process landscape model

By studying the process architecture and using the process landscape model for its level one identifies the core, management, and supportive processes. Defining vision, developing strategy, risk management and strategy implementation are identified as the management processes in this manufacturing organization.

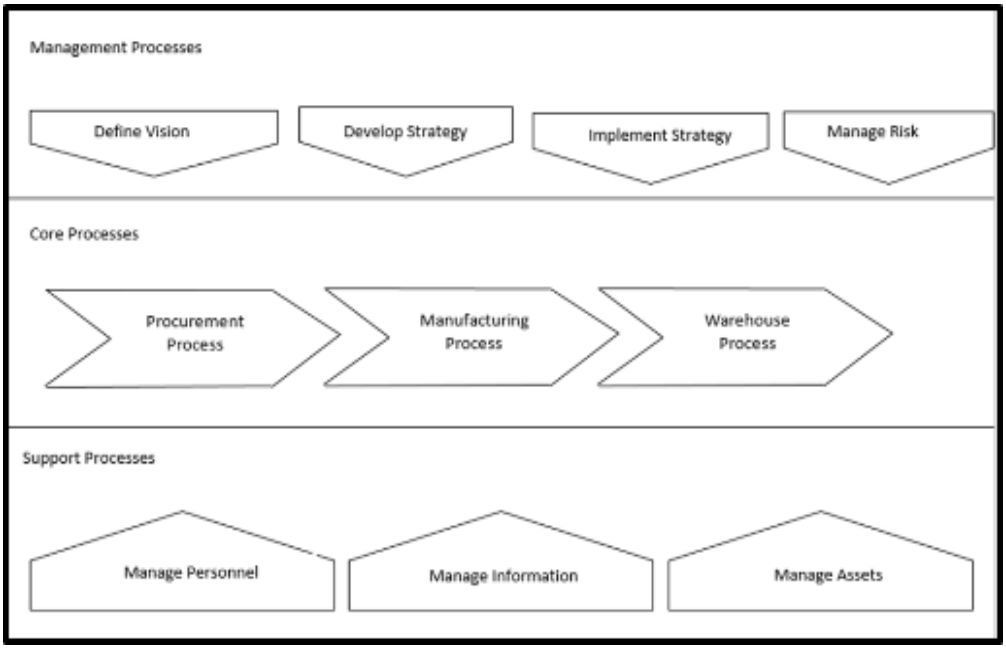


Figure 4. Process landscape model for manufacturing organization.

By using the landscape model, we identify the core, support, and management processes of this organization. Through that, we are going to achieve the objective of identifying core and supportive processes in our research.

4.2.3. Process architecture model

Using that prepared impact matrix, we are going to organize the selected processes using the process architecture framework. According to the processes we selected through the impact matrix, we have to categorize those selected processes into four main levels. The number of levels depends on the nature of the Process. According to that, the manufacturing and procurement process goes up to the second level. The warehousing process moves up to level three.

4.2.3.1. Subprocesses at Level 02

Here, the core business processes were the second level. Researchers have identified the procurement, warehousing, and manufacturing processes as level 02 of the architecture model. Here, researchers used BPMN to identify business processes in these three sectors. Steps are identified here for each core process identified at level 1.

Figure 5. Basic process architecture framework.

4.2.3.2. Subprocesses at Level 03

Here, we are going to describe the level 03 process architecture model. Here, procurement, warehousing, and manufacturing processes were divided into another level. It means earlier researchers considered procurement, warehousing, and manufacturing processes as researchers' business-level processes. Through those business-level processes, researchers will identify some subprocesses and tasks relevant to those particular steps in business-level processes. It means sub-processes of each major process were considered under level three. There are no sub-processes for every step of the core processes in level 02. Some steps of those core processes have subprocesses. We considered those under Level 03.

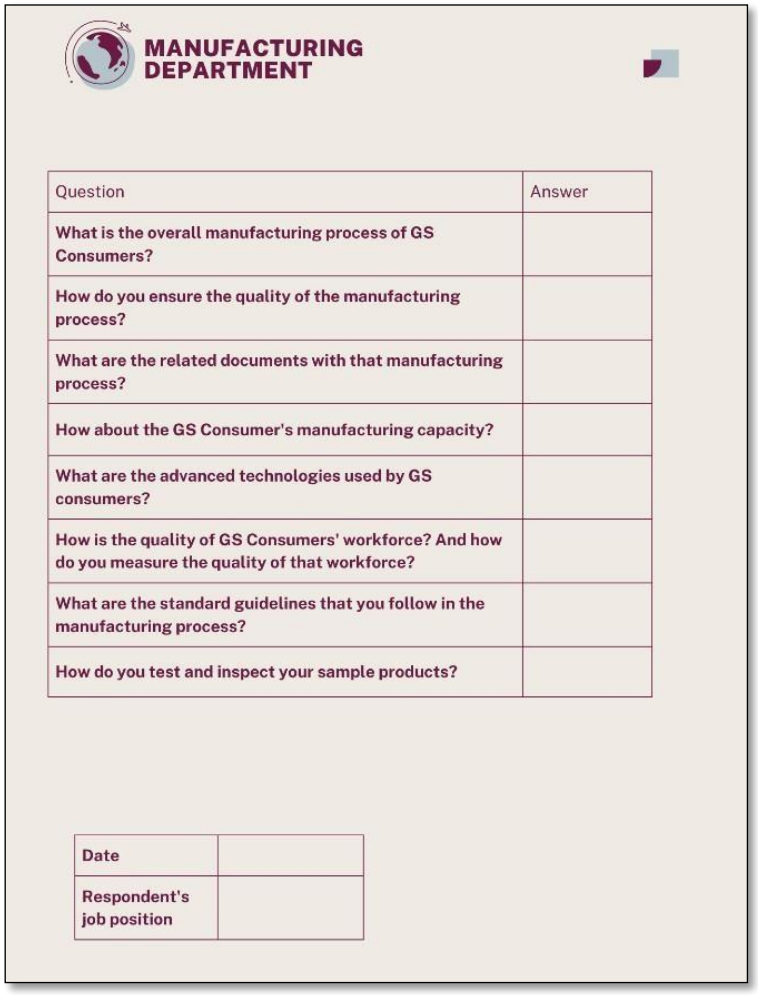
4.2.3.3. Work instructions at level 04

Here, we developed a total of 221 work instructions for every process that we selected for our further research considerations. It is hoped to develop 36 work instructions for the procurement division. Also, it is expected to develop 30 work instructions for the warehouse division. We hope to develop 11 work instructions for the manufacturing division as well. All these work instructions are developed in such a way that they are linked to level 3 of our architecture framework. That means that the work instructions in level 04 of this architecture framework have a direct linkage with the processes in level 03. Our objective of comparing existing processes with the process architecture framework is going to be achieved by dividing the identified processes into separate levels of the architecture and building relationships between them.

4.3. Development of the SOPs

After identifying the critical processes and sub-processes and developing the process maps of those processes, researchers have a thorough understanding of the activities, decision points, and responsibilities. With that understanding, we then move to our next objective of developing the SOPs for a manufacturing organization. The research group has to conduct some discussions with the management team of the base company. Our data collection and analysis are qualitative as the group refers to the company's past documents and reports, which the company used to build up their basic SOPs. Not only

that but also the research group has to study the requirements of the ISO 9001 standard. Then the group has to prepare SOPs for procurement, warehousing and manufacturing sections with the knowledge of senior management.



MANUFACTURING DEPARTMENT

Question	Answer
What is the overall manufacturing process of GS Consumers?	
How do you ensure the quality of the manufacturing process?	
What are the related documents with that manufacturing process?	
How about the GS Consumer's manufacturing capacity?	
What are the advanced technologies used by GS consumers?	
How is the quality of GS Consumers' workforce? And how do you measure the quality of that workforce?	
What are the standard guidelines that you follow in the manufacturing process?	
How do you test and inspect your sample products?	

Date	
Respondent's job position	

Figure 6. Sample of a developed questionnaire.

5. Conclusion and Implications

To prepare the particular SOP documents for manufacturing, procurement, and warehousing processes for a manufacturing organization, the research group applied the "process architecture framework" concept. To build the relationships between the processes, there must be a process categorization method. By using this process architecture framework, the group categorized the identified core processes and subprocesses. According to that, the group has identified 4 main levels in their process architecture hierarchy. While developing the SOP document, the relevant selected processes should be studied in depth. Especially, we have to consider, what the subprocesses are and how they are linked with the processes of other divisions. Because a SOP means some step-by-step instructions that we give to some process. First, using the process landscape model, the company's core processes were identified, and this framework was used to identify their contents separately. Due to the use of this process architecture framework, the research group was able to easily and logically study the sub-

processes separately at each level. Also, when developing work instructions, referring to process architecture will be easy, and the team can easily develop work instructions by linking with the level 03 processes. Otherwise developing work instructions becomes a very complex thing. If you go to SOP development without using this architecture, complex problems may arise such as how many SOP documents are required, which processes require them, and which levels are written. If this process architecture framework is not used, it would not be possible to do such an in-depth analysis of the core processes we identified in this research, and it would also be impossible to develop comprehensive and complete SOP documents.

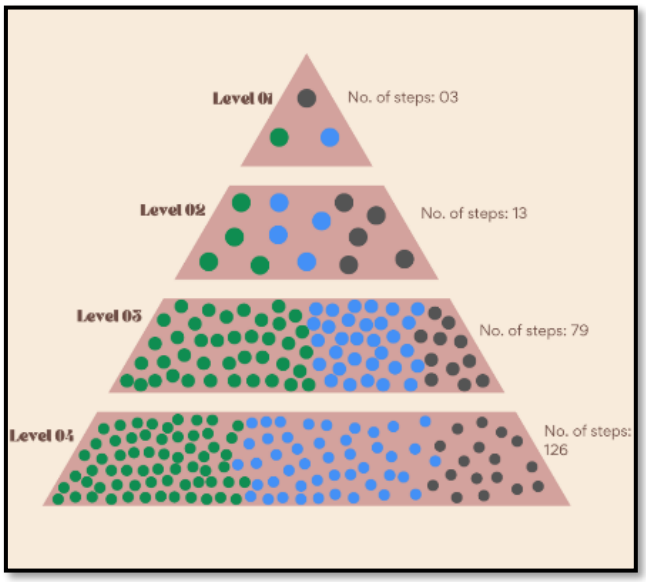


Figure 7. The process architecture framework identified 221 processes of the manufacturing organization.

Acknowledgement

First and foremost, our heartfelt gratitude is extended to our research supervisor Dr. Prasanna Illankoon, Senior Lecturer, Department of Management of Technology, Faculty of Business, University of Moratuwa for his guidance, valuable ideas, time, and support rendered throughout our project, especially with her knowledge and experience. Our gracious gratitude is further extended to our panel of lecturers of the Department of Management of Technology for their support given to fulfill this project. Furthermore, we would like to express our gratitude to all the academic & non-academic staff members of the Faculty of Business for the support given. We would also like to express our profound gratitude to the resource persons from the FMCG industry for the immense support they showed to make this research study a success. Finally, we thank all our families and friends who encouraged us in many ways throughout the research project.

References

Ahmudi, Purwanggono, B., & Handayani, N. U. (2018). Effectiveness analysis of ISO 9001:2015. *SHS Web of Conference*, 49.

Barros, V. (2007). Business Process Architecture and Design. *BP Trends*.

Borra, V. V. (n.d.). Implementing an ISO 9001:2015 Quality Management System within evidence.

Bounabri, N. O. (2017). Barriers to ISO 9001 implementation in Moroccan. *OmniaScience.*

E. Krauth, M. P. (n.d.). Performance Indicators in logistics service provision and warehouse management.

Fonseca, L. M. (2018). ISO 9001:2015 Adoption: A Multi-Country Empirical Research. *Journal of Industrial Engineering and Management, 24*.

iso-9001-2015-requirements. (n.d.). Retrieved from Retrieved from the9000store: https://the9000store.com/iso-9001-2015-requirements/iso-9001-2015-context-of-the- organization/processes-procedures-work-instructions/

J. Semrau, A. H. (2021 June). Use of tools to improve production and logistics processes.

Jayaraman, S. (n.d.). Design and development of an Architecture for computer-integrated manufacturing in the apparel industry.*School of Textile and Fiber Engineering, Georgia Institute of Technology*.

Lambert, D. (2008). Supply Chain Management Third Edition. *Supply chain management institute*.

Leonardo, R. f. (2020). Retrieved from Process Architecture: https://www.leonardo.com.au/business-process-architecture-consulting-services#:~:text=What%20is%20a%20Business%20Process,decision%2Dmakers%20and%20e xecutes%20strategy.

M. Dumas, M. L. (2018). Definition of the process architecture. *In fundamentals of business process management*, 546.

McGinnis, M. A. (n.d.). Warehousing, competitive advantage and competitive strategy. *Journal of business logistics.*

Mitchell, C. &. (2022). An Analysis of Barriers to the Implementation of an ISOCertified Quality Management System for National Meteorological and Hydrological Services in the Anglophone Caribbean. *MITCHELLANDFAKHRUDDIN.*

Petrigna, L. P.-L. (2022). The importance of standard operating procedures in physical fitness assessment: a brief review. *Sport Sciences for Health.*

R. Shimelmitz, S. K. (2020). The evolution of raw materials.

Sampaio, P. S. (2008). ISO 9001 certification research: questions, answers and approaches. 38-58.

Talib, F., & Rahman, z. (2015). Identification and prioritization of barriers to total quality management implementation in the service industry. *Emerald*.