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Operations management and service quality

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Abstract
Operations management is most important to the organization. The success of operations of the organization depends on effective operations management and implementation of the transformation process. The operations may be failed due to several reasons that is inability of the management to coordinate the activities among the people, the activities are information systems, product development and design, engineering services, packaging testing, and distribution, and it is the challenging job to work with the global suppliers, production and distribution network within the island etc. to mitigate these kind of failures, we have to identify the competitive dimensions such as cost, quality, delivery, flexibility and service in proper manner. The purpose of this research is to study the product development process of Rainco (Pvt) Ltd, special reference to PermaNet. The product development process and implementation are at the end of stage and the organization is facing the problem of succeeding the product in the market due to several reasons. This report further measures the performance of product development process and identify the reasons for failure. Eventually, it focuses the alternative solution that is manufacturing the product in Sri Lanka to position in the market i.e. selection of process and designing the manufacturing process for Permanet.

Keywords: service quality, operations management, island, manufacturing process, engineering services, production and distribution network

1. Introduction

1.1. Background of the Company

Rainco (Pvt) Ltd has been in the Umbrella, Mosquito Nets & Raincoats industry since 1977 and now have 04 production facilities in the island, namely Kadugannawa, Mawanella, Dunture and Dipitiya, all are managed by the sister Company (Sri Lanka Umbrella Industries) of Rainco. As a policy, all factories are situated as much as possible in area where un-employment is high even the first-class infrastructure is not available in the central hill country of Sri Lanka. The Head Office is conveniently located close to Colombo at No. 05, Postmaster's Place (Off Templer's Road) Mount Lavinia, where the whole marketing and distribution are executed. It is the nerve centre of the Company. The island-wide distribution network enables the Company to reach all major wholesalers and retailers in the country. Empowering an organization that endows the largest market share, Rainco continually strives to provide the best in quality, service and success to all its customers. Over the years the extensive efforts have ventured into various products and lured path to expand into various markets overseas, presently situated in India and China. Traditionally based in Sri Lanka, Rainco now ventures through various countries in the region, with solution in the core business of imparting shelter to décor as a whole entirely. Rainco is also boasts of the only ISO certified Mosquito Nets manufacturing plant in the South Asian region.

1.2. Objective of the Study

Rainco (Pvt) Ltd is the market leader in Umbrella & Mosquito Nets in Sri Lanka. They have their own production facility, and are the first company who obtained ISO for Mosquito Nets in South Asia. With the intention to develop a new product, they negotiated with the Company in Switzerland, called Vestergard Frandsen who is the owner of the PermaNet for the rights to market the product in Sri Lanka *(Licensed the Product).* This is the Mosquito Nets, having special features that it kills mosquitoes and it is treated with the delthra methrine chemical and no harm to human. It is certified by World Health Organization (WHO). This was the attractive option for company to fill a product very quickly. Since the day launching the products, it took more than one year; *the product is not succeeded in the market*. The primary objective of the study is to understand the new product development process of company towards its quality aspects, and also recommends them the best way of manufacturing process of the Permanet in Sri Lanka, at their own production plant at highest quality.

1.3. Product Specification and Description

Vestergaard Frandsen is a Europe-based international company specializing in complex emergency response and disease control products. It is guided by a unique Humanitarian Entrepreneurship business model, whose "profit for a purpose" approach has turned humanitarian responsibility into its core business. Their products and concepts under the brand names Perma Net ®, Life Straw ®, Zero Fly ®, Zero Vector ® and Care Pack ® have the potential to revolutionize health management as we know it fighting preventable disease and saving lives. Rainco (Pvt) Ltd received the certificate of sole distributor of PermaNet® 2.0 in Sri Lanka in 2009. It is the long-lasting insecticidal net (LN) is recommended by the WHO for the prevention and control of malaria. Based on the same technology, the PermaNet® Net Curtains have a long-lasting killing effect on vectors that transmit

diseases like dengue, filariasis, leishmaniasis, and Chagas disease. Frandsen is committed to investing in products that will protect the most vulnerable members of society.

PermaNet® 2.0 - Features

- Is a ready-to-use bed net pre-treated with deltamethrin.
- Has a long-lasting killing effect on malaria mosquitoes, as well as other disease-transmitting susceptible vectors.
- Prevents and controls malaria as well as other vector-borne diseases.
- Is made of 100% polyester, which is the preferred material by end-user.
- Requires no re-treatment or dipping; thereby decreasing the need for repeat intervention.
- Is based on a superior technology of impregnation, where the bioavailability of active ingredient is controlled through a slow release process.
- Does not allow mosquitoes to penetrate the net due to the optimum mesh size.
- Is available in various colours, shapes and sizes to accommodate local preferences.
- Is safe to use for all, including pregnant women and young children.
- Is produced in a large-scale, professional production facility under strict quality measures.
- Is the most widely tested bed net in both the laboratory and field?

New Product Development Process of PermaNet

1.4. Introduction to New Product Development

New product development process had been followed by Rainco. As far as Rainco concern, with the intention to fill the new product need very quickly, they followed it through obtaining the licence of developing new products into the market. They negotiated with the marketer from Switzerland, who owns the product, for right to market it in Sri Lanka. This is called as license the product. In the new product development process, the part played by Rainco was to imports the goods, packing and distribution. In addition to that the marketing activities and campaign was executed by them.

1.5. New Product Development Process and Rainco's Practice

In general, there are seven (07) processes comprising the key elements of new products development. The following flow chart illustrates the new product development process.

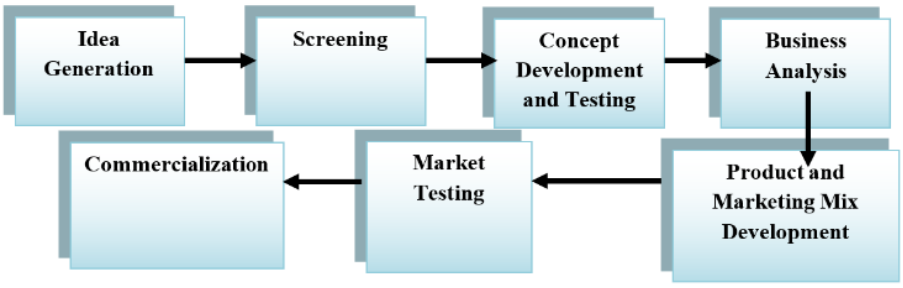

Fig 1

Step 1. Idea Generation

The first step of new product development requires gathering ideas to be evaluated as potential product options. It is an ongoing process with contributions from inside and outside the organization. In Rainco the idea for permanet was generated from focus visit on territory wise. There were no alternative to protect the people from killing mosquitoes and also disease from dengue and malaria spread among the people. The company identified the gap that the needs of mosquito nets which kills the mosquitoes. The company was used the team-based idea generation to generate better ideas than individuals with concerning the quality of the ideas.

Step 2. Screening

In Step 2, the ideas generated in Step 1 are critically evaluated by company personnel to isolate the most attractive options. Depending on the number of ideas, screening may be done in rounds with the first round involving company executives judging the feasibility of ideas while successive rounds may utilize more advanced research techniques. As the ideas are whittled down to a few attractive options, rough estimates are made of an idea's potential in terms of sales, production costs, profit potential, and competitors' response if the product is introduced. Acceptable ideas move on to the next step. The strength of the Rainco in developing this product in Sri Lanka is that they were the market leader for Mosquito nets in Sri Lanka and also the first company who got the ISO in the South Asian Region. This was the possible side of the company to go into this new product category when they did the screening. However Rainco was not focused on the customer expectations on the new product. Also they failed to predict the benefit to the customers from the product.

Step 3. Concept Development and Testing

With a few ideas in hand the marketer now attempts to obtain initial feedback from customers, distributors and its own employees. During focus groups with customers the marketer seeks information that may include: likes and dislike of the concept; level of interest in purchasing the product; frequency of purchase (used to help forecast demand); and price points to determine how much customers are willing to spend to acquire the product. The concept was already developed by the company who exist in overseas. Vestergard Franchised, from Switzerland was the company who developed the concept and distributed worldwide network. Therefore Rainco was not more focused on this step in Sri Lanka as it was experienced the pervious markets.

This analysis was failed with the new product of Rainco as it is very much essential to test the customers' views on the new product before launching it.

Step 4. Business Analysis

Now in Step 4, the process becomes very dependent on market research as efforts are made to analyze the viability of the product ideas. (Note, in many cases the product has not been produced and still remains only an idea.) The key objective at this stage is to obtain useful forecasts of market size (e.g., overall demand), operational costs (e.g., production costs) and financial projections (e.g., sales and profits). Additionally, the organization must determine if the product will fit within the company's overall mission and strategy. This was not the case as far as Rainco concern, they were not going to produce the product in Sri Lanka, they got the licensed to market and distribute island wide network. The production cost was not the matter for this stage and they already forecasted the expected sales from their past historical data of existing mosquito net. The price was the problem for the company in predicting the demand for the new product as it differs from the existing product. Eventually, they decided to market the product at full cost-plus mark-up. It is needed to analyze the business environment before making the development of the product. In Rainco, they did with their past experiences and failed with over estimation of the sales of permanets.

Step 5. Product and Marketing Mix Development

Ideas passing through business analysis are given serious consideration for development. Companies direct their research and development teams to construct an initial design or prototype of the idea. Marketers also begin to construct a marketing plan for the product. Once the prototype is ready the marketer seeks customer input. However, unlike the concept testing stage where customers were only exposed to the idea, in this step the customer gets to experience the real product as well as other aspects of the marketing mix, such as advertising, pricing, and distribution options (e.g., retail store, direct from company, etc.). The Company was focused on marketing mix development. The advertisement campaign was developed by the company but the cost was covered by the owner who owned the product before. The price was set based on the policy which was the total cost plus mark up. The distribution channel was set based on the network sales, whole sales and showroom sales where company already establish in the marketing systems. The company had used many distribution channels to promote the product within Sri Lanka. It shows that Rainco has concerned with the coverage & effective communication with the new product.

Step 6. Marketing Testing

Products surviving to Step 6 are ready to be tested as real products. In some cases the marketer accepts what was learned from concept testing and skips over market testing to launch the idea as a fully marketed product. But other companies may seek more input from a larger group before moving to commercialization. This was not the challenge for the company. They had already distribution network and dealer network. It was easy them to store display and test the product through their existing customers. The product was tested and approved by the ministry of health in Sri Lanka. Therefore the company had experienced the over expectations with the present market of Sri Lanka. Accuracy of the data collection also was uncertain.

Step 7. Commercialization

If market testing displays promising results the product is ready to be introduced to a wider market. Some firms introduce or roll-out the product in waves with parts of the market receiving the product on different schedules. This allows the company to ramp up production in a more controlled way and to fine tune the marketing mix as the product is distributed to new areas. This was done by the company in launching the product within the Colombo city first. Then move to other part of the island. But they could not cover all islands in Sri Lanka.

Process Analysis of PermaNet

1.6. Process Analysis and Selection

Understanding the process of the operation is most important in the competitive environment. The process is essential to determine the quality, cost and time of the product. The process of the organization should meet the goals and objective in short term as well as long term. A process is any part of organization that takes inputs and transforms them into output that it is hoped, are of greater value to the organization than the original input. Process of PermaNet is the manufacturing process, it involves in transforming raw material into finished goods, PermaNet. It involves several steps and process to transform the Net into mosquito net, called as PermaNet. In all process, there are units, divisions and departments involve and taking time to accomplish the process is called as cycle time. In average, it takes 4 hours to complete a PermaNet. The process is generally described as hybrid process that includes conversion process and assembling process of PerrnaNet manufacturing. Conversion process includes converting the raw material into mosquito net plastic frame and assembling process includes assembling net and frame into mosquito net, PermaNet.

1.7. Process Flow Structure and Flowchart

A process flow structure refers the way how the factory organizes material flow using one or more of the process technologies. The way the material moves on the flow describes the process flow structure. In this method, it is described as Assembly Flow that the material moves from division to division and unit to unit. One-unit output is the input for other unit like that every other unit depends on the previous unit's function. If there is any delay

In other unit due to raw material shortage or labor shortage, it will affect the productivity of next unit.

Process Flowchart for Perma Net

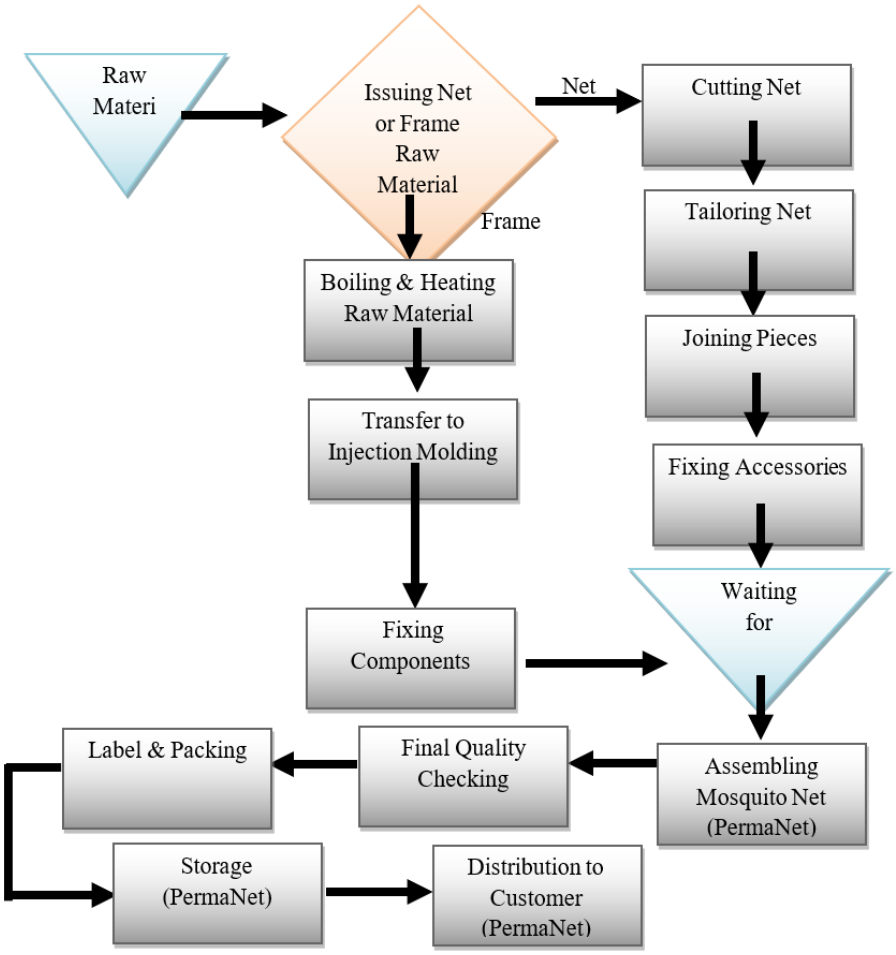

Fig 2

1.8. Process Design and the Contribution towards Quality

The adjustment of the key production means (machines) and/or production formula (compound, dying…) are known, formalized and available for the operators or person in charge of setting up (value + tolerance) and/or production formula (compound, dying…) for each machine and by type of product. These are understandable for the operators or person in charge of setting up. The person in charge of setting up is able to adjust machine with the parameters defined and also having relevant skills on this point. The work instructions are known, formalized and available for each workstation for operators, for all type of products. But for hand stitching area, there should be some pictorial representation of operations and sophistications for assuring each and every person on the job is clear of what they have to do and they all work in same direction. The important production parameters are checked, conform, recorded and records are available. A list of machine operators trained and validated is done and recorded. There is separate training section. Operators are trained and master the production tool, they know what the important parameters are; know working instructions, know what to do in case of non-conformity. They use training on the job. They use Kaizen and 5S as model to reduce waste and to improve production, effectiveness and safety. A system (procedure…) is not defined in order to guarantee that when operator changes his workstation, he is trained and validated before to be autonomous on his new workstation. And it can be possible only when a proper skill matrix is in place stating which worker is trained for which operation and when worker shifted to other work station, it is made that the person is either already trained for that particular operation or has to be trained before allocating that work to him/her. Curative maintenance is carried out and each operation is recorded for each machine (with the date, type of maintenance and the person who carried out) and every tool which require it (example wear tool). If a machine or tool is non-conform, it is identified “Cannot be used”. There is a preventive maintenance planning defined by machine (with frequency, what the maintenance contents – monitor/change oil/mechanical checking and reference method). Preventive maintenance planning is respected for each machine & there is a record of maintenance done (what, who and when) for each machine. The process is managed by based on the production target, still they work based on the management by objective method. They have

implemented the leadership such as managers and supervisors for each and every division and also allocated sufficient resources.

Designing and Manufacturing Process of PermaNet

1.9. General Guideline for Factory Building

In Sri Lankan context there are some guidelines to follow on factory buildings. These guidelines are developed by the Board of Investment. When considering the quality aspects of the factory building it is necessary to follow. In order to start the manufacturing process, it is the most important and essential function of the company to identify the plant location and built the building for manufacturing process. In selecting the site for the factory building of the proposed manufacturing process, the covered areas of the factory building and its structure such as warehouse and workshop are most important. Internal road, packing area, loading and unloading are the additional consideration when choosing the site for factory building. Fire gap, fire escape, space, location with transformer, and water tank should be considered by the management. When built the factory building, the following general guidelines need to be followed.

- The building should be design with accepted Codes of practice and in conformity with the current Factory ordinance.
- Final ground and floor level of the factory must be fixed in relation to the surrounding lay of land, adjoining road level, and ensure proper surface water drainage and sewage disposal. The place is situated in Kandy, so they need to plan well in advance.
- Floor space should be designed based on the workers movements and machinery installation and raw material movement.
- The building should consists of storage capacity
- Guarding of wall opening, open side floor, platform, and catwalks.
- Security lights exist door, parking area and access should be design well.
- Considering the sanitation and health requirements such ventilation and thermal comfort, sanitary conveniences, washing room, first aid room, and meal room.

1.10. Designing Product for Manufacturing Process

In Pernanet, The product design considers the customer expectation of mosquito nets such as easy to open, fix, easy to hang it up, and wash. The most important advantage of the product is that it can be washed 20 times and having 02 years warranty. The product is treated with the special chemical delthramethrin which kills the mosquitoes. The product design and sketch are in the form of 3D systems and all specification is illustrated and given to the production manager to follow up the design. The TQM is generally describes as a collective, interlinked system of quality management. Product design is one of critical factor of the TQM. The customer focus and customer driven quality in product and service design and delivery can be considered as commonly associated element on TQM. When analyzing we have considered that what makes a design successful, how do we judge a design quality on following aspects.

- Function - What does it do and how does it work?
- Aesthetics - Is it attractive, why and what makes it so?
- Construction - What is it made from, how and why?
- Economics - How much does it cost and is this good value for money?
- Ergonomics - How easy or comfortable is it to use?
- Quality - How well is it built, what materials are used?
- User - Who is it for and is it appropriate?
- Environment - What effect do the product's manufacture, use and disposal have?

In a product, unique characteristics and features are called the product specification. We have identified these and compare them with the specification of other similar products. In that sense, construction, quality and function was fitted with from the producers' point of view. From Quality in customers' perspective was not successful.

1.11. Manufacturing Process Flow Design

This is the process of manufacturing that material, parts, and accessories follows as they move through the plant. Designing the process flow is most important for work study as well as work measurement. It gives the frame work for manufacturing PermaNet and guidelines for production manager to follow the material movement and reduce the wastage on the flow. The quality control, quality and operational results in TQM can be considered in this process flow design. In PermaNet manufacturing process flow design has organized accordingly.

Manufacturing Process Flow Design for the PermaNet

Analysis of Quality Standards relevant to the Supply Chain

Supply chain management has been described many ways, namely physical distribution, Material management, Transportation management. However the final mission of this is set the level of the logistic activities so as to make products and services available to customer in the most profitable or cost effective away. In simple term, supply chain management is brought the product from its raw material stage to the end user. The supply chain consist with suppliers, distribution point and transportation providers. Managing these activities with other functional area of business and across multiple businesses will be the main responsibility of logistic department. As far as Rainco is concern, no manufacturing process have been involved, (till they launch the production process) they directly import finished goods from a supplier in Switzerland. The Finished goods of PermaNet come to the end user through a logistic operation where finished goods brought down warehouse at Rainco. Packaging, labeling and distribute to showrooms and whole sale shops are main operations taking place in Sri Lanka. **S**ince quality is the main concern of these study logistic operations of Rainco (Pvt) Ltd, were compared with quality audit guidelines, observed following gaps with compared to the standards.

- Suppliers should ensure that all technical requirements or product specifications via suppliers reports, but we observed that a proper mechanism has not been placed in Rainco to monitor the manufacturing process of supplier in Switzerland.
- It is required to audit supplier's sub-contractors and their action plan, but we failed to find such mechanism within the logistic operation of Rainco.
- Even though, stocks are maintained in a way which each unit are to be clearly identifiable, other standards requirements such as management of temperature, minimum storage specification, storage area without risk of damage area where

specified in the manufacture has not been maintained up to the standard.
- Records were not available in Rainco operation regarding the stock management practices FIFO or LIFO. In this situation, we have to conclude that finished good quality has been attached in the absence of proper stock management practices.
- It is hard to find measures regarding social accountability other than WHO (World Health Organization) approval. Since this is a chemical based product WHO approval is needed for carryout the business operation. But information relevant to the discrimination, compensation management, disciplinary practices and working hours were not available and this also a deviation from the standards level of quality audit.
- Relationship with supplier is vital important aspect of product quality management. Since because after sometimes supplier may failed to comply with quality specification and therefore, regular cordial relationship with suppliers and subcontractors are necessary in quality management.

1.12 Inventory Management

Inventory management is the process of efficiently overseeing the constant flow of units into and out of an existing inventory. The main objective of the inventory control is to assure satisfactory levels of customer service while keeping inventory costs within reasonable bounds. To maintain appropriate level of inventory, it is very much essential to decide when an order should be placed, how much should be ordered, and what level of safety to be maintained. Inventory control models such as fixed order quantity model, fixed time period model and single period inventory modes are used to decide the above decisions in order to manage better inventory management. Inventory management mainly focusing to keep inventory cost within reasonable level considering Holding cost, Ordering cost, set up cost, and shortages cost. In Rainco, following factors are considered to maintain effective stock management system:

- Components included in inventory
- Identification and separation of stock
- Stock level position
- Stock issuing method

Components, semi-finished product, finished product are kept in proper conditions as per the storage specification and requirement. Storage area is clean and is in order without risk to damage products. Need to remove unwanted items from stores in order to make it more organized. The stocks are clearly identified and separated. There is a clear identification for the inspection/status of the stock implemented sticker system as follows.

- Product tested and confirm (Green Sticker)
- Product tested and non-confirm (Red Sticker)
- Product not tested or waiting test results (Yellow Sticker)

The stock level position is known and up to date (compared to available stock and launched stock). This is done by stock monitoring and this is up to date for any reference. Inventory position, how much stock is available and how much is released can be track through this stock management system. Further First In First Out system is defined and implemented as a method of stock issuing.

1.13 Conclusion

That is acceptable that the success of operations of the organization depends on effective operations management and implementation of the transformation process. The purpose of this report was to study the product development process of Rainco (Pvt) Ltd, special reference to PermaNet. With the intention to develop a new product, they negotiated with the Company in Switzerland, called Vestergaard Frandsen who is the owner of the PermaNet. The product development process and implementation are at the end of stage and the organization is facing the problem of succeeding the product in the market due to several reasons. Eventually, it focuses the alternative solution that is manufacturing the product in Sri Lanka to position in the market i.e. selection of process and designing the manufacturing process for Permanet. Rainco did the product developments using their own way & they failed to rethink with Sri Lankan market. They applied the quality aspects when developing the products through whole process & finally they came up with a failure in Sri Lankan Market. They should pay more attention on quality improvements in development process in the future as well. In the process design for new product to be manufactured the work instructions are known, formalized and available for each workstation for operators, for all type of products. Further, they use Kaizen and 5S as model to reduce waste and to improve production, effectiveness and safety. There is a preventive maintenance planning defined by machine as well. When we analyze the Supply Chain and Inventory Management, they are following minimum storage specification and requirement defined by standards. Standard system like sticker system can be implementing for the inspection or test status for stock in order to maintain effective identification and separation of activities. Although Rainco defined FIFO methods study reveals it was not required and it was not implemented so far. Further, Rainco need to monitor Stock level position up to date for any references. Proper Inventory Management System is needed to be implemented in Rainco to prevent shortages in production, optimize warehouse organization, and Track inventory levels in real time. Accordingly, eventhough construction, quality and other functions were fitted with the producers' point of view; quality in customers' perspective was not successful. In conclusion, proper operations management and the right service quality will in one way or the other leads to firm performance (Nwokwu, Dharmadasa, & Rathnasingha, 2018; Nwokwu, Atapattu, & Azeez, 2019; Nwokwu, 2018; Nwokwu, Rathnasingha & Pradeep, 2019) [7, 5, 7, 4].

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