Analysis of supply chain management system using lean six sigma: Balanced scoredcard parameters approach

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Abstract

The potential development of the beauty product industry in Indonesia is considered very attractive. The beauty products industry and trade in Indonesia is projected to increase by USD 7.5 billion with a growth of 6.5% annually for the next five years. The huge potential in the cosmetics retail business is considered to trigger the emergence of competition, especially in the supply chain system which has implications for product affordability to consumers. So that this becomes an interesting condition for research to be carried out as well as efforts to provide certain improvement treatments so that there is an improvement in the flow of the supply system in the object company. In this study, 3 layers of the research process will be carried out, namely observing and describing the existing supply chain system in the research object company, improving and treating the supply chain system using a lean six sigma model with stages of define, measure, analyze, improve, control (DMAIC), and make observations as well as measure the results of improvement using 4 (four) balanced scoredcard performance indicators. Data mining using observation methods, interviews, scoring key performance indicators in each perspective, and study of company operational administration data. Based on the results of study, the supply system based on 4 balanced scoredcard indicators still has shortcomings, namely in the value of debt-to-equity ratio, quantity and customer quality, internal business organization, and personnel accountability. The recommendation is that this study can have an improving effect on the object company and also be a reference for other companies specifically with the same segmentation.

Introduction

The current era of digital transformation is marked by increasing global competition in various industrial sectors (Prasetyo, 2022). This competition opens opportunities that can have implications for the development of free trade (Prasetyo et al., 2022). Complex trade competition in today's modern market, the introduction of a business's products with increasingly simple flow process procedures, and the increasingly high expectations of product users have indirectly encouraged business people to start increasingly shifting their focus to organizing supply chain systems (Nguyen et al., 2020). The assumption is that the better the supply chain system that coordinates their supply system, the more effective and efficient the production performance that occurs within the company will be. Of course, the implication is that the lighter the cost of the production flow they invest and automatically the applicable selling price to consumers will also be lower and more affordable (Potter et al., 2004).

The industry and trade of beauty products in some literature and news is said to be one of the most promising business centers as well as inviting a very competitive (Alzoubi et al., 2022). Research from Statista explains that the potential of the beauty and personal care market in Indonesia itself is very large, in 2021 it is projected that trade in the sector will increase at USD 7.5

billion with a growth of 6.5% every year for the next five years (Statista Research Department, 2023). The increasing trade in cosmetics indicates that in Indonesia the interest in public consumption of cosmetic products is very high (Lestari et al., 2021). The potential development of the beauty product industry sector in Indonesia is also included in the main part of the master plan and integration of national industrial development from 2015 to 2035 (Kementerian Perindustrian RI, 2015). Capturing how much data is enough to provide an overview and at the same time the potential for very competitive global competition among the beauty product business.

The beauty product trading business is a business that can be classified as a modern business, eventhough the price of commodity products is quite temporary, but the finished products published on the market look very elastic (Ishigai et al., 2021). The fact that is happening in the market today encourages supply chain players to adjust to market price competition. In addition, the trade in beauty products is very easy for anyone to do, with a very high level of differentiation, making the supply chain system very decisive later whether the products on the market are easily affordable or not by consumers (Chakraborty et al., 2020). In addition, in the past few years, the emergence of more variations in new beauty product brands has made the cost of goods and sales of a product decrease, so that the profits obtained by each sub-unit of the supply chain are also decreasing. Indirectly, this condition makes businesspeople provide added value to product users by improving customer relations management including the capacity to provide additional services (Potter et al., 2004).

A method of maximizing operational functions that are adaptable to current market conditions to plan and improve an operational system is Lean Six Sigma (Darwati et al., 2015). This systematic method can help plan and improve the processes of a business. This method uses a systematic approach that focuses on providing process value that has implications for critical areas of customer needs (Uluskan, 2016). This approach is considered the most appropriate to set a customer-oriented process strategy because it has an effective customer satisfaction orientation (Wisker et al., 2023). The advantage of using this system in the operation of the goods distribution system is that it is able to minimize defects and maintain speed stability to achieve goal standards at the highest level. The application of the systems approach in Lean and Six Sigma can improve revenue turnover through the planning, analysis, and control functions in it (Makarenko & Plastun, 2017). The implication is that the more intensive the use of this approach is carried out in the supply system, it will minimize delays and customer dissatisfaction. The supply chain system has active and valuable characteristics, which are based on four dynamic streams, including availability of production goods, money, and development plan of the products (Juzer & Darma, 2019). So that the lean six sigma combination method with value control through 4 balance scorecard perspectives will be easier to direct a business goal towards a good goal.

Previous research that reinforces the above opinion was conducted by (Ridwan & Noche, 2018) measuring supply chain performance in logistics companies using a lean six sigma system. The results of the study stated that by carrying out this method the company became able to create products that were fast, effective, on time and increased customer satisfaction with the certainty of previously agreed orders, so that product value increased, and customer satisfaction also increased, and the implication was the increasing profits (Shekhawat, 2015). It is just that the study does not recognize in depth by presenting a measurement perspective on the achievement of each process, so it is not known in which aspects the indicators need to be maintained and improved. In this study, in general, we will use the same approach, namely Lean Six Sigma in the improvement process, but to test each of the achievement values, it is mseasuresd by a score performance indicator balanced scoredcard.

Effectiveness assessment through key performace indicators compiled based on 4 balanced scoredcard perspectives will be able to help a management process in compiling supply chain performance measurements based on processes, in this way companies will be able to assess and measure the achievement of the supply system as a whole through various points of view (Abdullah et al., 2014). In the end, the improvement of the supply system with a lean six sigma approach can be measured and controlled through measurement indicators based on 4 balanced scoredcard perspectives.

Literature Review

Supply Chain Management (SCM) framework was presented as a new business model and a way to create competitive advantage by strategically managing relationships with key customers and suppliers (Lambert & Enz, 2017). In general, the scope of supply chain managament is first, the product supply process from beginning to end. The picture is like the process of the main raw material sent from the first hand to the processing company, after entering the processing process and becoming a finished product then sent to distributors, retailers, to consumers. Second, the flow of money and the like that flows from downstream to upstream and third, is the flow of information that can occur from upstream to downstream or vice versa (Nguyen et al., 2020). So that in this study improvements will be made to all aspects of the supply chain using the Lean Six Sigma structured performance principle so that the performance of each stage is more controlled, effective and efficient.

In the Lean Six sigma is a system of approaches used in business operations, systematic, and organized procedures to plan, identify and minimize minus components or work processes that do not provide added value to the production of a product (non-value added) through radical continuous improvement in order to achieve optimal performance results (six sigma activities) (Sreedharan et al., 2018). The integration of Lean and Six Sigma methodologies provides organisations with the methods, tools and techniques for superior improvements. Lean Six sigma is a powerful methodology for achieving process efficiency and effectiveness resulting in enhanced customer satisfaction and improved bottom-line results (Antony, 2014).

In the Lean Six Sigma approach uses a process structure known as DMAIC through processes (Identification, Measurement, Analysis, Development, and Control) (Darwati et al., 2015). At the Identification stage (define) carry out a systemic process to coomperehensively define an object. The Measurement stage (measure) focuses on the measurement process and assigning value to an object finding, at this measurement stage a justification is also carried out for which parts will be the focus of measurement, how the measurement method is, how the process and measuring system will be carried out. The Analysis stage (analyze) begins to focus on analyzing the findings in the previous stage by presenting several alternative solutions. At the Development stage (improve) focuses on the process of providing treatment or treatment of objects in accordance with the findings found in the next stage, the improvements made at this stage are carried out with the aim of achieving the targeted goals at the beginning. The Control stage is the stage of evaluating, assessing the achievement and control process in the production process whether the improvement given is effectiv or not (Darwati et al., 2015).

The implications of the next improvement are measured by the Balanced Scoredcard (BSC) performance indicator method as well as being used to find out which minor and major aspects need to be the focus of attention in the next implementation. This method is an instrumentation approach procedure that is mostly used by businesspeople to plan, describe and control the organization to realize company plans, steps and goals into a systemic format patterned strategic measurement of a comprehensive set of parameters/indicators in each perspective, so as to improve the company's work ability to create sustainable competitiveness (sustainable competitive advantage (Yacob et al., 2021). In this study, it used balanced scorecard aspects consisting of financial aspects (revenue growth and capital health), customer aspects (number of new customers, customer complaints and customer loyalty), internal business aspects (internal organization and innovation capabilities) and learning aspects (employee empowerment, personal accountability) (Yuen & Chan, 2010). The Balanced Scorecard approach retains measures of financial performance-the lagging outcome indicators-but supplements these with measures on the drivers, the lead indicators, and of future financial performance (Kaplan & Norton, 2001).

Methods

In this study, it used an integration system process with a lean six sigma approach as an internalization process and then integrated with balanced scored card perspective control. Lean six sigma is used as a varaiabel treatment to improve the quality as well as the systematics of the supply process so as to minimize the waste area at every stage of define, measure, analyze, improve and

control during its implementation. As a control function, the implementation of the supply system uses a measurement approach from 4 balanced scoredcard perspectives, namely financial, customer, business process and growth & development aspects (Tawse & Tabesh, 2023). Data mining using observation methods, interviews, scoring key performance indicators in each perspective, and study of company operational administration data.

The research was conducted on CV. XYZ which is a company engaged in retail beauty products. This company field is considered representative to represent several research questions that lead to a supply chain system with an orientation in the field of cosmetics retail. The results of preliminary research that there are many interesting things from the supply chain process that occur in this company. This company has a diversity of roles in the supply chain, with the variety of products it has puts this company can be a line of distributors, agents, resellers or even as a dropshipper. This diversity makes the strategies implemented will also inevitably be diverse. In addition, this company is sufficient to have a device that represents all indicators of the measuring instruments used in this research both in terms of financial reports, customer databases, internal work programs, and business development plans (Lueg & Vu, 2015).

In sequence, the method is carried out in several stages, namely Define, describing the CV. XYZ supply chain system using a flowchart. Then measure the performance of the supply chain with the scope of measuring CV. XYZ based on the key indicator of each unit of the process that was compiled earlier. Measurement (measure) and determination of which unit of process is the least based on the accumulated value of the assessment indicator. Analyzing (Analyze), includes critical reasons for the non-achievement of assessment indicators through the discovery phase and deepening of the root cause using the Fault Tree Analysis (FTA) method. Improvements are made to improve and improve the effectiveness and efficiency of the supply chain system using the Lean Six Sigma approach thinking flow.

Results and Discussion

Stage 1: Define

This stage discusses an overview of the existing supply chain system that is already running in the company. In sequence, the supply chain begins with the process of supplying raw materials from suppliers, raw materials sent by several suppliers then carried out a manufacturing process at the main processing plant until it becomes semi-finished goods. The assembling and packaging process is carried out in several subsidiaries and partners of the company before the marketing and distribution process to the next supply chain is carried out. Stockist as the main subject appointed by the company in each province then distributes to each of its downline distributors according to the quantity of demand (Antony et al., 2017). This whole process is carried out using the main transport owned by the company. This process continues all the way to the next downline. Agents, wholesellers, resellers channel products to each end user using many marketing channels.

Next, observations, interviews, and in-depth analysis are carried out to find out the value that causes waste throughout the company's supply series. Measurement is carried out using a key performance indicators tool that is adjusted to the company's internal characteristics using the balanced scored card measurement aspect. The results of the assessment carried out are as follows:

Table 1. Measurement of Financial Aspect

Financial Aspect	Value	Target	Result
Return of investment	19.12%	23%	82%
Current ratio	7.41	9.26	80%
Debt-to-equity ratio	32%	86%	37%
Profit growth	82%	100%	82%

*Financial report January-March 2022
*Current ratio = current assets : investor capital debt/12 in year
*ROI = profit/capital*100%; target ROI = profit target/assets*100%
*Debt vs capital ratio; der = debt total (43,000,000)/capital (50,000,000)
*Average 1st quarter

The results of measuring financial aspects in table 1 above show that the overall achievement of the indicator is at the level of 70% with the lowest achievement in the debt-to-equity ratio (capital value compared to active debt) meaning that it can be concluded simply that the company needs more capital to increase sales of its products. It is comparable to its development potential. The profit growth value of 82% shows that this beauty product agency company has quite promising potential. The health of capital is considered as a potential that has a great influence on companies with rapid capital expenditure. The type of cosmetic retail company should have good capital and capital management, so that the flow of sales that has implications for stock value greatly affects the sustainability of subsequent sales (Thomas et al., 2016).

Table 2. Measurement of Customer Aspect

Customer Aspect	Value	Target	Result
New customer	43	150	29%
Loyal customer	37	100	37%
Customer complain	7	0	-7
Reseller development	23	50	46%

The results of measuring customer aspects in table 2 above show that the achievement has not been maximized. Almost all appraisal indicators have values below 50% of the achievement target. The achievement of the number of new customers is at 29% of the target, which means that the quantity of new customers who place orders at this company still urgently needs to be improved. This is also almost comparable to the pattern of loyal customer resilience which was at 37%, followed by customer complaints during the first quarter there were already 7 times complaints with the development of downline resellers which was still at 46%. This data shows that the company's marketing mix and strategy is still very undeveloped. The quality of service and its market penetration still need to be developed using more active and customer-oriented strategies (Lameijer et al., 2021). From the results of the analysis above, it can be seen that quantity of the number of customers also greatly affects the conversion to the final sale (Maleyeff et al., 2012). This is in line with the principle of marketing in various companies, that if the company want to increase sales potential, it must be able to increase the manifestation of potential customers.

Table 3. Measurement of Internal Business Aspect

Internal Business Aspect	Value	Target	Result
Internal organization	4	50	8%
Innovation capability	29	50	58%
New product procurement	12	20	60%

The measurement results shown in table 3 above show that the internal organization system is still very low (8%). This is because the company is still very minimal in managing the organization systematically (organizational structure, work procedures, work guidelines, and other organizational tools). The system that is run is still very familial. This gives rise to the assumption that all components in the company are still working without systematic instructions and rules. Organizational management is needed as a guideline for the implementation of work, this is considered to have significant implications for both large and small companies. The absence of guidelines will make organizational actors lack standard guidelines in carrying out all existing work operations, so that work behavior tends to use volatile assumptions with the influence of surrounding conditions (Gastelum-Acosta et al., 2022).

Table 4. Measurement of Development and Education Aspect

Development and Education Aspect	Value	Target	Result
Employee empowerment	31	50	62%
Personal accountability	8	50	16%
Employee satisfaction	30	40	75%

The measurement results shown in table 4 above show that the internal organization system is still very low (8%). This is because the company is still very minimal in managing the organization systematically (organizational structure, work procedures, work guidelines, and other organizational tools). The system that is run is still very familial. This gives rise to the assumption that all components in the company are still working without systematic instructions and rules. Commitment can arise due to the authorization of the company owner given to the executor of the organization, the executor of the organization will feel more valued and have a feeling of security while carrying out his duties and responsibilities (Ishigai et al., 2021). Organizational implementers are built from human resources that have dynamic characteristics, so that supports such as individual development are also indispensable as ammunition for improving performance performance in the organization.

Stage 2: Measure

In the next stage of measure, waste identification is carried out in each aspect of the appraisal by considering the indicators that have the lowest value and are considered as a priority for improvement (Delgado et al., 2010).

The minus value in the financial aspect lies in the achievement of the capital value compared to the value of active debt (debt-to-equity ratio = 37%). This shows that the health of the company's capital needs to be improved to support sales development while strengthening market penetration.

The minus value in the customer aspect lies in almost all aspects; aspects of new customers (29%), aspects of loyal customers (37%), high levels of customer complaints and reseller development (46%) that have not been maximized.

The minus value in the internal business aspect lies in the one-third of the internal organization. Almost in all internal lines of the organization the belu system is formed and is more carried out as a family function.

The minus point in the aspects of development and education lies in personal accountability. This arises and can be known from the inability to achieve the existence of a system of agreements and work conduct that is carried out as a control function in the company's organizational system.

Stage 3: Analyze

The analyze stage is carried out by compiling the critical reasons for the non-achievement of the assessment indicators through the discovery phase and the deepening of the root of the problem using the Fault Tree Analysis (FTA) method (Albliwi et al., 2015). From this process, the main reasons and causes that need to be followed up on can be identified.
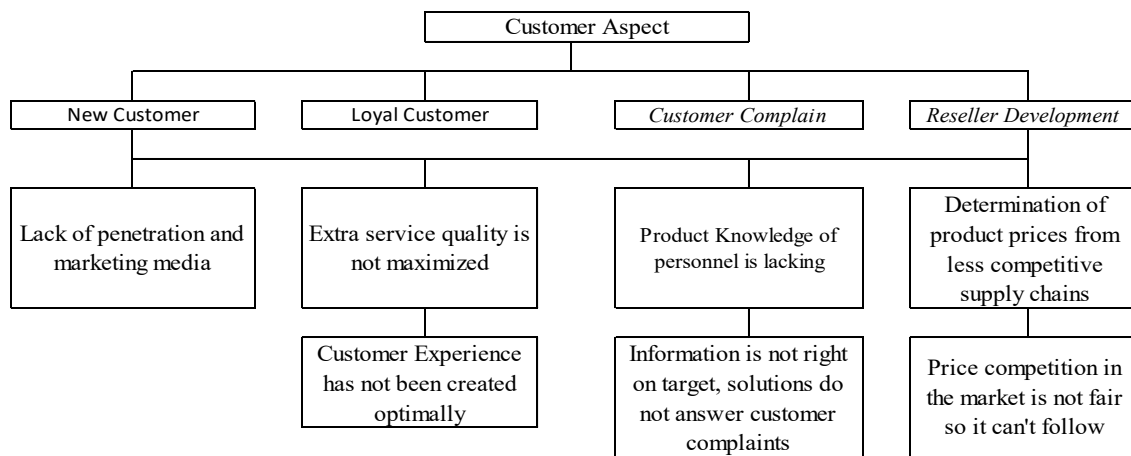
* Fault Tree Analysis of Financial Aspect
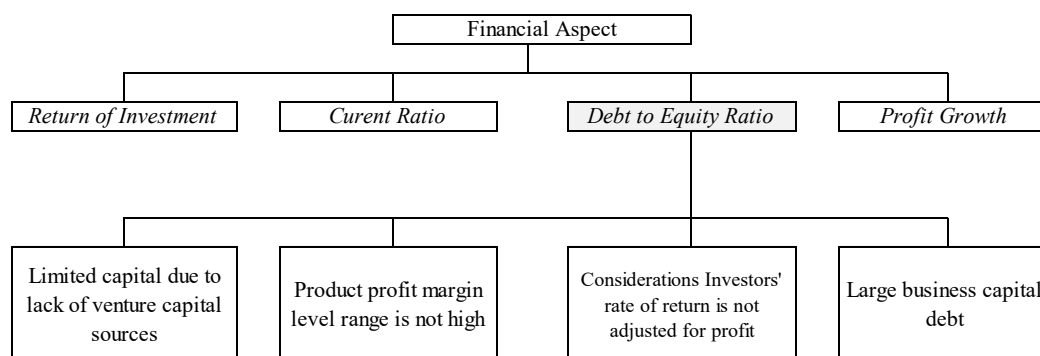
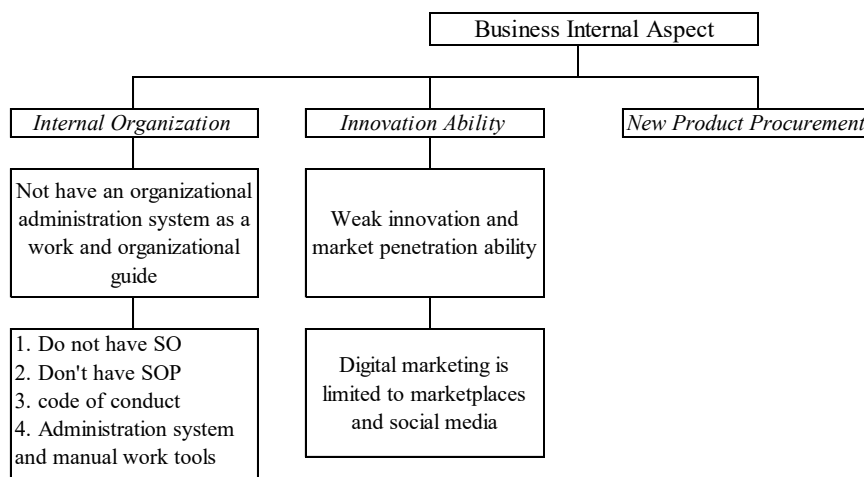**Figure 1.** FTA Diagram of Financial Aspect

In Figure 1 of the financial aspect FTA diagram, it shows that the potential non-achievement of financial aspects in general is caused by 4 things, namely; limited capital due to the

lack of sources of venture capital, the range of product profit margins is not high, the high rate of return of investors' profits because there is no valid calculation system in accordance with the level of pure income and large enough business capital debt.

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                              │   Customer Aspect    │
                              └─────────────────────┘
        ┌──────────────┬────────────────┬────────────────┐
┌──────────────┐ ┌──────────────┐ ┌──────────────────┐ ┌────────────────────┐
│ New Customer │ │Loyal Customer│ │Customer Complain │ │Reseller Development│
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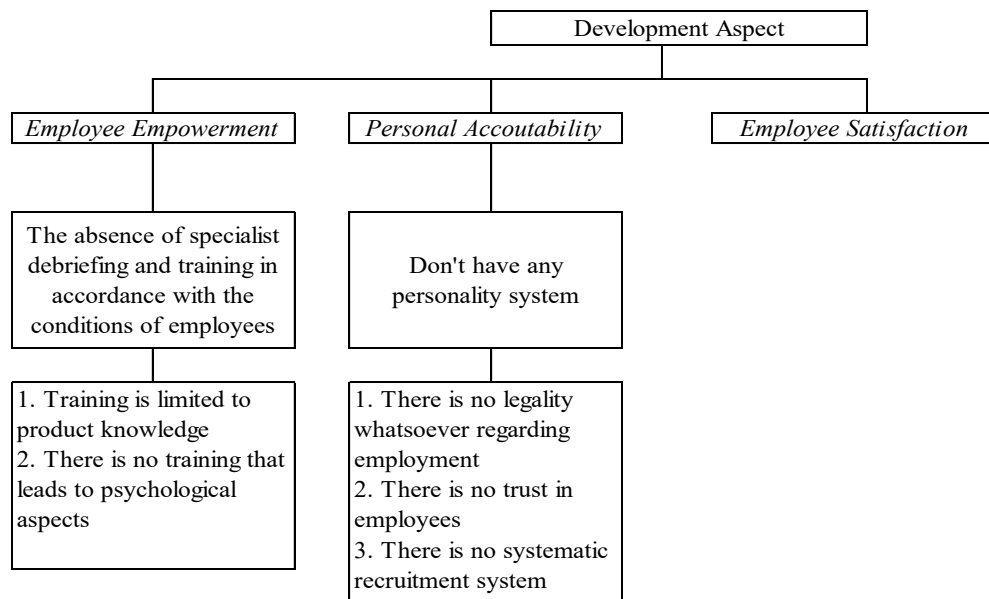| New Customer	Loyal Customer	*Customer Complain*	*Reseller Development*
Lack of penetration and marketing media	Extra service quality is not maximized	Product Knowledge of personnel is lacking	Determination of product prices from less competitive supply chains
	Customer Experience has not been created optimally	Information is not right on target, solutions do not answer customer complaints	Price competition in the market is not fair so it can't follow

Figure 2. FTA Diagram of Customer Aspect

In Figure 2 of the customer aspect FTA diagram, it shows that the potential for unattainable customer aspects is generally caused by 4 things, namely; lack of market penetration and marketing media due to low marketing tools and channels, lacking extra service quality so that the customer experience impact is not optimal, personnel knowledge about products is minimal so they cannot provide solutions that suit customer needs, the company's upline network provides less competitive prices with market prices and the occurrence of price wars in the market that cannot be followed due to considerations of profit margins and commitments with uplines.

Internal Organization	*Innovation Ability*	*New Product Procurement*
Not have an organizational administration system as a work and organizational guide	Weak innovation and market penetration ability	
1. Do not have SO 2. Don't have SOP 3. code of conduct 4. Administration system and manual work tools	Digital marketing is limited to marketplaces and social media	

Business Internal Aspect

Figure 3. FTA Diagram of Internal Business Aspect

In Figure 3 of the internal business aspect FTA diagram, it shows that, the potential for not achieving internal business aspects is due to the absence of a well-organized operational system such as not having an organizational structure, not having standard operating procedures used as work guides, not having a code of conduct, manual administration system, limited digital marketing in the marketplace and social media and the majority of work tools are still manual.

In Figure 4 of the internal business aspect FTA diagram, it shows that,the potential for not achieving the education and development aspects is due to the development pattern which is still only focused on technical matters or there is no training that leads to psychological matters, the company does not have any legality related to employees so that it is vulnerable to fraud, lacks trust from company owners, making it difficult for personnel to develop, and employee acceptance system that is still family so that it has implications for the quality and credibility of personnel.

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                        ┌─────────────────────────┐
                        │   Development Aspect     │
                        └─────────────────────────┘
            ┌────────────────────┼─────────────────────────┐
  ┌──────────────────┐  ┌──────────────────────┐  ┌─────────────────────┐
  │Employee Empowerment│ │Personal Accoutability│  │Employee Satisfaction│
  └──────────────────┘  └──────────────────────┘  └─────────────────────┘
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The absence of specialist debriefing and training in accordance with the conditions of employees	Don't have any personality system
1. Training is limited to product knowledge 2. There is no training that leads to psychological aspects	1. There is no legality whatsoever regarding employment 2. There is no trust in employees 3. There is no systematic recruitment system

Figure 4. FTA Diagram of Development and Education Aspect

Stage 4: Improve

Based on the results of the analysis using a fault tree analysis shows several things that affect the less than optimal performance of the company's organization. So from this analysis, the research raises several suggestions and recommendations for improvement so that some negative aspects can be minimized (Singh & Rathi, 2019). The suggestions and recommendations is following:

1. Financial Aspect
   a. Limited capital and capital sources
      Seeking and receiving investors and looking for upline payment system distributors tempo.
   b. Profit margin is too small
      Add upline preference with higher price margin and clustering product segmentation with higher profit margins by reducing minor product segments with low profit margins.
   c. Share profit investors' profits are not systematic
      Creating a profit-sharing system based on the percentage of profit not with a fixed nominal system and within a period of 1 reporting year.
   d. Large venture capital debt
      Running a credit accumulation system with profit sharing so that it can cut the principal debt of capital.
2. Customer Aspect
   a. Media and marketing penetration lack improvement
      Expanding marketing channels (Marketplace, social media, downline sellers, SEO-based business WEB and other digital media) and Exhibitions and holding promos on special day events.
   b. The impact of service to customer experience has not been maximized
      Excellent service training for personnel and cut profits by increasing gifts/bonuses to special customers.
   c. Product knowledge of personnel is lacking which has implications for the quality of customer service
      Targeted product knowledge training for all employees and Beauty advisor training.
   d. Lose product price competition
      Adding upline preferences with lower prices.
3. Business Internal Aspect
   a. Does not have an internal organizational administration system
      Developing an Organization Development Based system (Corporate identity, Organizational Structure, Job Description, Work Guidelines and other guiding tools).

   b. Weak personnel innovation ability

Includes the obligation to innovate for all personnel by making development reports every day, by providing internet tools to conduct digital market research.

4. Development Aspect

   a. There is no specialist training program

Creating a training program through a training need analysis process in order to have the right effect on the target.

   b. Does not have a system and legality related to employee

Set up a supervisory organization system to improve performance monitoring and Conducting a working agreement letter to minimize fraud.

The suggestions and recommendations for improvement above can be made in accordance with the level of urgency and consideration of the capacity of the company's resources. The evaluation findings and recommendations are based on the findings and analysis carried out by researchers so that it is still very possible to be re-evaluated and developed into a form that is more practical and adaptable to the conditions of the company at that time.

Stage 5: Control

The last stage of the analysis and improvement module is to evaluate, assess and prepare the next improvement plan. The achievement assessment and control process in this process serves to assess whether the improvements provided have been effective or not (Swarnakar et al., 2020). The achievement assessment system can be seen by conducting the same analysis as the steps carried out above or by creating a new, simpler parameter in the form of key performance indicators in each aspect that was decided to be carried out at that time by the company.

Implication and Conclusion

The results of the study on the analysis of the supply chain management system in the research object company using the lean six sigma work organization pattern produced evaluation data and recommendations. Through 4 aspects of the balanced scoredcard, it was found that the weak characteristics were in the strength of capital and the value of debt owned so that companies must be more able to increase capital capacity by increasing sources and healthier cash turnover while taking into account the implications of the value of business debt which is used as business capital in a balanced manner. Then on the customer side, the company needs to increase market penetration capabilities by expanding marketing channels, its function is to increase the probability of increasing profits (Lande et al., 2016).

In the internal business aspect, it has weaknesses in the administrative and organizational system, this arises because the company is too pessimistic so that it carries out more family work functions, the recommendation is of course that the company must reverse the paradigm by helping a more systematic system. Finally, the education and development aspects show personnel capacity and accountability that are not yet fit, so companies need to penetrate and program more focused on improving personnel capabilities in order to have positive implications for other aspects (Alzoubi et al., 2022; Juzer & Darma, 2019; Moya et al., 2019). With this research findings module, companies can add and collaborate with other approaches and recommendations for subsequent research to further develop the scope of company segmentation with a more comprehensive approach.

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