

Quality Improvement of Vannamei Shrimp Production Process Using ISO 90012015

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Submission date: 21-Nov-2018 10:52AM (UTC+0700)

Submission ID: 1871938439

File name: ent_of_Vannamei_Shrimp_Production_Process_Using_ISO_90012015.pdf (1.54M)

Word count: 4766

Character count: 27662

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To cite this article: R Iskandar *et al* 2018 *IOP Conf. Ser.: Earth Environ. Sci.* **207** 012011

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Quality Improvement of Vannamei Shrimp Production Process Using ISO 9001:2015

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Abstract. Every manufacturer who joins the trade blocks must always produce high quality products to compete in free market. This article presents the research results on implementation of quality management system in order to produce high quality products of fishery sector in Indonesia. Vannamei shrimp (*Litopenaeus vannamei*) is one of important high value of fish export commodities. Indonesia's vannamei shrimp production volume continues to increase but in reality it only supplies 12.1% of world's shrimp demand. This low supply has been linked to higher world competition in vannamei shrimp. In order to face the competition, it needs to improve the quality management system of production. Therefore, it needs a research to answer the competition problem. The study sample was chosen purposely from vannamei shrimp hatcher managers in East Java, Central Java, West Java, and Lampung and experts from universities. The implementation of study includes self assessment, readiness study, and implementation priority of ISO 9001:2015 clause. The research results show that some preparation elements of quality system are in compliance with international standards but there is still an important part of quality system not appropriate. Priority clauses in its application are Leadership, Enhancement, Performance Evaluation, Organizational Context, Operation, Planning, and Support.

2 Introduction

Indonesia has joined in trade blocs, such as APEC and MEA. This has the consequence of always producing high quality products. High quality products were obtained through the application of quality assurance concept, a quality system designed to ensure all stages of production activities work well. A definite guarantee to produce high quality products was a quality management system, such as ISO.

Indonesia was spurring various sectors to produce high quality products, one them was fishery sector. The GDP contribution of fishery sector to national GDP year 2014 was 2.4%, higher than 2013, while the contribution of agricultural sector was declining [1]. The vannamei shrimp (*Litopenaeus vannamei*) was high-value export commodities in fishery sector. Indonesian vannamei shrimp production increased 20.49% per year in period 2010-2014 [2]. According to [3], Indonesia has only supplied 30% of Japan's shrimp needs while world-level supply was only 12.1%. The not maximal supply was related to higher competition of world shrimp trade as a result of emergence of new producing countries.

The supply of Indonesian vannamei shrimp to global market was still likely to increase and compete with China and Thailand. With special efforts, Indonesia was optimistic to seize 10% -15% of needs of world markets. According to [4], to seize the above mentioned market, there were still many things that must be addressed, such as increasing the development of cultivators and seed producers should create products with best quality. Only quality commodity could win the market competition.

Production management should be improved to win the competition. Indonesia should improve the high quality production consistently. This could, among others, be pursued by upgrading the producers



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by implementing **international** quality standards. Vannamei shrimp production process was applied Indonesian National Standard (SNI). That was SNI 01-7252: 2006 standard about vannamei shrimp shed quality [5] and SNI 7311: 2009 about standard production of vannamei shrimp [6]. The previous research results indicated that application of this standard has a fair category. This means that some elements of SNI have been applied well, but there were still important elements that have not been consistent with these standards [7].

In relation to international quality commodity suppliers, it was necessary to change the application of high SNI quality standard toward ISO, the international quality standards recognized by various countries. The most up-to-date ISO series was a revised by 2015 series, therefore the ISO standard in question was ISO 9001: 2015.

Above description has encouraged this research with priority of upstream sector, **the seed quality of vannamei shrimp for export quality**. This research would analyze and develop the **implementation of ISO 9001: 2015** on process of **vannamei shrimp** seeding to analyze the application level and at same time developed the correction efforts for vannamei shrimp farming agribusiness was to get ISO certified.

This research was conducted at vannamei shrimp production center in Indonesia. This area had many companies with "Good/Excellent" certificate and this area has been able to supply farmers in Indonesia.

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2. Literature Review

2.1. Quality Control and Quality Assurance

To produce high quality products, producers must apply following Quality Management Principles: maintaining customer focus, optimizing leadership, using workers' participation, using process approach, making quality improvement commitments, using factual data in decision **making**, and fostering relationships with suppliers [8]. More specifically, [9] suggests that in order to **obtain high quality products**, companies need to apply the concept of quality control and quality assurance.

Quality Control means that every product must be produced in accordance with demand, where **the approach was done through the application of Total Quality Management**. It was an approach in **running a business that tries to maximize employee participation and organizational competitiveness through continuous improvement**. The effective of Quality Assurance includes three things: (1) **an effective Quality Management System**, (2) **Periodic examination of system implementation** to ensure system effectiveness, and (3) **Periodic review of system** to ensure the system continuously meets the changing demand.

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2.2. ISO 9001:2015 Quality Management System

ISO 9001 documents explained argued that the adoption of a high quality management system is a strategic decision for any organization to improve overall performance and provide a foundation for sustainable development. In other words, ISO 9001 is a very definite guarantee and a standard guideline for design, manufacturing, sales and even service activities. ISO 9001 is a set of standards to leads the company to a high level of quality assurance in world-level business activities. The ISO 9001 documents also expressed the potential benefits to be gained by implementing ISO-9001 2015:

- Ability to deliver high quality products and services consistently.
- Increasing customer satisfaction.
- Knowing the risks and opportunities to achieve the goals.
- Proving that its quality managements system conforms to requirements of international standards.

[10] said that body certification give a certificate as a sign of a business activity applied sustainable quality system standards. The average economic profitability of a company with ISO 9001 was greater than non certified company. The products of certified company of a country would be easier to be accepted in other countries. It could be said that ISO 9001 was the international language produces

the goods. In addition, the study results indicated that companies performance with ISO 9001 certificate were better than without ISO 9001 certificate [11]. Similarly, performance point view in statistical analysis indicated that implementation of ISO 9000 significantly improves quality performance [12]. [13] concludes that ISO 9001 certification has a significant effect on quality outcome, business performance and customer satisfaction.

The advantages of ISO 9001 certification were greater access to foreign markets (especially those requiring ISO 9001) and compatibility with overseas suppliers. The process to achieve certification tends to improve the quality and uniformity of work and simultaneously also increase productivity which in turn could also increase competitiveness.

The most important thing that should be developed in application of ISO 9001 was quality documentation. All procedures, work instructions, formats, data, records, receipts, etc were written on paper. The quality documentation was described as a document pyramid, wider scope becomes at down in terms of details and volume.

The most important quality documentation was quality manual and quality system procedures. They were all reference to ISO 9001 activities. Quality manual were documents that contain company statements and commitments on application of ISO 9001. Quality manual were made by interpreting ISO 9001 clauses that were tailored to application conducted by company. The Quality System Procedure was a system to describe the methods used to implement the quality system specified in quality manual.

Sustainable production process is a controlled process to produce a high quality product. Each stage of the process will be executed with clear reference to quality standards, for example presented in Table 1 shows the nauplius and fries production process based on Indonesian National Standard.

Table 1. Seed Production Benchmark for Nauplius and Seed

No	Criteria	Unity	Size	Measurement time
1	Water temperature	°C	29 - 32	Twice a day
2	Salinity : Seed - Nauplius	0/00	29 - 34 31 - 34	Everyday
3	pH	-	7,5 - 8,5	Everyday
4	Dissolved oxygen, min.	g/l	5	Maximum every 3 days
5	Nitride, max.	g/l	0,1	Everyday
6	Pathogen bacterial, max.	Cfu/ml	10 ³	Maximum every 3 days

Reference at Table 1 showed that the seed produced would have high quality and ISO 9000 ensures that standard reference was adhered properly.

2.3. Good Seeding Method

The vannamei shrimp seeding farming agribusiness was conducted based on Good Seeding Practices (CPIB) as a reference for fish seed business to produce high quality seeds. Good seeds were characterized by: rapid growth, uniform, high syntax, adaptive to enlargement environments, parasite-free and disease resistant, efficient in feed usage and contain no chemical residues and drugs which could harm humans and environment.

The study of quality seeds production was based on the compliance of production systems to CPIB. It was similar to implementation of ISO, difference lies in intended market scope. The problem was if the production system applied good CPIB, whether the production system was said to have implemented the good well? This study does not compare the two but the two quality systems were mutually supportive. It could generally be said that application of CPIB could support the successful implementation of ISO, or vice versa. It depends on where we would analyze it. The CPIB generally contains following standards: seeding requirements, production processes, biosecurity implementation, and personnel management. In addition, it also contains the requirements of documentation system consisting of Standard Operational Procedure (SOP), form and record.

3. Research Method

This research was conducted at vannamei shrimp seed production center in East Java, Central Java, West Java and Lampung. Samples were taken purposively, consisting of vannamei shrimp farmers and experts from universities. The population is 26 hatcheries and the samples taken are 4 hatcheries. The study was conducted in April-August 2017.

3.1. Research Stages

- Identifying the ISO 9001:2005 clause and adapting to the vannamei shrimp seeding.
- Improvement and refinement of the ISO 9001:2015 clauses that were still weakly applicable based on self-assessment results by employers.
- Assessing the readiness to implement ISO 9001:2015 clauses.
- Deciding the clauses implementation priority of ISO 9001:2005.

3.2. Flow Chart of Research

The research flowchart was structured as shown in Figure 1 below.

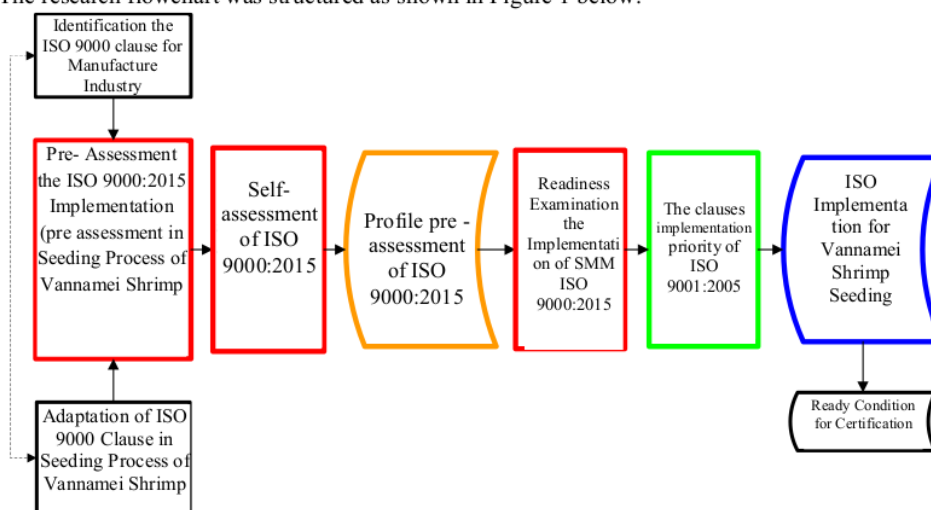


Figure 1. Research Flow Chart

3.3. Measurement and Development Method of Quality Management System

- Identification of ISO 9001:2015 clause for manufacture and its adaptability into vannamei shrimp breeding process.
ISO clause identification was done by Arnold method [9], then the clauses were spelled out for vannamei shrimp seeding conditions.
- Self-Assessment the Implementation of ISO 9001:2015.
This readiness assessment to apply the ISO uses checklist method. Choice the answers: (1) complete/exist/written/documented, score = 10, (2) incomplete/exist/ unwritten/undocumented, score = 5, and (3) none = 0. Assessment of 114 statements was made in 4 classes, namely: strong for 858-1140 score, fair for 572-857, weak for 286-571, and poor for 0-285 poor.
- Readiness Study on Clauses Implementation.
Based on self assessment in point b) above, the performance calculation was done for each clause, as shown in Table 2. The category status of each clause was obtained. Clauses with low performance did not mean unnecessary of less important, they should be prioritized the improvement. The ISO 9001 standard was a unity, no clauses were categorized as more important than others.

- d) Pairwise assessment in the Framework of Implementation Priority of ISO 9001:2015 Clauses. With respect to 7 clauses (Table 2), interests comparison between clauses is made within the Analytic Hierarchy Process (AHP) framework. AHP is one of multi criteria decision making method. In short, it is a method to derive ratio scales from paired comparisons. The expert choice system will get the priority implementation, but clause with high priority does not mean more important, although it still has to be prioritized the improvement.

Table 2. ISO 9001:2015 Clauses

Clauses	Sub-clauses
Organizational context	<ul style="list-style-type: none"> Understand the Organization and its context Requirement and expectations Scope Management system
Leadership	<ul style="list-style-type: none"> Management Commitment Policy Roles, Responsibilities and Authorities
Planning	<ul style="list-style-type: none"> Action to address risks and opportunities Goals and plans to achieve them Planning change
Supporter	<ul style="list-style-type: none"> Resources Competence Consciousness Communication Documented information
Operation	<ul style="list-style-type: none"> Operational control and planning Product and service condition Design and development of product and service Control process for the product and service proved by external source Production and service supply Product and service release Output non-conformance control
Performance evaluation	<ul style="list-style-type: none"> Monitoring, measurement, analysis and evaluation Internal audit Management review
Improvement	<ul style="list-style-type: none"> Non-conformance and Corrective Action Continuous Improvement

Source: [8].

4. Results and Discussion

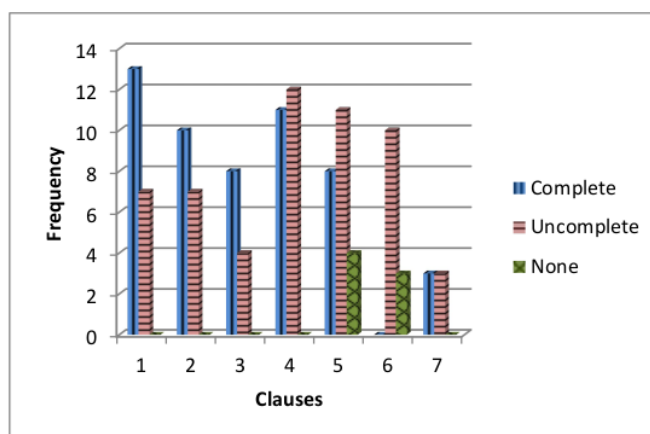
4.1. Self Assessment

Table 3 and figure 2 below showed the frequency distribution of 7 clauses.

Table 3. Score Based on Expert Assessment

No	Clause	Complete (x10)	Incomplete (x5)	None (0)	Total score	Average
1	Organization Context	13	7	0	165	8.25
2	Leadership	10	7	0	135	7.94
3	Planning	8	4	0	100	8.33
4	Supporter	11	12	0	170	7.39
5	Operation	8	11	4	135	5.87
6	Performance evaluation	0	10	3	50	3.85
7	Improvement	3	3	0	45	7.50
Total		53	54	7	800	7.02

Table 3 showed that Clause 5 and Clause 6 still contain "None" assessment. In other words, the application level of both clauses was low category even Clause 6 did not have "Complete" score.

**Figure 2. Self-Assessment Diagram for Implementation Readiness of ISO 9001:2015**

The lowest average value was in Clause 6 (Performance Evaluation). It means that Clause 6 requires more improvement to improve the implementation of ISO 9001:2015 quality management system.

4.2. Examination the Readiness of Clauses Implementation

Examination the readiness to implement clauses are based on score, category and self-assessment description, as shown in Table 4.

Final assessment result showed the total score for the readiness of vannamei shrimp agribusiness company to implement ISO 9001: 2015 was 800, with following details:

- 53 components were considered complete x 10 = 530
- 54 components were considered incomplete x 5 = 270
- 7 components were loss x 0 = 0

Above total score shows that vannamei shrimp agribusiness company in Indonesia is included in fair category. The next analysis was to determine the performance value of each clause to determine

the category of each clause in whole quality management system. The calculation result of performance value could be seen in Table 5.

Table 4. Overall Self Assessment Score, Category, and Overall Description

Score	Category	Description
858-1140	<i>Strong</i>	Most of company's system elements were consistent with ISO 9001 quality system standard. Areas with low score should apply improvements. It was also advisable to hold a pre-assessment of ISO 9001 registration agency.
572-857	<i>Fair</i>	Some elements of company's system were consistent with ISO 9001 quality management system standard. But there was still an important part of company's quality system that has not complied with standard or even none at all. Find exactly the field and apply the system in question; and get the services of ISO 9001 training specialists and consultants.
286-571	<i>Weak</i>	There were many company had quality management systems that inconsistent with ISO 9001 quality system standards. Companies have to do a lot of orientation and specific training on those standards. If the company was serious about ISO 9001 certification, arrange the implementing and controlling teams and get service from ISO 9001 training specialists and consultants.
0-285	<i>Poor</i>	Company quality system practically did not exist. Company should to carry out the review. Careful rules regarding training in Total Quality Management (TQM) tools and techniques were indispensable. It included ISO 9001 training and consulting, before the company invests time and effort in ISO 9001 certification.

Table 5. Performance Value of each Clause

Clause	Assessment Score	Maximum Value	Scale Value 100	Category
Organization Context	165	200	82.50	Strong
Leadership	135	170	79.41	Strong
Planning	100	120	83.33	Strong
Supporter	170	230	73.91	Medium
Operation	135	230	58.70	Medium
Performance evaluation	50	130	38.46	Weak
Improvement	45	60	75.00	Medium
TOTAL	800	1140	70.18	Medium

Clauses that within Strong category were Organizational Context, Leadership and Planning. This means that clauses largely complied with ISO 9001 quality system standard. The company had a quality policy that has been well described and implemented in production process. The organizational structure has been formed by showing the structure and work relationship management. The vannamei

shrimp agribusiness manager and staff have conducted testing activities on effectiveness of production process.

Clauses within Fair category were Supporters, Operations, and Improvement. This indicates that some components of these clauses were consistent with ISO 9001 quality management system standards, but there were still important components of these clauses that were not in accordance with those standards. If the company would apply these clauses properly, it was necessary to initiate and undertake training under the guidance of ISO 9001 consultants for activities pertaining to this clause.

Clauses that within Weak category was application of Performance Evaluation clause. This means that there were many components of this clause that were inconsistent with ISO 9000 quality standard. All components of this clause were assessed by management but there was no written document. The Company did not set in writing the responsibility and authority to evaluate performance on all parts, especially in production department. The company did not have a written procedure to assess the performance of production process capability. Therefore, the company has to do a lot orientation and special training on the standard. In addition, company also needs to prepare the implementation and controlling teams assisted by ISO 9000 training specialists and consultants.

Performance value of each clause became benchmark to arrange clauses ISO 9001: 2015 grouping in according to level of readiness of its implementation. Table 6 showed more clearly the conditions of implementation.

Table 6. ISO 9001:2015 Clauses Grouping in According to Implementation Readiness Level

Category	Clauses	Score
<i>Weak</i>	Performance Evaluation	38.46
<i>Fair</i>	Operation	58.70
	<i>Overall Performance</i>	70.18
	Supporter	73.91
	Improvement	75.00
<i>Strong</i>	Leadership	79.41
	Organizational Context	82.50
	Planning	83.33

Table 6 showed that vannamei shrimp agribusiness in Indonesia has 3 clauses with strong category. It needs effort to strengthen the other 4 clauses to apply rightly all parts of ISO 9001: 2015 quality management system. The four clauses classified as moderate and weak were the clauses that need to be addressed. The overall revamping priority was done by prioritizing the clause with lowest category and value. It was merely to catch up the better clause of category and value without assuming one clause was more important than other.

4.3. Implementation Prioritization of ISO 9001:2015 Clauses

The criteria to determine the priority of clause implementation are the principles of integrated quality management, namely customer satisfaction, respect for everyone, sustainable improvement, and factual management [15]. The respondents' assessment results of integrated quality management principles can be seen in Figure 3.

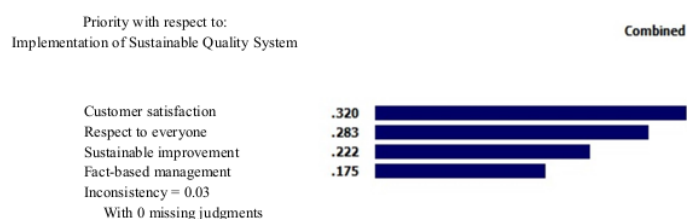


Figure 3. Priority Principles of Integrated Quality Management Implementation on Vannamei Shrimp Seeding Agribusiness

Analytical Hierarchy Process (AHP) results on the comparison of principles application of integrated quality management in selection of ISO 9001: 2015 implementation priority for shrimp vannamei shrimp agribusiness show that the principle that has the highest priority is the Customer Satisfaction with weight of 0.320. The principle of customer satisfaction becomes the main key for sustainable vannamei shrimp hatchery business because the demand determinant is only by customers. The higher customer satisfaction will increase the demand fries and ultimately the volume of sales can increase and affect the company's profits amidst intense market competition. It can be understood if customer satisfaction is considered a top priority that must be considered in implementation of ISO 9001: 2015. The Fact-based Management principle has the lowest priority principle because the agribusiness manager of vannamei shrimp farmers feels that steps to realize the Fact-based Management principle requires a complex understanding process and requires a systematic (plan-do-check-act) process and takes a long time to make it happen.

The implementation priority of ISO 9001:2015 clause with respect to Sustainable Quality System Implementation for Vannamei Shrimp Seeding Agribusiness in Indonesia is shown in figure 4.

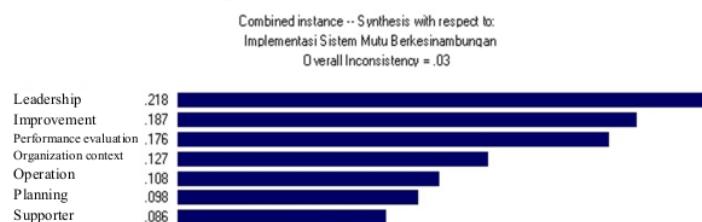


Figure 4. Implementation Priority of ISO 9001:2015 Clause Based on Sustainable Quality System Implementation

Figure 4 shows that priority weighting of ISO 9001:2015 clauses in implementation of sustainable quality management system for shrimp vannamei shrimp agribusiness is a Leadership clause with weight value of 0.218, next is Improvement (0.187), Performance Evaluation (0.176), Organizational Context (0.127), Operation (0.108), Planning (0.098) and Supporters (0.086). Leadership is the primary key in business operations for vannamei shrimp agribusiness companies because the company's leadership role will be able to determine the desired vannamei shrimp specification. It is necessary to open and expand market access amidst intense competition. Leadership in vannamei shrimp hatchery business can bring producer to market leadership, production, resources and price leader. In particular, leadership will lead the company to an improvement process related to process quality. Good vannamei shrimp agribusiness leadership has ensured ongoing performance evaluation process. Likewise good leadership has encouraged the improvement of relationships between communities and organizations, especially shrimp clubs related to disease control techniques and market expansion. This can improve the quality of production process. Furthermore, consistency of production process and planning also determined by organizational leadership in internal scope.

Likewise the Supporter clause as a clause with lowest rank of importance has been in good condition if under good leadership.

Overall, implementation of ISO 9001:2015 does not distinguish between clauses or all clauses. The priority is only to show that a clause must first be improved in its implementation to catch up with other clauses that have been implemented well.

5. Conclusion

- a. The vannamei shrimp hatchery agribusiness in Indonesia had enough clauses with 3 Strong categories from 7 clause. Therefore, vannamei shrimp hatchery agribusiness in Indonesia has applied almost half of ISO 9001:2015 quality management system. This good condition is supported by implementation of Indonesia National Standar quality management system as the adoption of ISO series. The other half clauses still need to be addressed by prioritizing the correction of lowest category clause. It is merely to catch up with better clauses of category without regard a clause more important than the other clause.
- b. The vannamei shrimp seeding agribusiness companies in Indonesia were categorized in medium (fair) category to implement the ISO 9001:2015 quality management system. Some elements of company system were consistent with ISO 9001:2015 quality management system standards. However, there were important parts of agribusiness quality system that were inconsistent with standards or none. This could be overcome by applying improvements to these elements under the guidance and service of ISO 9001:2015 training and consultant specialists.
- c. The ISO 9001:2015 clauses priority for the are Leadership, Enhancement, Performance Evaluation, Organization Context, Operations, Planning and Supporting clauses.

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