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Comparative Analysis of Key Success Factors in S&OP: Focusing on Manufacturing and Retail Industry in South Korea

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Abstract: The global supply chain is facing unprecedented challenges due to pandemics, geopolitical tensions, volatile commodity prices, and rapid changes in consumer demand. The Sales and Operations Planning (S&OP) process can be an important solution by integrating supply and demand with business strategy and operational planning. However, previous studies have developed single frameworks or maturity models without considering industry-specific factors, overlooking the structural and operational characteristics of different industries that can have a significant impact on the approach and success factors of S&OP. Therefore, this study identifies and compares the key success factors of S&OP in the manufacturing and retail industries using the Analytic Hierarchy Process (AHP) technique. The results show clear differences in the prioritization of success factors between two industries. In the manufacturing industry, strategic support and leadership were evaluated as the most critical factor, while in the retail industry, operational processes were emphasized. In addition, the relative importance was concentrated on the top-ranked factor in the manufacturing industry, but the relative importance was distributed among several factors in the retail industry. This study provides valuable insights into the critical success factors for S&OP implementation in different industries and offers an understanding of how industry-specific characteristics influence the effectiveness of S&OP strategies.

Keywords: sales and operations planning (S&OP); key success factor; manufacturing industry; retail industry; cross-industry comparison; analytic hierarchy process (AHP)

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1. Introduction

In recent years, global supply chains have faced greater challenges than ever before due to a variety of external factors, including COVID-19, geopolitical tensions, increased volatility in commodity prices, and rapid changes in consumer demand. According to a McKinsey survey of 60 senior supply chain executives from a variety of companies in the post-COVID-19 era, the most respondents experienced supply chain problems as a result of COVID-19 [1]. In addition, according to the survey of 633 Korean companies on the current status of supply chain crisis awareness by the Korea International Trade Association about 69% of all respondents had experienced a crisis due to supply chain problems during the current two or three years, and 80% of companies had experienced a supply chain crisis, which had let them change their supply chain strategies [2]. It means that companies should make their supply chains more agile and resilient. Also, it can be regarded as a stern warning that corporates cannot survive without strategic operational plans and agile response mechanisms [3,4]. To cope with these challenges, most companies are trying to enhance the effectiveness of supply chain management based on collaborative processes [5], and one such effort is the implementation of new or enhanced sales and operations planning (S&OP) process.

S&OP is one of the core processes of Supply Chain Management (SCM) [6,7] and refers to a collaborative planning process or tactical execution-directing process that involves

organizations across operations such as marketing, sales, production, retail, and purchasing to optimize business performance by balancing supply and demand and integrating business strategy and operational planning [8,9]. S&OP has recently been referred to as Integrated Business Planning (IBP). IBP is perceived as a process that integrates and aligns an organization's entire business plan, including finance, marketing, sales, operations, and product development [10,11]. However, there is a deficiency of academic research on the definition and conceptual differences between IBP and S&OP, which has recently been studied as a concept that extends to finance and product development processes, and some researchers criticize IBP as a commercial term invented by consulting/IT companies [12]. Therefore, this paper has targeted S&OP as a practically and academically validated concept.

As in the definition of S&OP mentioned above, the cross-functional nature of S&OP enables a company to respond flexibly and allocate resources effectively when the external environment changes, which results in enhanced performance [3]. There are several cases in which S&OP can enhance the supply chain performance. Kim J. et al. [13], through a case study of the food industry, state that S&OP can be applied in any industry. Also, Boeing Defense & Space, a global defense company, increased its on-time delivery rate from 28% to 98% and reduced lead time by 40% after implementing S&OP. Heinz reduced inventory by as much as $4.6 million. While it is possible to find various successful cases like previous global companies, S&OP could not always guarantee successful goal achievement. One of the major reasons of failure is the lack of consideration of structural characteristics such as upstream and downstream within the same supply chain, which is related to industry-specific characteristics. Although these characteristics have a significant impact on S&OP operational strategies and processes, it is not easy to find cases that consider the basic characteristics of supply chains while designing S&OP strategies and operational processes [4,14,15].

On the other side, previous research has focused on presenting generic frameworks, or maturity models, or identifying generic success factors and evaluating their relative importance, without considering supply chain-specific factors. Only a few studies have considered the structural and operational characteristics of each industry, which can influence S&OP approaches and success factors. It is vital to clearly understand the differences among industries for developing and implementing effective S&OP strategies [14,16]. This comprehension can enhance the probability of achieving success when implementing S&OP processes. Therefore, this research has compared the S&OP success factors of the manufacturing and retail industries which are the key stakeholders in a single supply chain and proposed insights that can serve as guidelines for industry-specific S&OP process adoption.

For the first step, we have identified the critical factors for successful S&OP adoption and operation, and then, the relative importance of the identified factors using AHP analysis from experts in manufacturing and retail companies. We also analyzed the differences in relative importance and priorities between the two groups, which can derive some insights for the successful S&OP in both manufacturing and retailing parts. The results of this study can be utilized by organizations as a guideline for developing S&OP strategies and improving the current operational efficiency of S&OP. In addition, it can be also referred to for comparative studies across industries.

The remainder of this paper is organized as follows. In the Section 2, we have reviewed the previous literature on the S&OP framework, maturity model, S&OP success factors, and industry-specific characteristics from the perspective of S&OP. In Section 3, the proposed research framework has been explained including the procedure of the survey and analysis method, AHP, and we have identified the major factors and subfactors for success of S&OP process. In Section 4, the AHP results of the manufacturing and retail industries have been compared and analyzed, and finally, we have summarized the results and implications of this study in Section 5.

2. Literature Review

2.1. S&OP Framework and Maturity Model

In order to identify the success factors of S&OP, it is necessary to identify the components of the S&OP process or the criteria by which the quality of the process can be evaluated. For this purpose, the authors first reviewed the literature that presents S&OP frameworks and maturity models. The work of Grimson and Pyke [17] provides a representative study of the S&OP framework. They developed a framework consisting of Meeting & Collaboration, Organization, Measurements, Information Technology, and S&OP Plan Integration and proposed a five-level maturity model through a literature review and interviews with several companies. In a related study, Hulthén et al. [18] proposed a framework for evaluating the performance of S&OP processes based on twelve interviews with five companies selected from different industries. Similar to the findings of Grimson and Pyke [17], this framework defines process, organization, and people as components from the perspective of S&OP efficiency. In addition, it proposes six factors from the perspective of S&OP effectiveness: input data quality, forecast accuracy, resource adherence, tradeoff measures, plan adherence, and actual vs. Target. Danese et al. [19] proposed a maturity model based on a literature review and case studies of companies at different stages of S&OP maturity, consisting of four dimensions: people and organization, process and methodology, information technology, and performance measures. The authors of the study note that the four dimensions are closely interrelated and that the transition to higher levels of maturity becomes more challenging as the size and complexity of the organization increase with maturity. At the same time, the People and Organization dimension becomes more important as maturity increases, highlighting the importance of organizational culture, managing people, S&OP team building, and understanding and empathizing with the S&OP process.

In consideration of the factors derived from the representative literature mentioned above and the literature that presented the S&OP framework and maturity model, the components can be divided into four major categories. First, in terms of People & Organization, the involvement of top management, S&OP meetings, and the organization managing the S&OP process were identified as important. Second, in terms of Process, the integration between processes, efficiency of processes, and process performance were considered important. Third, from the perspective of information management, the synchronization between information, visibility, and the quality of information was identified as a crucial factor. Finally, from the perspective of performance management, the measurement indicators and performance management policies were identified as significant elements. Table 1 shows these results.

Table 1. Components of S&OP Framework and Maturity Model [6,7,17–24]. Circle means that the reference is referring to the content of that component.

Components	Authors	Lapide (2005)	Grimson & Pyke (2007)	Feng et al. (2008)	Viswanathan (2009)	Wagner et al. (2014)	Hulthén et al. (2016)	Pedroso et al. (2017)	Kocaoglu (2017)	Danesea et al. (2018)
People & Organization	Meeting	O	O						O	
	People					O	O	O		O
	Organization		O		O	O	O	O		O
Process	Process	O			O		O			
	Process Effectiveness					O				
	Process Efficiency					O				
	Process and Methodology									O
	Level of Process								O	
	Organization of Process							O		
	Plan Integration		O	O				O	O	
	Plan Adherence						O			
	Plan Balance								O	
	Forecast Accuracy						O			
	Resource adherence						O			
	Process Organization									
Information Management	Knowledge Management				O					
	Input Data Quality						O		O	
	Information Synchronization									
	Technology	O	O		O	O		O	O	O

Table 1. *Cont.*

Components	Authors	Lapide (2005)	Grimson & Pyke (2007)	Feng et al. (2008)	Viswanathan (2009)	Wagner et al. (2014)	Hulthén et al. (2016)	Pedroso et al. (2017)	Kocaoglu (2017)	Danesea et al. (2018)
Performance Management	Performance Management		O		O				O	O
	Measurement									
	Metrics							O	O	
	KPI Effect								O	
	Actual vs. Target						O			
	Tradeoff Measure						O			

2.2. Success Factors for SCM and S&OP

SCM (Supply Chain Management) is a higher-level concept of S&OP and research on SCM success factors can be used as a reference to derive success factors for S&OP. Kim and Suh [25], in a study of SCM success factors for 200 machine manufacturing companies in Daegu, Korea, derived 17 SCM success factors such as IT-based SCM investment, employee training, predictive visibility, and information standardization in the categories of information management, enabling support, partnership, planning and collaboration, and performance management. In a study on SCM success factors for SMEs in India, Kumar et al. [26] identified the main success factors as top management commitment, development of effective SCM strategy, dedicated resources for the supply chain, synchronization of logistics, use of modern technologies and information sharing with SC members. Table 2 summarizes the existing studies on the success factors of S&OP and SCM and categorizes the key success factors into six criteria (People and Organization, S&OP Operation Process, Information Management, Performance Management, Rule & Policy, etc.).

As for the success factors of S&OP, Muzumdar and Fontanella [27] considered people, process, technology, strategy, and performance as the five critical success factors for a successful S&OP process as S&OP is directly related to growth, profitability, and customer satisfaction. According to the study, the people aspect emphasizes active management support, the establishment of a cross-functional organization, and training to improve employee expertise, while the process aspect emphasizes regular meetings, real-time visibility of supply and demand, and event/risk management based on what-if scenarios. In terms of technology, the authors suggested developing a real-time system for decision-making, citing the importance of visibility and synchronization of information to provide a comprehensive view. In strategy, they emphasized the integration of demand-driven planning and collaboration with customers and suppliers, and finally, in performance, they stressed the importance of defining indicators that can reflect S&OP performance and the frequency of monitoring and analysis. Swaim et al. [28] derived the antecedents of S&OP success based on agency theory and stewardship theory. The authors highlighted collaboration and integration among different departments through organizational integration, a standardized S&OP process that reflects a methodology that is agreed upon and understood by the entire organization, and an S&OP priority that considers employee involvement, empathy, and responsibility as key antecedents of S&OP success. Tchokogué et al. [4] derived 15 enablers for S&OP success based on a literature review and empirical data from ASTRO Inc., a plumbing and fittings manufacturer in the United States from 2016 to 2018, and proved that these enablers have different importance at the strategic, tactical, and operational levels. Especially, the leadership and S&OP culture are important at all levels, but S&OP prioritization is most important at the strategic level, the selection of appropriate support tools (IT) is important at the tactical level, and training is important at both the tactical and operational levels.

2.3. Manufacturing and Retail Industry in the Perspective of S&OP and SCM

Due to the nature of their industries, manufacturing and retail have different sales strategies, internal operational processes, and infrastructures. In addition, from the perspective of SCM, the manufacturing industry is upstream in the supply chain and the retail industry is downstream, and there are differences due to these different locations. Lee, T. [15] investigated the differences in the management and performance of supply chain orientation according to the location in the supply chain through statistical analysis of a total of 1061 samples, including upstream companies that procure raw material parts, center companies that manufacture and produce, and downstream companies that are responsible for sales and distribution. The study found that retail companies, which are downstream, have a different perspective on the supply chain than manufacturing companies, which are upstream and central. Manufacturing companies, which focus on production plans and operate production and procurement according to a schedule, have relatively low uncertainty of change, so supply chain management activities are homoge-

neous among upstream companies located in the same supply chain, but retail companies, whose main task is to respond to the uncertainty of demand and volatility of customer demand, have more immediate and organic supply chain management activities. In other words, manufacturing companies view the supply chain from a supply perspective, while retail companies view the supply chain from a customer perspective. Ab Talib et al. [16] analyzed the research on 26 SCM success factors from 1995 to 2014 and suggested that the importance and application of the key success factors may vary depending on the characteristics and needs of each industry. For example, the use of information technology may be more important in technology-driven industries, and government policies may be more important in the public sector or highly regulated industries. Bhalla et al. [29] discussed the potential of S&OP planning for delivery date setting within the context of Engineer-to-Order (ETO) production environments. They noted that previous S&OP research has been developed for mass production environments in manufacturing, and that the specificities of ETO environments have not been sufficiently considered. They emphasized the need for consideration of the special environment of the industry in the adoption of S&OP processes. Kristensen and Jonsson [14] reviewed 68 studies and found that S&OP processes are influenced by a variety of factors, including industry, complexity, and organizational characteristics, and that these factors must be considered for success. They found that industry-specific characteristics should be considered for S&OP to be successful, but there has been no comparative analysis of success factors across industries.

Although many studies have found that industry characteristics affect SCM and S&OP, cross-industry comparisons are rare, with most studies focusing on manufacturing and few on retail, which is further downstream in the supply chain. Dreyer et al. [30] show how S&OP processes and integration mechanisms can help retail companies in tactical planning through a case study of food retailers in Finland, Norway, and the U.K. The authors state that while there is a growing literature on S&OP in manufacturing, the topic is rarely addressed in retail companies and there is a need for quantitative validation and case studies of S&OP success factors in retail companies.

From the previous literature, it can be found that leadership, consensus, and a dedicated organization are critical success factors in the people and organization perspective of S&OP. From the perspective of the operational process, collaboration, visibility, and risk management are selected as the important factors. In addition, from the information synchronization perspective, IT technology adoption, demand forecasting, production/procurement planning, and performance management are considered critical factors, which may define the performance metrics of S&OP.

Still, it is very hard to find the previous S&OP-related studies that considered the industry-specific characteristics or compare the different perspectives across the whole supply chain such as manufacturing and retailing functions.

Table 2. Success Factors for S&OP and SCM [4,16,25–28,31–35].

Authors	Success Factors	People & Organization	Process	Information Management	Performance Management	Rule & Policy	Etc.
S&OP	Muzumdar and Fontanella (2006)	• People	• Process	• Technology	• Performance	• Strategy	
	Cecere et al. (2009)	• Call to action • Executive sponsorship	• Balance • Outside in • Planning linked to strategic decision making • Planning linked to execution	• Technology designed to enable collaboration	• Shared and aligned metrics	• Governance	
	Swaim et. al (2016)	• Organizational Integration • Organizational Engagement	• Standardized S&OP Process			• S&OP Priority	
	Hassanzadeh & Asghari (2020).		• Supply-Procurement • Marketing-Sales • Transport-Distribution	• Technology-Resource			• State-Political • Economic-Financial
	Tchokogué et al. (2022)	• Capacity to learn from previous mistake • Ability to make change • Leadership and S&OP culture • S&OP organization and governance • Organizational engagement–Top management support • Training	• Business process formalization • S&OP set up • Legitimacy process	• Selection of appropriate support tools • S&OP parameters	• Shared and aligned metrics	• Planning and decision structure • Discipline • S&OP priority	

Table 2. *Cont.*

Authors	Success Factors	People & Organization	Process	Information Management	Performance Management	Rule & Policy	Etc.
SCM	Kim & Suh (2013)	• CEO Support • SCM Organization • Employee Training	• Reliability with partner • Communication with partner • Collaborative Action • Planning horizon and cycle • Forecast Visibility • Sales/Production Plan	• Investment on SCM IT • Development of Information System • Level of IT Utilization • Standardized Information	• Performance Metrics • Responsibility and compensation • Customer Satisfaction	• Operation Strategy	
	Kumar et al. (2015)	• Top management commitment • Long-term vision for survival and growth	• Higher flexibility in production system • Forecasting of demand on point of sale • Development of effective • Development of reliable suppliers • Trust development in SC partners	• Information sharing with SC • Logistics synchronization • Use of modern technologies • Developing JIT capabilities in system		• Focus on core strengths • SCM strategy	• Devoted resources for supply chain

Table 2. *Cont.*

Authors	Success Factors: People & Organization	Process	Information Management	Performance Management	Rule & Policy	Etc.
SCM	Ab Talib, M.S. et al. (2015)	• Top Management Commitment • Skilled Employee • Assurance and Empathy • Organizational Hierarchy	• Partnership/Integration • Service Quality • Processes • Open Communication / Trust • Planning and Implementatio • Internalization • Customer-Supplier Experience • Centralized Control	• Use of Information Technology • Data Security • Adoption of Standard	• Performance Measurement	• Cost Minimization	• Industry Focus • Resource Capability • Government Intervention • Image/ Reputation • Market Competence • Infrastructure Readiness • Change Management
	Manuela, P. G. C (2019)		• Supplier Relationship Management Manufacturing Flow Management • Product Development and Commercialization				
	Meyer & Torres (2019)	• Clarity of project objectives • Support of project sponsor and senior management • Organizational setup • Experience of project management	• Appropriate communication and stakeholder management				• Availability of sufficient resources • Utilization of a PM methodology

Table 2. *Cont.*

Authors \ Success Factors	People & Organization	Process	Information Management	Performance Management	Rule & Policy	Etc.
SCM	SETINO (2020)	• Establishment of Capable Human Resources and Training	• Implementation of Enabling Supply Chain Systems	• Development of SCM Measures and Measurement Systems	• Strategy Alignment • Development of Supply Chain Policies and Procedures	

3. Proposed Research Framework and Key Success Factors

3.1. Proposed Research Procedure Using AHP

The following Figure 1 shows the problem-solving process proposed in this study.

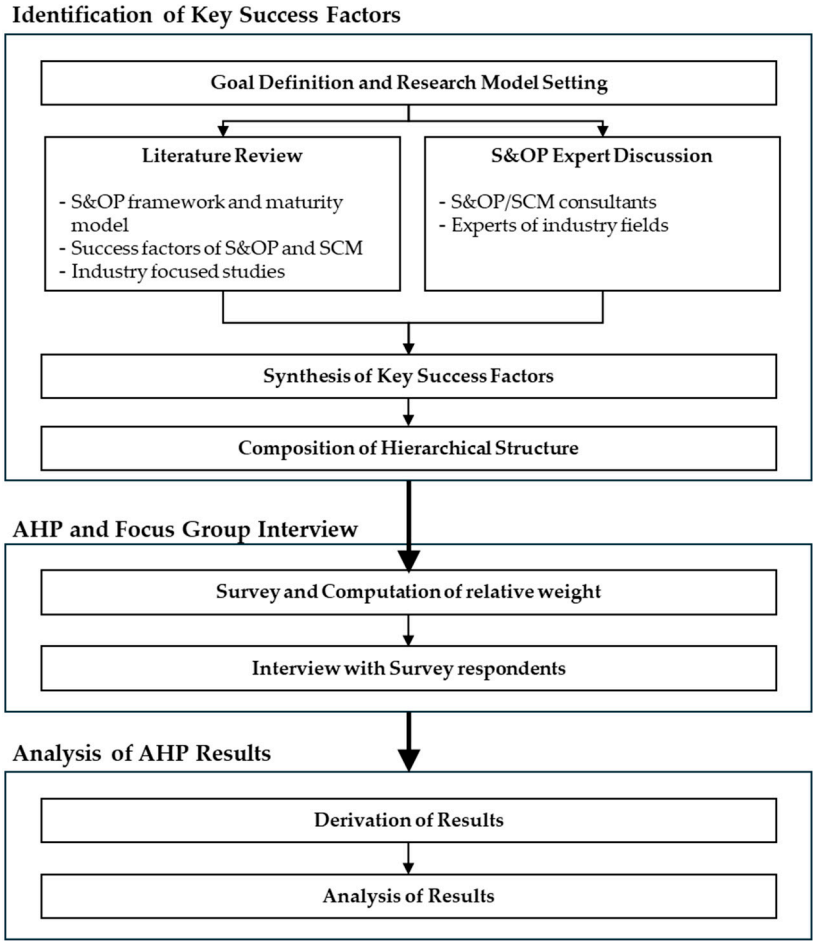

Figure 1. Research Procedure.

The first step is to identify the critical success factors of S&OP. To derive the critical success factors, this study synthesized previous research related to S&OP frameworks, maturity models, and SCM success factors. We have organized the structural hierarchy among derived success factors.

In the second phase, the S&OP success factors derived from the literature review were finalized through discussions with management consultants specializing in SCM/S&OP and S&OP practitioners from manufacturing and retail companies. One expert was selected from the manufacturing and retail industries, and one expert was selected from the management consulting sector with experience in both SCM/S&OP in the manufacturing and retail industries. All three experts have over a decade of experience in S&OP. The discussion commenced with the sharing of the prepared critical success factors one week prior to the meeting, which was followed by a two-hour online meeting (Zoom) between the authors and the three experts in early February 2024. The results of the discussion were used to finalize the critical success factors for S&OP success.

The last phase has been applied to the AHP to assess and compare the relative importance of each S&OP success factor between the manufacturing and retail industries. AHP was developed by Thomas L. Saaty in the 1970s and is one of the most widely used multi-criteria decision-making techniques [36]. AHP uses a relative scale to construct a pairwise comparison matrix for each evaluation factor and calculates a priority vector to determine the relative importance of each factor. To construct the pairwise comparison

matrix, field experts are asked to give the relative importance between two factors with a seven or nine-point scale, and pairwise comparisons are conducted.

It is most important to evaluate the consistency of respondents in the pairwise comparison. The concepts of Consistency Ratio (*CR*) and Consistency Index (*CI*) are applied here, as shown in Equation (1), where the *CI* is calculated from the Eigenvalue of the pairwise comparison matrix, and the *CR* is divided by the Random Consistency Index (*RI*), which is derived from a randomly generated sample of the pairwise comparison matrix.

$$CI = \frac{\lambda_{max} - n}{(n-1)} CR = \frac{CI}{RI} \lambda_{max} : the\ maximum\ eigenvalue\ of\ pairwise\ comparison\ matrix n\ : number\ of\ variables \quad (1)$$

The *CR* value is generally considered to be inconsistent if it is greater than 0.1, and in this study, we excluded survey results that were greater than 0.1 to ensure the consistency of the responses. Additionally, each response was geometrically averaged and summed to calculate the final importance. The process of AHP is described in Figure 2.

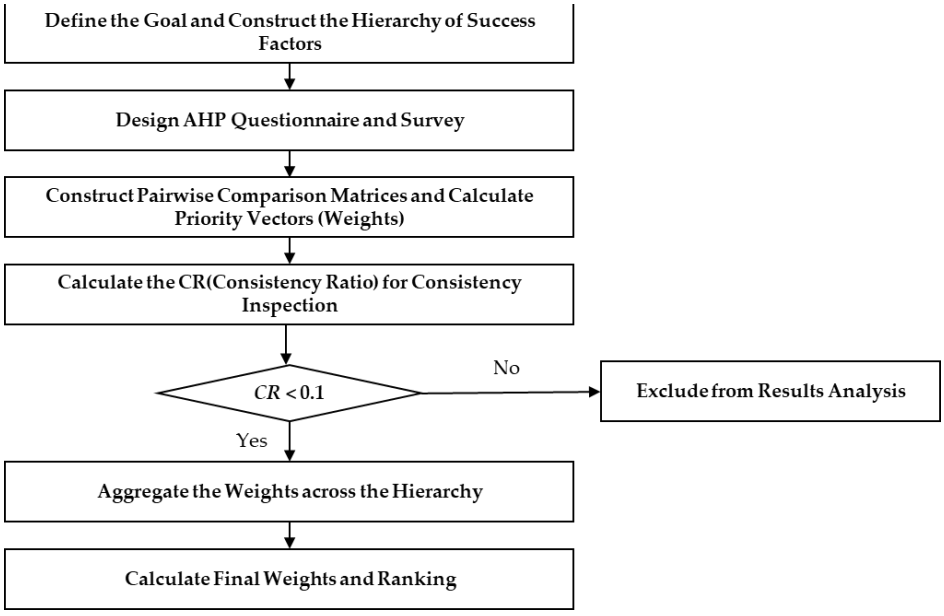

Figure 2. Process of AHP Analysis.

To analyze the difference in the relative importance of S&OP success factors between manufacturing and retail, which is the ultimate goal of this study, it is most critical to organize the respondents from both industries. To ensure the logical accuracy of comparative analysis, 13 experts from each industry, in total 26 experts with more than 10 years of work experience, are invited for the survey, who have enough knowledge of S&OP processes. The basic information about the survey participants such as work experience and department is explained in Table 3. The respondents' companies are presented in Table 4, which is divided into large-sized companies and medium/small-sized companies based on the criteria defined by Statistics Korea. Large-sized companies include companies such as Samsung Electronics, LG Chemical, and Coupang, with an average revenue of USD 60,314 million and an average number of 139,780 employees as of 2023. Medium/small-sized companies include YURA Corporation, BGF, and others, with an average revenue of USD 8838 million and 248 employees in 2023.

Table 3. Profile of Survey Respondents.

		Sample Size	%
Industry	Manufacturing	13	50%
	Retail	13	50%
Department	Sales	2	8%
	Production	2	8%
	Purchasing/Merchandising	4	15%
	SCM/S&OP	10	38%
	Logistics	8	31%
	C-lever	3	12%
Position	Team Leader	14	54%
	Team member	9	35%
Years worked	~10 Years	3	12%
	10~20 Years	18	69%
	20 Years~	5	19%

Table 4. Summary of the Companies.

Industry	Company Name	Average Revenue (Million $)	Average Employees
Manufacturing	Large sized Company	60,314	139,780
	Medium/Small sized company	784	910
Retail	Large sized Company	8838	6280
	Medium/Small sized company	266	248

For the additional validation of the AHP results, we interviewed two experts from both the manufacturing and retail industries, respectively. They helped to interpret the results of AHP and find valuable insight to make S&OP successful.

3.2. Comparative Approach for Analyzing AHP Results

The AHP results were divided into three groups: manufacturing and retail, manufacturing, and retail industry, respectively. First, we examined the AHP results within the manufacturing and retail industry. In each industry, we checked the ranking of major factors and the ranking of subfactors within major factors.

Next, we conducted a comparative analysis of the success factors for the manufacturing and retail industry. The criteria for comparison are the differences in prioritization and the differences in the magnitude of relative importance. Firstly, it is possible that the two industries may have different prioritization of importance for the same factor, and that the top-ranked factors in the two industries may be different. Further analysis is required to understand the reasons behind the observed differences. Secondly, the magnitude of relative importance indicates the degree to which a factor is considered significant within an industry. Even though a certain factor is ranked at a similar level, if the values of relative importance are significantly different, it may indicate that that factor should be considered the most important in the targeted industry. Also, the reason should be investigated and understood.

In accordance with the criteria mentioned above, a comparative analysis was conducted of the major factors for both industries. Subsequently, the subfactors within the major factors were compared. Finally, a global comparison of the subfactors was performed without considering major factors.

It is not enough to just calculate the difference in prioritization and relative importance. This is because there are no valuable insights from a process, organization, and system perspective that can be used to adopt successfully S&OP processes in real business. These insights can be derived from an analysis of the causes of the differences between

the two industries. This paper employs two analytical perspectives, which are industry characteristics and position in the supply chain, to elucidate the causes, thereby offering insights that are both meaningful and insightful.

3.3. Identified Success Factors of S&OP

Through the literature review and discussion with experts, four major factors of S&OP critical success factors were identified as "Strategic Support and Leadership", "Operational Process", "Information Synchronization", and "Performance Management". Also, each major factor consists of three or four subfactors, which are thirteen in total. In Table 5, all S&OP success factors are explained with a short description.

Table 5. Key Success Factors for S&OP.

Major Factor	Subfactor	Description
Strategic Support and Leadership	Top management support and commitment	• C-Level attention and ongoing investment in resources • Fast decision making on S&OP issues
	Consensus on goal and importance to the S&OP process	• Periodic sharing of S&OP goals and results • Understanding of S&OP processes and personal work of employees
	Dedicated S&OP team and team member skills	• Dedicated team to manage the S&OP process • Empowered people in the organization
Operational Process	Collaborative plan integration and decision making	• Plan integration by collaborating across organizations or companies in the supply chain • Collaborative decision making processes
	Process visibility	• Transparent view of all activities, allowing stakeholders to see real-time or near real-time data on the movement of products and information • Traceability of information at every step and information-based decision making
	Risk and event management	• Identification of possible risks or exceptional events • Scenario analysis and decision making processes for risk management
	Fast cycle of the Plan-Do-See loop	• Systematic Plan-Do-See process • Continuous improvement for agile responsiveness
Information Synchronization	Demand/sales plan	• Short/medium/long-term demand forecast and sales plan
	Inventory level	• Target inventory levels based on consensus
	Production/purchase plan	• Short/Medium/Long Term Production/Purchase Plan
Performance Management	S&OP Performance Metrics	• Define metrics to measure the performance of the entire S&OP process
	Regular monitoring and feedback	• Consistent monitoring indicators that reflect the status of the supply chain • Organized feedback mechanism
	Compensation policy	• Organizational and individual metrics goal setting • Accountability and reward policies

3.3.1. Strategic Support and Leadership

Sub-factors of the "Strategic Support and Leadership" were identified as "Top management support and commitment", "Consensus on goal and importance to the S&OP process", and "Dedicated S&OP team and team member skills". First, leadership is essential to provide direction and drive change in S&OP [4,6,16,25,31,34]. Leadership must motivate the team with a clear vision and strategy and manage the process effectively. In particular, the success of S&OP requires a change in the mindset of the organizational culture, which depends on the ability of managers to control the S&OP process. In addition, management must take the initiative to invest company resources in S&OP and make quick decisions on key S&OP agendas. Second, from an organizational perspective, the entire company must have a deep understanding of the importance and goals of S&OP [28,34]. This is an important factor in strengthening teamwork toward common goals and fostering cross-functional collaboration. Teamwork based on empathy aligns the strategic direction of the business with the direction of the organization, which in turn has a positive impact on business performance. Finally, it is important to have a dedicated S&OP organization and high competence of its members to consistently manage and execute S&OP processes [7,16–18,24,25]. A dedicated organization is essential to conduct regular meetings and to quickly identify and resolve issues that arise in the S&OP process. In addition, due to the complexity of S&OP, which includes functions such as demand, supply, logistics, and finance, the members of the organization must have expertise and excellent communication skills.

3.3.2. Operational Process

Sub-factors of the "Operational Process" were identified as "Collaborative plan integration and decision making", "Process visibility", "Risk and event management" and "Fast cycle of the Plan-Do-See loop". First, collaboration is an important factor mentioned in almost all research and practitioner opinions [17,23–25,28,31]. Collaboration includes both collaborating among internal organizational members and with other partners in the supply chain. Based on collaboration, it is necessary to synchronize the various plans in the S&OP process and operate all plans within the company as a single plan. In addition, cross-departmental and cross-enterprise collaboration is the basis for making quick and accurate decisions on various issues that arise in the S&OP process. The second is S&OP process visibility [27,31]. Process visibility, which allows members to review various data such as actual performance, plans, and standard information that exist in the S&OP process, not only facilitates cross-departmental collaboration by ensuring that all parties in the process have access to the same information but also builds trust among stakeholders by creating a culture where information is shared openly. Most importantly, process visibility allows for data-driven decision-making, enabling objective responses to issues. Third is the identification and response to risks or exceptional situations. S&OP processes can play an important role in managing various risks caused by uncertain external variables. Viswanathan [23] highlights the ability to identify and manage events that are not defined in the S&OP process, and the ability to create scenarios to anticipate and respond to risks in S&OP operations as key success factors for S&OP. The final success factor is the fast cycle of the Plan-Do-See loop. This refers to agility, which is the ability of an organization to respond quickly to market changes or unexpected events. The market environment changes very quickly, and customer needs are unpredictable. If it is difficult to respond proactively, it is important to minimize the negative effects of problems that occur by quickly creating a virtuous cycle of the Plan-Do-Check loop.

3.3.3. Information Synchronization

When making S&OP plans or creating new information for decision-making, many other important pieces of information need to be reflected and synchronized with each other [26]. The important information that should be synchronized in the S&OP plan is "Demand/sales plan", "Inventory level", and "Production/purchase plan". Many research and practice experts agree that demand/sales plans are important and require a lot of

effort to improve their accuracy [26,28,37]. The core of S&OP is to balance supply and demand, and the demand/sales plan should be reflected to control supply and prevent inventory shortages and excesses in the company or supply chain. This in turn affects the company's financial performance and customer satisfaction. The second is inventory level. The inventory target, managed internally by the organization, has a significant impact on supply chain operations [18,28,38]. Excess inventory ties up capital unnecessarily, while shortages can lead to poor customer satisfaction. Therefore, S&OP plans should synchronize information on inventory targets. Finally, production/purchase plans are key information for resource allocation in manufacturing and retail companies [28,39]. In manufacturing, incorrect production plans cause problems such as production delays and material shortages, which directly affect the company's performance. In retail, incorrect purchasing planning leads to overstocking and understocking in the supply chain, which directly affects customer satisfaction. According to experts in the field, the production/purchase plan is the most important information to be standardized and synchronized when implementing S&OP, and an increasing number of companies are adopting Advanced Planning and Scheduling (APS) systems for accurate and practical planning [39].

3.3.4. Performance Management

Sub-factors of the "Performance Management" were identified as "S&OP Performance Metrics", "Regular monitoring and feedback", and "Compensation policy". First, S&OP Performance Metrics mean establishing evaluation criteria to measure the success of the S&OP process; these metrics include demand forecast accuracy, inventory levels, order fulfillment, and customer satisfaction [7,16,17,19,23]. Second, through regular monitoring, organizations can continuously track and evaluate their performance [25,27]. If it is expected that the goal will not be achieved, a detailed action plan can be developed to achieve the goal, or the higher-level strategy can be adjusted. Typically, an integrated information system with dashboards is developed and operated to monitor metrics. Finally, a compensation policy motivates the organization and its members to do their best to achieve S&OP goals [25,40]. By clarifying accountability for performance, each member is aware of his or her role and expectations, which encourages active participation and co-operation within the organization. Compensation policies are also an important factor in S&OP success because they directly influence employee behavior by encouraging an understanding of the business and organizational goals, cross-functional collaboration to achieve those goals, and process improvement.

4. Results and Discussion

Among the whole result of the survey, only two respondents with higher CR than 0.1 are excluded from each industry, respectively. Thus, from the total 22 respondents, 11 from the manufacturing industry and 11 from the retail industry remained. Through AHP analysis, the priority and relative importance of major and subfactors are assessed. From now on, the result of AHP and comparative analysis will be explained in detail.

4.1. Result in Manufacturing Industry

The relative importance and prioritization of manufacturing S&OP success factors are shown in Table 6. Major factors were prioritized in the order of "Strategic Support and Leadership", "Operational Processes", "Information Synchronization", and "Performance Management".

"Strategic Support and Leadership" (0.460) was selected as the most important success factor for the manufacturing industry. Among the subfactors, "Top management support and commitment" (0.572) was ranked as the first with a significant gap, followed by "Consensus on goal and importance to the S&OP process" (0.218), and finally "Dedicated S&OP team and tea member skills" (0.210).

Table 6. Weights and Ranking of Manufacturing Industry.

Major Factor (Weight, Ranking)	Subfactor	Relative Weight	Relative Ranking
Strategic Suppor tand Leadership (0.460, 1st)	Top management support and commitment	0.572	1st
	Consensus on goal and importance to the S&OP process	0.218	2nd
	Dedicated S&OP team and team member skills	0.210	3rd
Operational Process (0.269, 2nd)	Collaborative plan integration and decision making	0.356	1st
	Process visibility	0.302	2nd
	Risk and event management	0.099	4th
	Fast cycle of the Plan-Do-See loop	0.242	3rd
Information Sychronization (0.183, 3rd)	Demand/sales plan	0.538	1st
	Inventory level	0.150	3rd
	Production/purchase plan	0.312	2nd
Performance Management (0.088, 4th)	S&OP Performance Metrics	0.489	1st
	Regular monitoring and feedback	0.269	2nd
	Compensation policy	0.242	3rd

"Operational Process" (0.269) was ranked as the second major factor. Since the S&OP process is cross-functional and various departments should be involved, "Collaborative plan integration and decision making" (0.356) was ranked as the first among the subfactors. The next most important subfactor was "Process visibility" (0.302). This is followed by "Fast Cycle of the Plan-Do-See Loop" (0.242), which emphasizes the agility of the process. "Risk and event management" (0.099) was evaluated at the lowest level.

"Information Synchronization" (0.183) was ranked as the third major factor. Among the subfactors describing the type of information synchronized, "Demand/sales plan" (0.538), which can be regarded as the beginning of S&OP, showed a great difference in relative importance with the second-ranked subfactor "Production/purchase plan" (0.312). The last subfactor was "Inventory level" (0.150).

"Performance management" (0.088) was ranked as the last one. Among the subfactors, "S&OP performance metrics" (0.489) ranked as the first with a significant difference, followed by "Regular monitoring and feedback" (0.269) and "Compensation policy" (0.242).

4.2. Results in Retail Industry

The relative importance and priority among the S&OP success factors of the retail industry are shown in Table 7. Major factors were ranked in the order of "S&OP Operational Processes", "Strategic Support and Leadership", "Information Synchronization", and "Performance Management".

"Operational Process" (0.386) was assessed as the most important success factor for the retail industry. Among subfactors, "Collaborative plan integration and decision making" (0.354) was given the highest importance. It was followed by "Process visibility" (0.338) and "Fast Cycle of the Plan-Do-See Loop" (0.203). Finally, "Risk and event management" (0.105) was ranked at the fourth.

"Strategic Support and Leadership" (0.306) was ranked as the second most important success factor. Among the subfactors, "Consensus on goal and importance to the S&OP process" (0.437) was given the highest relative importance, followed by "Top management support and commitment" (0.369) and "Dedicated S&OP team and team member skills" (0.194).

Table 7. Weights and Ranking of the Retail Industry.

Major Factor (Weight, Ranking)	Subfactor	Relative Weight	Relative Ranking
Strategic Suppor tand Leadership (0.306, 2nd)	Top management support and commitment	0.369	2rd
	Consensus on goal and importance to the S&OP process	0.437	1st
	Dedicated S&OP team and team member skills	0.194	3rd
Operational Process (0.386, 1st)	Collaborative plan integration and decision making	0.354	1st
	Process visibility	0.338	2nd
	Risk and event management	0.105	4th
	Fast cycle of the Plan-Do-See loop	0.203	3rd
Information Synchronization (0.203, 3rd)	Demand/sales plan	0.573	1st
	Inventory level	0.222	2nd
	Production/purchase plan	0.205	3th
Performance Management (0.104, 4th)	S&OP Performance Metrics	0.530	1st
	Regular monitoring and feedback	0.293	2nd
	Compensation policy	0.177	3rd

Among the major success factors, "Information Synchronization" (0.203) was ranked as the third one. Among the subfactors, "Demand/sales plan" (0.573) was top-ranked with a significant gap, followed by "Inventory level" (0.222) and "Production/purchase plan" (0.205).

"Performance management (0.104) was given the least importance in the retail industry. Among subfactors, "S&OP performance metrics" (0.530) ranked as the first, followed by "Regular monitoring and feedback" (0.293) and "Compensation policy" (0.177).

4.3. Results of Comparative Analysis

This subsection explains about the result of comparative analysis at both levels of major factors and subfactors. First, we compare the major factors of the two industries. Then, we compare the subfactors within the major factors. Finally, we compare all subfactors, without considering the major factors.

4.3.1. Comparison of Major Factors

Table 8 shows the relative importance and rank among the major success factors of both manufacturing and retail industries.

Table 8. Comparison of Importance Weight between Major Factors.

Major Factor	Manufacturing + Retail Industry		Manufacturing Industry		Retail Industry	
	Weight	Ranking	Weight	Ranking	Weight	Ranking
Strategic Support and Leadership	0.385	1st	0.46	1st	0.306	2nd
Operational Process	0.327	2nd	0.269	2nd	0.386	1st
Information Synchronization	0.192	3rd	0.183	3rd	0.203	3rd
Performance Management	0.096	4th	0.088	4th	0.104	4th

While in the manufacturing industry, "Strategic Support and Leadership" (0.460) was ranked as the most important factor, "Operational Process" (0.386) was selected as the first one in the retail industry. This can be explained based on the difference in complexity between the manufacturing and retail industries. In terms of internal operations such as research and development (R&D), demand and sales management, purchasing management, and logistics management, the manufacturing industry seems more complex than the retail industry. To overcome this complexity and make strategic decisions aligned with long-term goals, it is essential to be supported by the top leadership. Tchokogué et al. [4] studied the case of American manufacturer ASTRO Inc. and highlighted that the success of the S&OP process fundamentally depends on the ability of management to bring about a mindset change in the organizational culture and to plan and co-ordinate the S&OP process, which is consistent with the results of this analysis. On the other hand, in the retail industry, to secure competitive advantages, it is vital to develop an optimal distribution network and well-designed S&OP processes while enhancing the customer service level at each geographical market. In an in-depth interview, an S&OP expert at the leading convenience store operator in South Korea noted the importance of synchronizing demand information from 16,448 stores with planning information from the purchasing department and establishing a fast decision-making process for ordering and delivering goods.

Another insight can be derived from the maturity levels of the S&OP processes of both industries. From the in-depth interviews, most of the experts from the retail industry indicated that their own S&OP processes have not matured yet. In the manufacturing industry, the S&OP processes are developed for a long time to optimize operations by enhancing cost-efficiency. However, S&OP has started to develop quite recently in the retail industry. This is also supported by previous studies, such as Dreyer et al. [30], who found that the S&OP process is relatively better established in manufacturing, and Cecere et al. [31], who found that the maturity level of manufacturing is generally higher than that of retail. Considering these studies, the results of the AHP are also consistent with the study of Danese et al. [19] which shows that the importance of the "people and organization" dimension increases with increasing maturity, which was addressed in the literature review section.

4.3.2. Local Comparison among Subfactors

In this subsection, the relative importance and rank of the subfactors within the major factors have been analyzed. The following Table 9 shows the importance and rank of subfactors in both the manufacturing and retail industries.

Within the first "Strategic Support and Leadership" major factor, in the manufacturing industry, "Top management support and commitment" (0.473) was ranked as the most important factor, while in the retail industry, "Consensus on goal and importance to the S&OP process" (0.437) was ranked. This is consistent with the results of the major factor analysis. Effective implementation of S&OP requires significant investments in technology, training, and process alignment due to the complex and resource-intensive nature of manufacturing operations. Thus, executive sponsorship is critical to provide the strategic direction and commitment required for stable investments. It also ensures that the S&OP process should be aligned with the overall business strategies. In other words, in the manufacturing industry, top-down leadership is required to emphasize the necessity for strategic direction, resource commitment, and cross-functional integration for successful S&OP process implementation. Top-down leadership can be defined as a style of leadership that provides clear direction and goals, and continually motivates and cares about achieving those goals. This is similar to transformational leadership, which has been extensively studied in the field of leadership. From this perspective, the study by Birasnav, M, which emphasized that transformational leadership could have an impact on reducing production lead times, reducing production costs, and improving production quality in manufacturing [41], can be used to support the results of the analysis.

Table 9. Comparison of Local Importance at the Level of Subfactors.

Major Factor	Subfactor	Manufacturing + Retail Industry		Manufacturing Industry		Retail Industry	
		Local Weight	Local Ranking	Local Weight	Local Ranking	Local Weight	Local Ranking
Strategic Support and Leadership	Top management support and commitment	0.473	1st	0.572	1st	0.369	2rd
	Consensus on goal and importance to the S&OP process	0.327	2nd	0.218	2nd	0.437	1st
	Dedicated S&OP team and team member skills	0.201	3rd	0.210	3rd	0.194	3rd
Operational Process	Collaborative plan integration and decision making	0.355	1st	0.356	1st	0.354	1st
	Process visibility	0.320	2nd	0.302	2nd	0.338	2nd
	Risk and event management	0.101	4th	0.099	4th	0.105	4th
	Fast cycle of the Plan-Do-See loop	0.223	3rd	0.242	3rd	0.203	3rd
Information Synchronization	Demand/sales plan	0.557	1st	0.538	1st	0.573	1st
	Inventory level	0.185	3rd	0.150	3rd	0.222	2nd
	Production/purchase plan	0.258	2nd	0.312	2nd	0.205	3th
Performance Management	S&OP Performance Metrics	0.511	1st	0.489	1st	0.530	1st
	Regular monitoring and feedback	0.280	2nd	0.269	2nd	0.293	2nd
	Compensation policy	0.209	3rd	0.242	3rd	0.177	3rd

In the retail industry, on the other hand, it is necessary to quickly respond to the volatile demand and changes in the market. To respond to a dynamic market environment effectively and efficiently every part of the organization must collaborate to fit its own operations while aligning with the ultimate goal and overall strategies. This means that the bottom-up approach which emphasizes a consensus among internal and external stakeholders is critical in the retail industry. In a case study of Rt-Mart, a retailer in China, Li, L. [42] proposed a bottom-up style of leadership as a means of transforming the corporate culture of teamwork, collaboration, and consensus among employees, with the objective of resolving the issues that Rt-Mart was facing. These findings are likely to be equally applicable to the adoption of S&OP processes in the retail industry.

Second, when comparing the differences within the "Operational Process" factors, in the both the manufacturing and retail industries, "Collaborative plan integration and decision making" is ranked as the first subfactor, followed by "Process visibility", "Fast cycle of the plan-do-see loop", and "Risk and event management". The importance of collaboration in planning and decision-making has been noted in many studies, as discussed in Sections 2 and 3.

The second most important factor, "Process visibility", has relatively higher importance in the retail industry (0.338) than in the manufacturing industry (0.302). Usually, retail companies take the role of warehousing, logistics, inventory, and order management in internal and external supply chains, which are extended to a wide geographical area. Thus, process visibility is required to monitor the whole supply chain and make agile and reasonable decisions. The retail business takes the role of communication channel with the customer in the supply chain. It is very critical to quickly respond to fluctuating demand and meet the high expectations of the customer by enhancing visibility. It is for this reason

that most global retailers heavily invest in ICT systems that can analyze customer behavior and market conditions and forecast future demand. Similarly, the third subfactor, "Fast Cycle of Plan-Do-See Loop" has a higher relative importance in the manufacturing (0.242) than the retail industry (0.203). In terms of the operating cycle, the manufacturing industry seems to be longer than the retail industry because whole functions of the value chain such as R&D, production, procurement, marketing, sales, and logistics are included in the manufacturing. Because of the longer operating cycle, it may be difficult to change the operation plans very quickly. In addition, it has a higher possibility of facing the greater bullwhip effect in the manufacturing industry. However, it may be possible to shorten the operational cycle based on the fast execution of the Plan-Do-See loop, which can ensure "Agility" in the supply chain.

Third, when focusing on the differences within "Information Synchronization", in both the manufacturing and retail industries, the "Demand/sales plan" was ranked as the most important subfactor. In both industries, most companies are working on improving the accuracy and visibility of the demand forecast or sales plan, which can be the most important basic information for executing the S&OP process. The second factor is "Production/purchase plan" (0.312) in manufacturing, but "Inventory level" (0.222) in the retail industry. In manufacturing, production/purchase plans should be synchronized with S&OP plans to account for material availability, which can prevent production delays and shutdowns due to the stock-out of raw materials or parts. In the retail industry, on the other hand, customer satisfaction is the most important KPI and inventory availability has a direct and great impact on the customer service level. The synchronization of target inventory levels means that popular items are always in stock and customer orders can be fulfilled immediately, which ensures higher customer satisfaction. From the in-depth interviews, it is possible to capture the difference in the perception of inventory between the manufacturing and retail industries. Experts from the manufacturing industry still regard inventory as something to be minimized, while those from the retail industry consider inventory as a valuable asset that must be always available.

In the manufacturing industry, inventory is regarded as the result of unnecessary investments along the processes including product development, production, or transportation. Still, there exist experts who believe that excessive inventory makes cash flow and profitability worse. As a result, it requires a great effort to improve the accuracy of demand forecasting. In the retail industry, although the accuracy of demand forecasting is also important, experts believe that they have to hold a wide range of inventory to fulfill various customer demands. It can be the source of core competitive advantage. In practice, excessive inventory makes managers focus on developing promotional strategies to adjust the unexpected inventory level due to overestimating the future demand.

Finally, for the "Performance Management" factor, in both the manufacturing and retail industries, "S&OP performance metrics", "Regular monitoring and feedback", and "Compensation policy" have been ranked in that order. The importance of compensation was higher in manufacturing (0.242) than in retail (0.117). Therefore, it can be interpreted that individual and team performance in manufacturing has a direct impact on production efficiency, cost control, and quality assurance, while the more balanced approach requires accountability and incentives as company-wide processes that may affect customer service levels rather than individual performance.

4.3.3. Global Comparison in Subfactors

The global relative importance and priority of the 13 subfactors, except major factors, are shown in Table 10.

Table 10. Comparison of Global Importance Weight between Subfactors.

Major Factor	Subfactor	Manufacturing + Retail Industry		Manufacturing Industry		Retail Industry	
		Global Weight	Global Ranking	Global Weight	Global Ranking	Global Weight	Global Ranking
Strategic Support and Leadership	Top management support and commitment	0.182	1st	0.263	1st	0.113	5th
	Consensus on goal and importance to the S&OP process	0.126	2nd	0.100	2nd	0.134	2nd
	Dedicated S&OP team and team member skills	0.077	6th	0.097	4th	0.059	7th
Operational Process	Collaborative plan integration and decision making	0.116	3rd	0.096	5th	0.137	1st
	Process visibility	0.105	5th	0.081	6th	0.130	3rd
	Risk and event management	0.033	11th	0.027	10th	0.041	11th
	Fast cycle of the Plan-Do-See loop	0.073	7th	0.065	7th	0.078	6th
Information Synchronization	Demand/sales plan	0.107	4th	0.098	3rd	0.116	4th
	Inventory level	0.036	10th	0.027	11th	0.045	9th
	Production/purchase plan	0.050	8th	0.057	8th	0.042	10th
Performance Management	S&OP Performance Metrics	0.049	9th	0.043	9th	0.055	8th
	Regular monitoring and feedback	0.027	12th	0.024	12th	0.030	12th
	Compensation policy	0.020	13th	0.021	13th	0.018	13th

Without considering the industries, subfactors "Top Management Support and Commitment" (0.182), "Consensus on Goal and Importance to the S&OP Process" (0.126), "Collaborative Plan Integration and Decision Making" (0.116), and "Demand/Sales Plan" (0.107) are top ranked. However, in the manufacturing industry, "Top management support and commitment" (0.263), "Consensus on goal and importance to the S&OP process" (0.100), "Demand/sales plan" (0.098), and "Dedicated S&OP team and team member skills" (0.097) are highly ranked. In addition, the relative importance is concentrated on the first ranked subfactor. In contrast, there are different results in the retail industry. The following subfactors are highly ranked: "Collaborative plan integration and decision making" (0.137), "Consensus on goal and importance to the S&OP process" (0.134), "Process visibility" (0.130), and "Demand/sales plan" (0.116). In addition, the difference among the top three subfactors is not significant.

These findings can provide crucial insights for the success of S&OP process in the manufacturing and retail industries. "Top management support and commitment" (0.263) of the manufacturing industry is over twice of the second ranked factor, "Consensus on goal and importance to the S&OP process" (0.100), and almost twice of the "Collaborative plan integration and decision making" (0.137) in the retail industry. This implies that top-down leadership is more important than others because of the complex and resource-intensive nature of the manufacturing industry, as discussed in Section 4.3.2. In other words, the manufacturing industry can enhance the probability of success of the S&OP process by focusing on the factor of top management support, rather than other factors. In contrast, the retail industry exhibits minimal variation in the relative importance of its top factors. This implies that for the success of the S&OP process, a balanced design that considers various factors, is more important than focusing on specific factors like the manufacturing industry.

"Consensus on goal and importance to the S&OP process" was ranked second in both the manufacturing (0.100) and retail (0.134) industries. It can be said that the consensus of the entire organization on the same goals is very important for successful S&OP regardless of the industry or domain. The third important factor was "Demand/sales plan" (0.098) in manufacturing and "Process visibility" (0.130) in retail. "Demand/sales plan" was ranked fourth in the retail industry, indicating that in the manufacturing industry, experts have focused more on the demand forecasting process. On the other hand, visibility into the S&OP process has been given more importance and ranked at third in the retail industry but ranked at sixth in the manufacturing industry.

5. Conclusions

S&OP is a critical core process that has a direct impact on supply chain performance. In addition, its strategic importance has been widely recognized in recent years. Thus, various companies across all industries have started to adopt the S&OP processes. However, there exist many companies that have failed to adopt and operate S&OP. One of the critical reasons can be found in the practical cases that did not consider the nature or its own characteristics of the industry and company. They have just applied a one-size-fits-all approach which leads to inefficiencies and operational failures. Nevertheless, it is very hard to find previous academic research that focuses on critical success factors for the S&OP process, especially comparing different industries that may consist of the global supply chain.

The purpose of this study is to identify the difference in S&OP success factors between the manufacturing and retail industries and to derive valuable insights to help real businesses. As a first step, various success factors that affect the success of S&OP have been identified for both the manufacturing and retail industries. Then, the relative importance of success factors has been evaluated based on the AHP approach. Based on the ranks and importance of both major and subfactors, the characteristics of the manufacturing and retail industries have been compared.

To summarize the AHP results of S&OP critical success factors for manufacturing and retail, in the manufacturing industry, "Strategic Support and Leadership" was selected as the most important factor among the four major factors, and "Top Management Support and Commitment" was the most important subfactor. Moreover, "Operational Process" was identified as the second most significant major factor, followed by "Information Synchronization". With regard to the subfactor of "Information Synchronization", the most important factor was "Demand/Sales Plan", while "Production/Purchase Plan" was of greater importance than "Inventory Level". In the retail industry, the most significant major factor was "S&OP Operational Processes", followed by "Strategic Support and Leadership". With regard to the subfactor of "Strategic Support and Leadership", the most significant factor was identified as "Consensus on goal and importance to the S&OP process". The third major factor was "Information Synchronization". The most significant subfactor was "Demand/Sales Plan", while "Inventory Level" was more important than "Production/Purchase Plan".

From the differences, some valuable insights can be derived. Firstly, "Top management support and commitment" is recognized as a relatively more important factor than other factors in the manufacturing industry, which means that a lot of attention needs to be concentrated on this factor for the success of the S&OP process. On the other hand, the retail industry has a similar magnitude of importance of the top three factors, which means that for S&OP success, several factors must be considered in a balanced view rather than focusing on specific factors like the manufacturing industry. Secondly, from a process perspective, "Collaborative plan integration and decision making" is an important factor regardless of the industry. Thirdly, from an information perspective, "Demand/sales plan" is the most important information, but manufacturing perceives "Production/purchase plan" and retail perceives "Inventory level" as the second most important information.

Finally, "Performance Management" had a low relative importance compared to other factors in both industries.

The findings in this research provide a comprehensive understanding of the success factors in implementing the S&OP process or improving the adopted projects in both industries as well as the global supply chain. Also, it may help develop effective S&OP strategies tailored to the characteristics of each industry by showing the factors that should be focused on. Practically, the results of the quantitative assessment of each factor can also help to efficiently allocate resources to accomplish a strategic goal. The academic value of this research can be found in highlighting the differences between the manufacturing and retail industries and providing a foundation for future research to further explore the more meaningful differences.

However, this research has still some limitations, which can be resolved in further research. Firstly, the present study compared manufacturing and retail from an industry-wide perspective. However, as Tables 3 and 4 illustrate, even within the same industry, there are large companies and medium/small companies, and their perspectives may differ. Furthermore, even within the same company, procurement experts and sales experts may hold disparate views. A more comprehensive analysis that incorporates these diverse factors within industries and companies should be a focus of further research. Secondly, the identified S&OP success factors need to be expanded to consider the global supply chain at the same time. External supply chain factors that have great impacts on the performance and operating of the S&OP process, such as geopolitical and environmental factors in global supply chains, should be considered. Thirdly, in this research, we have focused on only two industries: manufacturing and retail. A current global supply chain consists of various stakeholders and has a more complicated structure. Thus, the research framework should be extended by considering the different characteristics of various industries such as high-tech manufacturing, pharmaceuticals, fast-moving consumer goods (FMCG), and e-commerce, as well as companies with different positions in the supply chain. Lastly, further research that tracks the evolution of S&OP success factors over time to account for rapid changes in market demand, technological advances, and global trade patterns would also provide insights into the nature of S&OP effectiveness.

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