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Risk management and collaboration on firms' sustainability for supply chain resilience

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Abstract

Supply chain management is thought to increase a company's competitive advantage and has always been crucial to the success and pleasure of its clients in the industrial sector. Up until the COVID-19 outbreak, which is regarded as an unprecedented disruption impacting all organizations. It revealed the criticality of supply chain management while also impeding global operations. Increased supply chain resilience is required, as it has been noted that organizations were ill-prepared for the pandemic, which led to flaws in their present responses and strategies. Focusing on empirical research on several supply chain resilience performance indicators are necessary in cases when the pandemic had a higher impact on buyers and suppliers. The impact of risk management and collaboration on a company's sustainability was investigated in this study as a foundation for supply chain resilience. The findings showed that the industries with the highest concentration of supply chain and procurement experts are general manufacturing, aviation, and automotive. The risk management, collaboration, and sustainability of the manufacturing firms in CALABARZON exhibit notable variations based on various factors such as educational attainment, industry affiliation of the managers, department or unit within the company, employment status, length of service, and unit/department. Furthermore, there is a strong link between sustainability and risk management and collaboration.

Keywords: risk management, supply chain resilience, sustainability, collaboration, manufacturing firms

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1. Introduction

Supply Chain Management (SCM) has evolved into an important component of a thriving business and providing excellent service to clients. Increasing an organization's supply chain skills leads to improved organizational performance (Marhamati & Azizi, 2017). Modern businesses view supply chain management as a strategic instrument that may help them gain a competitive edge (Qrunfleh & Tarafdar, 2013). However, the COVID-19 problem has resulted in significant interruptions to the supply chain, and these disruptions may be linked back to fundamental supply chain vulnerabilities that have been previously extensively characterized in the relevant literature. During the COVID-19 (Corona virus) crisis, the supply chain has observed a lack of readiness, weaknesses of current reaction strategies, and the requirement for increased supply chain resilience (Van, 2020). Because of the need for businesses to create resilient business models in order to deal with the managerial and environmental disturbances that might affect individual enterprises as well as supply networks, resilience has emerged as an essential issue in the field of strategic management. On the other hand, the existing body of research does not provide enough in-depth insights into how businesses build and operate supply chains in accordance with the resilience principles (Shashi et al., 2020).

Chandra, et al. (2019) states that one of the key performance indicators of a resilient supply chain is collaboration, and it is also one of the most common signs. It is stated in the majority of the papers that were reviewed that if a company works together with other businesses for the purpose of gaining mutual benefit, then this makes the company's supply chain more robust. In addition to being a performance measure, sustainability also has a significant number of characteristics with resilience (Ivanov, 2018). Within the most successful businesses in the service sectors over the course of the past two decades, sustainability strategies and initiatives have steadily risen to the forefront of organizational priorities. However, the COVID-19 (Coronavirus) represents a significant obstacle for the vast majority of businesses operating within these sectors, and it may cause them to decrease their dedication to sustainable growth. On the other hand, a counterargument maintains that an ongoing commitment to sustainability will be crucially necessary in sustaining the links between the service sectors and the natural and social capital on which many of them depend (Jones & Comfort, 2020). The management of risks is often included under the umbrella term of "economic efficiency," which is a component of sustainable development. One of the fundamental issues in supply chain management right now is finding a balance between these two measures of structures and processes (Ivanov, 2018).

The consequence of the COVID-19 (Coronavirus) is a situation that no one anticipated, and it is regarded to be a wakeup call in supply chain management, notably in procurement, as a result of this. According to Choi et al. (2020), as procurement teams struggle to cope with the COVID-19 global pandemic, the majority of them have been trying to keep up with the news about global response measures and have been working diligently to secure raw materials and components and protect supply lines. In addition, they have been trying to keep up with the news about global response measures. The company's customers and vendors were the ones that suffered the most from the pandemic's effects. Supply chain disruptions are a normal occurrence and can be caused by a variety of factors, including natural or environmental events, alterations in government legislation, faulty planning and forecasting, and so on. Each of these disruptions has a specific strategy that may be used to mitigate its effects. Companies were able to formulate mitigation strategies and identify potential solutions.

Objectives of the Study - This study explored the effect of risk management and collaboration on firms' sustainability as a basis for supply chain resilience. The research study aimed to measure the effect of risk management in terms of supply risks. The study intended to assess the degree of collaboration in terms of Planning, Forecasting and Replenishment (CPFR) and Marketing. Furthermore, the study intended to assess the level of the participants understanding on the sustainability in terms of: Culture, Entrepreneurial Orientation and

Social Sustainability. Moreover, the study intended to test the significant relationship of risk management and collaboration, to sustainability.

2. Methods

Research Design - This research uses the descriptive technique of research in order to obtain the necessary material in order to investigate the influence that risk management and cooperation have on the long-term viability of businesses. The current state of the participants was the primary focus of the descriptive research that was done. Survey questionnaires were the primary instruments utilized in the data collection process. The goal of collecting data for descriptive research is to answer questions on the present status of the subject's preferences, attitudes, practices, worries, or interest and satisfaction among a sample. Research that is descriptive in nature and focuses on the circumstances of relationships that already exist; practices that are commonly followed; beliefs; processes that are already occurring; impacts that are currently being experienced; or trends that are currently forming (Calderon and Gonzales, 2017).

Participants of the Study - Companies that were registered with the Philippine Economic Zone Authority (PEZA) as manufacturers and were located in Region 4, CALABARZON were invited to take part in the research. There are 913 factories and manufacturing enterprises in total. Purposive sampling was the method that was utilized in the process of selecting the respondents to participate in the study. The companies were selected using a number of factors, including the production sites described above, as well as the industry or category of company. The respondents who were the focus of the survey were supply chain directors, supply chain managers, operations managers, and general managers, with middle management making up the balance of the sample. When determining the size of the sample, the researcher relied on Raosoft's Sampling Calculator, which provided a confidence level of 95 percent. The sample size has been calculated to be 258. The respondents were chosen using a set of lists that contained manufacturing companies together with the email addresses of the target respondents. These enterprises were located in a variety of Economic Zones within Region 4, CALABARZON. Respondents who had already worked with the researcher or who were professional acquaintances in the field of Supply Chain Management in CALABARZON were also selected for the study, and they contributed trustworthy answers. Through the use of email and several social media channels, a total of 300 online surveys were made available to respondents

Data Gathering Instrument - The researcher used four main data gathering instruments: Part 1 is based on the questionnaire made by the researcher. This includes the educational attainment, type of industry, department, position, employment status and length of service. Part 2 is standardized but modified questionnaire on Supply Chain Risk Management (Laradi, 2017). Part 3 is a standardized but modified questionnaire on Supply Chain collaboration (Singhry, 2015). Part 4 is a standardized questionnaire on Supply Chain Sustainability (Marshall, et. al, 2015).

Data Gathering Procedure - Every respondent was sent an email notice utilizing an online survey, and the email was connected to a letter of request that included an explanation of the study and how the survey was to be completed. The questionnaire was created by the researcher using Google forms, and it was sent online via email and by social media postings.

Data Analysis - Weighted mean and Ranking were used to evaluate the impact of risk management on supply risks; assess the degree of collaboration in terms of planning, forecasting, and replenishment (CPFR), and marketing; and evaluate the level of participants' understanding of sustainability in terms of culture, entrepreneurial orientation, and social sustainability. All of these evaluations were carried out in order to determine how well risk management mitigates supply risks. A Point Biserial Correlation analysis was carried out with the purpose of determining whether or not risk management and cooperation have a significant link to sustainability. The researcher also used the Likert Scale.

Ethical Considerations - Concerns pertaining to the ethical conduct of research, such as informed

permission, confidentiality, privacy, and anonymity, shall be respected throughout the course of this particular research project. Ethics are the norms or standards of behavior that influence moral decisions regarding our behavior and our interactions with other people, according to Saunders et al. (2009). Participants and responses will be provided with comprehensive information regarding the aim and objectives of the study so that they may make educated judgments regarding whether or not they would want to take part in the research. In addition, complete secrecy will be maintained with regard to any and all information concerning the identities and personalities of those who participate in the survey. In addition, any and all of the information that is acquired will be utilized solely for the purpose of the research study that is being conducted.

3. Results and discussion

Table 1
Risk Management in terms of Supply Risks

	Supply Risk	WM	VI	Rank
1	We are informed about possible risks in our supplier network.	3.32	Agree	13
2	We are constantly searching for short-term risks in our supplier network.	3.22	Agree	14
3	In risk analysis, we define early warning indicators.	3.32	Agree	10
4	During risk analysis for suppliers, we look for the possible sources of supply risks.	3.53	Agree	3
5	During risk analysis for suppliers, we evaluate the probability of supply risks.	3.51	Agree	4
6	During risk analysis for supplier, we analyze the possible impact of supply risks.	3.54	Agree	2
7	During risk analysis for suppliers, we evaluate the urgency of our supply risks.	3.45	Agree	6
8	During risk analysis for all suppliers, we classify and prioritize our supply risks.	3.49	Agree	5
9	During risk analysis for suppliers, we demonstrate possible reaction strategies.	3.36	Agree	8
10	During risk analysis for suppliers, we evaluate the effectiveness of possible reaction strategies.	3.36	Agree	8
11	Supply Risk Management is an important activity in our company.	3.65	Agree	1
12	We control our risk management methods in Procurement and Supply Management and adapt these to changing conditions.	3.42	Agree	7
13	We control the progress for critical supply risks.	3.32	Agree	10
14	We control our activities for identifying and analyzing supply risks	3.32	Agree	12
15	Our employees are experienced in solving occurrence of supply risks.	3.13	Agree	21
16	Our risk management processes in procurement are very professionally designed.	3.15	Agree	20
17	We managed to minimize the frequency of occurrence of supply risks over the last three years.	3.21	Agree	15
18	We managed to minimize the impact of occurrence of supply risks over the last three years.	3.17	Agree	18
19	We do have predictive analysis tools for SCRM.	2.90	Agree	22
20	We actively work on supply chain risk management	3.20	Agree	17
21	We work with buyers on supply chain risk management	3.16	Agree	19
22	We work with suppliers on supply chain risk management	3.20	Agree	16
Composite Mean		**3.32**	**Agree**	

Legend: 3.50 – 4.00 –Strongly Agree; 2.50 – 3.49 – Agree; 1.50 – 2.49 –Disagree; 1.00 – 1.49 – Strongly Disagree

Table 1 shows the mean distribution of assessment in effect of risk management in terms of supply risk. The result shows that respondents of the study agree with the assessment in terms of supply risk with a composite mean of 3.32. Ranked highest with a (WM=3.65), respondents agree that supply chain risk management is an important activity their company. While in the lowest rank with a (WM=2.90), respondents agree that they do have predictive analysis tools for SCRM.

The research conducted by Pertheban and Arokiasamy (2019) investigates the supplier risk management techniques and procedures that either help or impede the link between buying and operational improvement. According to them, the significant success in the operation process achieved via efficient supply risk management earns the trust of customers and increases the flexibility in terms of processing the urgent order requested by customers. Because of this, the global supply of every kind of component is now more likely to experience interruptions. Some of these disturbances are severe, and some of them may have repercussions on a global scale (Fang et al., 2013). The Supply Chain Risk Management Process allows for more efficient management of the risks associated with the supply chain (SCRMP). The steps of the structured method may be separated as follows: risk identification, risk measurement, and risk assessment; risk evaluation, risk mitigation, and contingency plans; risk control and monitoring via data management systems; and risk evaluation, risk

mitigation, and contingency plans. (Tummala & Schoenherr, 2011).

Table 2.1

Collaboration in terms of Collaborative Planning

	Collaborative Planning	**WM**	**VI**	**Rank**
1	We often adjust our production system to meet the requirement of our customers.	3.46	Agree	1
2	We often work with major customers to determine the delivery schedules that will best meet their needs.	3.45	Agree	2
3	We can depend on our suppliers to provide us with good planning information	3.11	Agree	6
4	Our firm prepares materials and production plan through a multifunctional (e.g., sales operations planning) team.	3.32	Agree	4
5	Our firm communicates with our suppliers through regular communication systems (telephone calls, letters).	3.33	Agree	3
6	Our firm collaborates with suppliers in preparing materials and production plans.	3.28	Agree	5
Composite Mean		**3.32**	**Agree**	

Legend: 3.50 – 4.00 –Strongly Agree; 2.50 – 3.49 – Agree; 1.50 – 2.49 –Disagree; 1.00 – 1.49 – Strongly Disagree

Table 2.1 shows the mean distribution of the degree of collaboration in terms of collaborative planning. The result shows that respondents of the study agree with the evaluation in terms of collaborative planning with a composite mean of 3.32. Supply chain professionals often adjust their production system to meet the requirement of their customers, got the highest rank with a (WM=3.46). Moreover, they agree that they can depend on their suppliers to provide them with good planning information. This got the lowest rank with a (WM=3.11). Relationships in the supply chain are most successful when they are planned collaboratively. It is vital to maintain an effective flow of goods from the stage of raw materials all the way through to the end user through the use of collaborative planning in supply chain connections (Guenter & Grote, 2012). The successful implementation of supply chain planning in cooperation will also have an effect on future partnerships. Depending on the level of success achieved by existing partnerships, businesses who are interested in working together on supply chains may want to explore the possibility of participating in long-term collaboration (Ramanathan & Gunasekaran, 2014).

As an essential component of the execution of collaborative planning, there is a pressing need for a deeper comprehension of the volume and scope of information exchanged among participants. (Panahifar et al., 2015) There has been a recent uptick in interest in supply chain collaboration, also known as SC collaboration, which refers to a method that encourages inter-company cooperation in many business fields. In collaborative planning endeavors, the amount of collaboration that is achieved may be affected by factors such as the goals of the collaboration, the elasticity of demand, the product diversity, and the spatial complexity of the supply network. (Danes, 2011)

Table 2.2

Collaboration in terms of Collaborative Forecasting

	Collaborative Forecasting	WM	VI	Rank
1	We try to incorporate our suppliers' and customers' forecast into our forecast	3.29	Agree	1
2	We work with major suppliers and customers to help them improve their forecast accuracy	3.16	Agree	3
3	We can depend on our suppliers to provide us with good market forecast.	3.02	Agree	5
4	If we request forecasting data from our customers, they would respond constructively and caringly	3.10	Agree	4
5	Our firm prepares demand forecast through a multifunctional (e.g., sales operations planning) team.	3.19	Agree	2
Composite Mean		3.15	Agree	

Legend: 3.50 – 4.00 –Strongly Agree; 2.50 – 3.49 – Agree; 1.50 – 2.49 –Disagree; 1.00 – 1.49 – Strongly Disagree

Table 2.2 represents the mean distribution of assessment in the degree of collaboration in terms of collaborative forecasting. The result shows that respondents of the study agree with the assessment in terms of collaborative forecasting with a composite mean of 3.15. The respondents try to incorporate their suppliers' and customers' forecast into their forecast", got the highest rank with a (WM=3.29) among the items enumerated above. Moreover, they agree that they can depend on their suppliers to provide them with good market forecast.

This got the lowest rank with a (WM=3.02). According to Kurtulus (2012) and associates, both the supplier and the retailer may enhance the accuracy of their demand predictions by making significant financial expenditures in forecasting technologies to collect and evaluate information. Integration of partners is an essential prerequisite for collaborative forecasting, while the kind of the information provided and the quality of that information are both essential for forecasts. While the forecasting tactics of manufacturers and merchants play a crucial role for consensus projections, it is important not to overlook the function that forecast horizon and frequency play in the process. (Eksoz et al., 2014).

Table 2.3
Collaboration in terms of Replenishment

Replenishment		WM	VI	Rank
1	We work with supply chain partners to develop joint sales forecast for replenishment	3.18	Agree	1
2	Our firm shares databases with our suppliers.	2.84	Agree	2
Composite Mean		3.01	Agree	

Legend: 3.50 – 4.00 –Strongly Agree; 2.50 – 3.49 – Agree; 1.50 – 2.49 –Disagree; 1.00 – 1.49 – Strongly Disagree

Table 2.3 represents the mean distribution of assessment in the degree of collaboration in terms of replenishment. The result shows that respondents of the study agree with the assessment in terms of collaborative forecasting with a composite mean of 3.01. The participants of the survey agree that they work with supply chain partners to develop joint sales forecast for replenishment, with a (WM=3.18). Moreover, they agree that their firms shares databases with their suppliers, with a (WM=3.02). It has been determined that collaboration within the supply chain and the implementation of replenishment standards that are more gradual are among the most effective treatments for the bull-whip effect (Cannella, 2012). Developed a replenishment solution based on the Theory of Constraints (TOC) with the goal of aggregating inventory buffers and shifting the operational model from push to pull. (Chin et al., 2012). It was discovered that the TOC replenishment approach considerably enhanced the efficiency of the refill process. A research on the automated replenishment approach was conducted by Kiil et al. (2018) and it may be seen here. By utilizing an automated replenishment method, the retailers are able to cut down on the amount of food waste they produce by up to twenty percent, and their products are able to have a longer remaining shelf life without impacting the availability of the items on the shelves. According to the findings of the study, the effectiveness of the program that automatically restocks supplies is also reliant on the shelf life of the product.

Table 2.4
Collaboration in terms of Collaborative Marketing

Collaborative Marketing		**WM**	**VI**	**Rank**
1	Future markets are explicitly addressed in our interactions with major customers	3.04	Agree	3
2	We often participate in our customer's decisions regarding retail pricing	2.78	Agree	8
3	We often consult with this customer to help design promotional activities that are exclusive to this relationship	2.98	Agree	4
4	We work with major customers to plan and execute a pricing strategy for the sale of products	2.96	Agree	7
5	We work with major customers to plan and execute a promotion strategy for the sale of products	2.97	Agree	5
6	We work with major customers to plan and execute a distribution strategy for the sale of products	2.97	Agree	5
7	Our major customers are always frank and truthful with us	3.15	Agree	1
8	We believe the marketing information major customers provides us	3.10	Agree	2
Composite Mean		**3.00**	**Agree**	

Legend: 3.50 – 4.00 –Strongly Agree; 2.50 – 3.49 – Agree; 1.50 – 2.49 –Disagree; 1.00 – 1.49 – Strongly Disagree

Table 2.4 represents the mean distribution of the degree of collaboration in terms of collaborative marketing. The result shows that respondents of the study agree with the assessment in terms of collaborative marketing with a composite mean of 3.00. The respondents agree that their major customers are always frank and truthful with them, highest rank with a (WM=3.15). They also agree that respondents often participate in their customer's decisions regarding retail pricing, lowest rank with a (WM=2.78). By tying together, the values of customers with a more efficient flow of products, the purpose of integrating SCM and marketing is to provide firms with distinctive advantages over their rivals in the marketplace. In a market that is always evolving, the flow must be continuously improved, and a customer value proposition must be developed (Madhani, 2011). When marketing

is integrated with dynamic supply chain management (SCM), a company has more leeway to serve consumer demand in a manner that takes into account the specific requirements of each client as well as the worth of those customers to the company. Marketing is concerned with the generation of demand, whereas supply chain management is concerned with meeting that demand. (Madhani, 2015). Kuang-Jung (2015) and associates states that the development of a worldwide brand is highly impacted by integrated marketing communication as well as collaborative marketing. Additionally, collaborative marketing has a beneficial impact on the development of worldwide brands.

Table 2.5
Summary Table in Degree of Collaboration

Degree of Collaboration	Composite Mean	VI	Rank
Collaborative Planning	3.32	Agree	1
Collaborative Forecasting	3.15	Agree	2
Replenishment	3.01	Agree	3
Collaborative Marketing	3.00	Agree	4
Over-all Mean	3.12	Agree	

Legend: 3.50 – 4.00 –Strongly Agree; 2.50 – 3.49 – Agree; 1.50 – 2.49 –Disagree; 1.00 – 1.49 – Strongly Disagree

The table 2.5 represents the summary of the assessment in the degree of collaboration among supply chain professionals. Collaborative planning is a dominant activity in supply chain with composite mean of 3.32 on the highest rank, collaborative marketing on the other hand is in the lowest rank with composite mean of 3.00. Overall the respondents agree that there is collaboration in their firms with a composite mean of 3.12.

Because the volume and degree of information sharing is such an important role in the execution of collaborative planning, forecasting, and replenishment, there is a pressing need for a deeper knowledge of each of these aspects (Panahifar et al., 2015). There is a study that was conducted by Kamalapur et al. 2013) on the Collaborative Planning Forecasting and Replenishment (CPFR) or Vendor Managed Inventory (VMI) strategy for both the retailer and the manufacturer in several distinct supply chain settings. According to the findings, both VMI and CPFR are able to generate cost savings in inventory management when compared to the conventional supply chain. These cost benefits are realized by the retailer as well as the manufacturer. When compared to VMI, CPFR often results in greater cost savings for the majority of supply chain configurations. In addition, CPFR is able to produce greater cost savings in circumstances in which demand fluctuation is large, manufacturing capacity is limited, the cost of the penalty associated with backorders is high, and delivery lead time is considerable. Communication, business understanding, a common goal, mutual benefit, transparency, and trust were identified as the key factors in the implementation of CPFR in a major grocery retailer in South Africa (Niemann et al., 2018). In addition, a common goal was identified as one of the key factors.

Table 3.1
Supply Chain Sustainability in terms of Culture

Culture		WM	VI	Rank
1	At your firm, you provided information to all employees to understand the importance of social sustainability	3.26	Agree	1
2	You tried to promote social sustainability as a major goal across all departments	3.23	Agree	2.5
3	Your firm had a clear policy statement urging social sustainability in every area of operations	3.16	Agree	5
4	Social sustainability was a high priority activity in your firm	3.14	Agree	7
5	Social sustainability was a central corporate value in your firm	3.15	Agree	6
6	Your firm had a responsibility to be socially sustainable	3.23	Agree	2.5
7	Your firm worked hard for an image of social sustainability	3.22	Agree	4
Composite Mean		3.20	Agree	

Legend: 3.50 – 4.00 –Strongly Agree; 2.50 – 3.49 – Agree; 1.50 – 2.49 –Disagree; 1.00 – 1.49 – Strongly Disagree

Table 3.1 represents the mean distribution of the assessment in the level of understanding of the participants on the sustainability in terms of culture. The result shows that respondents of the study agree with the assessment with a composite mean of 3.20. Participants of the survey agree that their firms provide information to all employees to understand the importance of social sustainability, highest rank with a (WM=3.26). They also agree that social sustainability was a high priority activity in their firm, lowest rank with a (WM=3.14). The four components that make up a sustainable supply chain strategy are a sustainability leadership, supply chain

member participation in organizational sustainability efforts, supply chain member participation in supply chain sustainability strategy planning, and technical proficiency. Leadership in sustainability legitimizes the organization's supply chain-oriented sustainability activities and planning targets, as well as the staff's participation in such efforts (Orr & Jadhav, 2018). Business sustainability enables the integration of non-financial environmental, social, ethical, and governance sustainability performance dimensions into corporate culture, supply chain management, and business model development in order to create shared value for all stakeholders. Financial economic sustainability performance is one example of a non-financial dimension of sustainability performance. (Rezaee, 2018)

Table 3.2
Supply Chain Sustainability in terms of Entrepreneurial Orientation

Entrepreneurial Orientation		WM	VI	Rank
1	In your industry, your firm typically initiated actions, which competitors responded to	3.10	Agree	5
2	In dealing with competitors, your firm was very often the first business to introduce new products or services	3.06	Agree	7
3	In general, the top managers of your firm had a strong tendency to be ahead of others in introducing novel ideas or products	3.16	Agree	2
4	In general, the top managers of your firm favored a strong emphasis on research and design and innovations	3.26	Agree	1
5	Many new lines of products or services were marketed in the past two years	3.13	Agree	3
6	Changes in product or service lines were usually quite dramatic	2.95	Agree	9
7	In general, the top managers of your firm had a strong inclination for high risk projects (with chances of high returns)	3.00	Agree	8
8	In our industry bold, wide-ranging acts were necessary to achieve the firm's objectives	3.11	Agree	4
9	When confronted with decisions involving uncertainty, your firm typically adopted a bold strategy to exploit opportunities	3.09	Agree	6
Composite Mean		3.10	Agree	

Legend: 3.50 – 4.00 –Strongly Agree; 2.50 – 3.49 – Agree; 1.50 – 2.49 –Disagree; 1.00 – 1.49 – Strongly Disagree

Table 3.2 represents the mean distribution of the assessment in the level of understanding of the participants on the sustainability in terms of entrepreneurial orientation. The result shows that respondents of the study agree with the assessment with a composite mean of 3.10. Respondents agree that top managers in their firms favored a strong emphasis on research and design and innovations, highest rank with a (WM=3.26). They also agree that changes in product or service lines are usually quite dramatic, lowest rank with a (WM=2.95). Adapt to the new normal Mishra and Mishra (2019) examine and prioritize characteristics of entrepreneurial orientation for the development of supply chain flexibility in a market that is characterized by a high level of uncertainty. According to the findings, in an environment where there is a great deal of unpredictability, businesses should prioritize the development of innovativeness in order to increase supply chain flexibility.

Table 3.3 represents the mean distribution of the assessment in the level of understanding of the participants on the sustainability in terms of social sustainability. The result shows that respondents of the study agree with the assessment with a composite mean of 3.14. Participants of the survey agree that they monitored their key supplier's compliance with their health and safety requirements, highest rank with a (WM=3.30). They also agree that they helped their key supplier obtain OHSAS 18001 certification, SA8000 or other management system certification, lowest rank with a (WM=2.92).

According to Mani et al. (2015), social sustainability in the supply chain has garnered increasing attention in recent years due to increased knowledge on fairness, health and safety, education, child and bonded labor, and ethical standards in corporates. This awareness has been brought about by an increase in the number of people who are concerned about these issues. The amount of sustainability enforcement legislation in the nation of the buyer or the country in which the supplier is located, the power relationship between the buyer and the seller, and the volume of commerce between the buyer and the supplier are all factors that are likely to have an impact on sustainability efforts. (Najjar et al., 2019). Kaur and Puja (2018) carried out a research to investigate the degree to which decisions about supply chain were influenced by considerations of social sustainability in multinational corporations that produced goods in India. The findings indicate that the decision-making process in the supply chain of multinational industrial firms, particularly those operating in the manufacturing industry, is

beginning to incorporate social sustainability. According to the findings of the study, the process of making decisions affecting social sustainability requires more comprehensive frameworks for organizational preference.

Table 3.3
Supply Chain Sustainability in terms of Social Sustainability

Social Sustainability		WM	VI	Rank
1	You monitored your key supplier's compliance with your health and safety requirements	3.30	Agree	1
2	You sent health and safety questionnaires to your key supplier to monitor their compliance	3.22	Agree	3
3	You monitored your key supplier's commitment to health and safety improvement goals	3.18	Agree	5
4	You conducted audits of the health and safety of their employees	3.16	Agree	9
5	You designed systems for work/family balance across the supply chain with your key supplier	3.05	Agree	14
6	You introduced employee health and safety compliance and auditing systems with your key supplier	3.10	Agree	13
7	You helped your key supplier obtain OHSAS 18001 certification, SA8000 or other management system certification	2.92	Agree	16
8	You developed an ethical code of conduct system with your key supplier	3.22	Agree	2
9	Your company developed new product/processes with our key supplier that reduced health risks for consumers	3.16	Agree	7.5
10	Your company developed new product/processes with your key supplier that benefited workers throughout the supply chain	3.18	Agree	4
11	Your company developed new product/processes with your key supplier that reduced health and safety hazards for employees	3.16	Agree	7.5
12	Your company developed new product/processes with your key supplier that provided fair margins to all your suppliers	3.11	Agree	12
13	Your company has changed its supply chain strategy to bring non-governmental organizations and community groups into the supply chain	2.99	Agree	15
14	Your company has changed its supply chain strategy to minimize negative impacts on communities around your supply chain operations	3.15	Agree	10
15	Your company has changed its supply chain strategy to make social sustainability data (ethical code of conduct/ impact on communities) throughout our supply chain available to the public	3.12	Agree	11
16	Your company has changed its supply chain strategy to focus on fair trade throughout the supply chain	3.16	Agree	6
Composite Mean		3.14	Agree	

Legend: 3.50 – 4.00 –Strongly Agree; 2.50 – 3.49 – Agree; 1.50 – 2.49 –Disagree; 1.00 – 1.49 – Strongly Disagree

Table 3.4 represents the summary of the assessment in the level of understanding of the participants on supply chain sustainability. The respondents understand supply chain sustainability in terms of culture the most with composite mean of 3.20 on the highest rank, Entrepreneurial orientation on the other hand is in the lowest rank with composite mean of 3.10. Overall, the respondents agree that they understand supply chain sustainability in terms of culture, entrepreneurial orientation and social sustainability with a composite mean of Marshall (2015) and associates conducted research on adoption of a variety of socially sustainable supply chain methods. The culture of sustainability has a positive correlation with all of the activities; however, an entrepreneurial orientation has an effect on the culture of social sustainability and helps to regulate it in advanced social sustainability supply chain adoption. According to Manners-Bell (2014), in order for supply chains to be sustainable, they need to take into account the ethical, environmental, and societal components. 3.14.

Table 3.4
Summary in Degree of Supply Chain Sustainability

Supply Chain Sustainability	Composite Mean	VI	Rank
Culture	3.20	Agree	1
Entrepreneurial Orientation	3.10	Agree	3
Social Sustainability	3.14	Agree	2
Over-all Mean	3.14		

Legend: 3.50 – 4.00 –Strongly Agree; 2.50 – 3.49 – Agree; 1.50 – 2.49 –Disagree; 1.00 – 1.49 – Strongly Disagree

In table 4.1, there is significant relationship between assessment in effects of risk management in terms of supply risks and degree of collaboration in terms of planning, forecasting, replenishment ad marketing since the computed p values are greater than 0.05 level of significance. Thus, the higher the assessment in effects of risk management in terms of supply risks and the higher also the assessment in degree of collaboration in terms of planning, forecasting, replenishment and marketing.

Table 4.1
Effects of Risk Management in terms of Supply Risks and Degree of Collaboration

Degree of Collaboration	R-value	p-value	Interpretation	Decision
Collaborative Planning	.697**	<0.01	Significant	Reject
Collaborative Forecasting	.615**	<0.01	Significant	Reject
Replenishment	.464**	<0.01	Significant	Reject
Collaborative Marketing	.451**	<0.01	Significant	Reject

Legend: Significant at p-value < 0.05; R – Rejected; FR – Fail to Reject; S – Significant; NS – Not Significant

According to Ali and Shukran (2016), cooperation has a moderating function in the management of risks as well as the improvement of business performance within a supply chain. According to Li and Chen (2019), organizations that collaborate with their suppliers on an operational level are able to achieve greater performance. This is accomplished by enhancing the firms' risk management capacities with regard to normal risks, internal processing risks, and unusual risks. According to Kache and Seuring (2014), the notion of competitive advantage serves as a connecting mechanism between the concepts of cooperation and risk.

Table 4.2
Risk Management in Terms of Supply Risks and Supply Chain Sustainability

Supply Chain Sustainability	R-value	p-value	Interpretation	Decision
Culture	.685**	<0.01	Significant	Reject
Entrepreneurial Orientation	.545**	<0.01	Significant	Reject
Social Sustainability	.559**	<0.01	Significant	Reject

Legend: Significant at p-value < 0.05; R – Rejected; FR – Fail to Reject; S – Significant; NS – Not Significant

As presented in table 4.2, there is significant relationship between assessment in effects of risk management in terms of supply risks and supply chain sustainability in terms of culture, entrepreneurial orientation and social sustainability since the computed p values are greater than 0.05 level of significance. Thus, the higher the assessment in effects of risk management in terms of supply risks and the higher also the assessment in understanding supply chain sustainability in terms of culture, entrepreneurial orientation and social sustainability. According to Shafiq et al. (2017), a correlation may be seen between increased levels of perceived sustainability risk and increased levels of monitoring of supplier sustainability practices by companies. Efforts made to lessen environmental impact assist to lower risk in supply chains. Although reactive risk mitigation measures cannot reduce supply chain risk on its own, (Gouda & Saranga, 2018) it has been found that these tactics are beneficial when implemented in combination with initiatives to improve sustainability. According to Rafi-Ul-Shan et al. (2018), in order to guarantee the long-term viability of a project, risk-based information should serve as an input for sustainability decision making, and information about sustainability should be incorporated into the process of risk management.

As presented in table 4.3, there is significant relationship between assessment in the degree of collaboration in terms of Collaborative Planning and supply chain sustainability in terms of culture, entrepreneurial orientation and social sustainability since the computed p values are greater than 0.05 level of significance. Thus, the higher the assessment in the degree of collaboration in terms of Collaborative Planning, the higher also the assessment in understanding supply chain sustainability in terms of culture, entrepreneurial orientation and social sustainability. There is significant relationship between assessment in the degree of collaboration in terms of Replenishment and supply chain sustainability in terms of culture, entrepreneurial orientation and social sustainability since the computed p values are greater than 0.05 level of significance. Thus, the higher the assessment in the degree of collaboration in terms of Replenishment, the higher also the assessment in understanding supply chain sustainability in terms of culture, entrepreneurial orientation and social sustainability.

Table 4.3
Relationship between Degree of Collaboration and Supply Chain Sustainability

	Collaborative Planning				Collaborative Forecasting				Replenishment				Collaborative Marketing			
Supply Chain Sustainability	**r**	**p**	**I**	**D**	**r**	**p**	**I**	**D**	**r**	**p**	**I**	**D**	**r**	**p**	**I**	**D**
Culture	.575**	<0.01	S	R	.617**	<0.01	S	R	.505**	<0.01	S	R	.461**	<0.01	S	R
Entrepreneurial Orientation	.473**	<0.01	S	R	.568**	<0.01	S	R	.418**	<0.01	S	R	.528**	<0.01	S	R
Social Sustainability	.410**	<0.01	S	R	.541**	<0.01	S	R	.575**	<0.01	S	R	.536**	<0.01	S	R

Legend: Significant at p-value < 0.05; R – Rejected; FR – Fail to Reject; S – Significant; NS – Not Significant

The results that were acquired are connected with the many research that were done regarding teamwork and sustainability. According to Ferreira Alves et al. (2018), collaborative actions are produced with supply chain connections to promote member integration and the adoption of sustainability practices. This was done in order to build collaborative actions. On the other side, research conducted by Pakdeechoho and Sukhotu (2018) found that Sustainable Supply Chain Collaboration (SSCC) results in improved social and economic performance. The viability of individual companies in the supply chain is improved by productive collaboration between those enterprises. Wang and Ran (2018) suggest and presented a framework that extends the knowledge and practice of sustainable supply chain management by emphasizing on its dynamic, elastic, holistic, uncertainty-handling, and future-oriented qualities. This extends both the understanding and the practice of sustainable supply chain management. They call it the Sustainable Collaborative Governance Framework, and it outlines adaptive decision-making and action mechanisms throughout the lifecycle of the supply chain. This framework will enable the entire supply chain to respond to uncertainties or agitations in a proactive and resilient manner without undergoing significant changes to the firms' normal operations. According to Pero et al. (2017), it is now generally understood that businesses cannot achieve sustainability by themselves; rather, it is a goal that can only be accomplished via the cooperative efforts of all parties involved in the supply chain.

4. Conclusion and recommendation

The results revealed that most of the procurement managers, supply chain and logistics professionals are college graduates. Top procurement and supply chain professionals from industry are from general manufacturing, aviation and automotive. In terms of department/ unit, majority of the respondents are from procurement, supply chain and logistics. Top management and middle management participate in the research study and majority of them are permanent and full-time employees. When it comes to length of service, top respondents worked for the firm for >2 to 5 Years. Majority of the procurement managers, supply chain and logistics professionals in manufacturing firms in CALABARZON moderately agree on the effect of risk management in terms of supply risks. Majority of the managers in the manufacturing firms in CALABARZON moderately agree on the degree of collaboration in terms of Planning, Forecasting and Replenishment (CPFR) and Marketing. Majority of the procurement managers, supply chain and logistics professionals in manufacturing firms in CALABARZON moderately agree on the level of understanding on the sustainability in terms of: Culture, Entrepreneurial Orientation and Social Sustainability. There are significant differences of risk management, collaboration and sustainability in terms of educational attainment, type of industry where the managers in the manufacturing firms in CALABARZON are affiliated, unit or department, position or rank in the firm, employment status and length of service. There is significant relationship between risk management and collaboration, to sustainability.

In pursuit of enhancing the quality and impact of the research, it is crucial to continuously evaluate and refine methodologies and approach. The following are the recommendations made: human resource management may connect to academic institution to include studies that will build competence in terms of end to end supply chain to the students of the undergraduate. Supply Chain Management and Data Analytics Manager may embrace digitization and the technologies that are relevant to improving the organization and enabling it to become more competitive in the marketplace. Marketing Management may work with major customers in terms of collaborative marketing and create a cross functional collaboration team of individuals who lead the

collaboration. President and Vice president of the firms may execute aggressiveness towards challenging the competitors. HR Manager and Supply chain manager may consider reviewing the competency and skill of each supply chain professional to have a transformational capability for supply chain professionals.

The research study may be presented in research forums and serve as an input for other scholarly works related to Supply Chain Management. Research forums are vital avenues for this study to reach a wider audience and generate influence supply chain practitioners. Further study may be conducted to explored the effect of risk management and collaboration on firms' sustainability as a basis for supply chain resilience in other regions in the Philippines were manufacturing are present. In addition, further study can be conducted in other industries like health and medicine, banking, Ports, shipping lines, trucking companies, customs brokers, highway administrators and storage providers. In these industries, supply chains can exist and these industries may have different approach to improve supply chain resilience.

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