CHAPTER 6. DISCUSSION OF RESULTS AND FUTURE RESEARCH DIRECTIONS

6.1. Introduction

The objective of this chapter is to clearly illustrate all the findings and contributions of the research. This research can be considered as a drop in an ocean, when we consider the research breadth and depth of the sustainable supply chain research works as a whole. But, this research will definitely help researchers and supply chain professionals to get better understanding on the overall interrelationships among the critical constructs of sustainability performance of supply chain. All conclusions derived from the data testing, factor analysis and regression analysis will be discussed in detail in this chapter. Results of hypotheses testing and the final theoretical framework concluded will also be presented in this chapter. Various insights received from expert interviews, questionnaire survey and all over throughout the survey are also incorporated in this chapter. Contributions of the research are interpreted in detail into two separate sections such as theoretical and managerial contributions in this chapter. In the end of the chapter, limitations of the study are also outlined. Last, but not but least, future research directions, which may help other researchers to extend this work in a meaningful way are also included in the final section of the chapter.

6.2. Key findings from the research

In this section summarization of the findings of the research is done by answering all the research questions set in a systematic way, one at a time. The first research question considered in the study is mentioned below: The first section is trying to give an answer to the question regarding the variables of sustainability performance of supply chain management. Ten variables of sustainability performance of supply chain were selected based on systematic literature review and expert opinion techniques. The research focus was limited to tier 1 auto component manufactures listed by Automotive Component Manufacturers Association of India (ACMA). All the critical variables analyzed and finalized in this research are listed out and concluded in the below section.

6.2.1. Variables of sustainability performance of supply chain

From literature review, it was understood that sustainability performance of supply chain are becoming more and more important and there is a research gap existing in clearly defining the variables effecting the sustainability performance of supply chain for small and medium scale auto-
component manufactures in India. Coercive pressure, mimetic pressure and normative pressure were identified as the three variables based on institutional theory and top management belief, top management participation, supply chain connectivity and supply chain information sharing as another four important variables based on resource based view theory.

Table 6.1 Variables derived in the research

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<tr>
<th>Variables</th>
<th>Definition</th>
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<tr>
<td>Coercive pressure (CP)</td>
<td>External formal or informal pressures from any of the external organizations or competitors of the firm or from the cultural expectations of the society it operates by which the firm gets motivated to go for sustainability initiatives in supply chain.</td>
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<tr>
<td>Mimetic pressure (MP)</td>
<td>Pressures arising when the firm tries to imitate or mimic other firms by which the organization gets motivated to go for sustainability initiatives in supply chain.</td>
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<tr>
<td>Normative pressure (NP)</td>
<td>Pressures arising from the move of firms trying to enforce better legitimacy through professional bodies and collaborative forums as a result of which the organization may get motivated to go for sustainability initiatives in supply chain.</td>
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<td>Top management belief (TMB)</td>
<td>The psychological state of the top management in embracing sustainability practices in supply chain is referred by Top Management Belief.</td>
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<tr>
<td>Top management participation (TMP)</td>
<td>The behavior and actions performed by the top management to encourage sustainability practices in supply chain are referred by referring the term participation.</td>
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<td>Supply chain connectivity (SCC)</td>
<td>Supply chain connectivity can be defined as the effective integration and co-ordination within the supply chain networks to assist the entire chain to achieve the goal effectively and efficiently by acting as a single unit.</td>
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<tr>
<td>Supply chain information sharing (SCIS)</td>
<td>The process of efficient information sharing among the entities of supply chain to ensure improved visibility which will help to have effective planning for sustainability initiatives in supply chain.</td>
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<tr>
<td>Sustainable supply chain performance (SSCP)</td>
<td>Social, economic and environmental performance that altogether contribute towards the sustainability performance of supply chain.</td>
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Based on the triple bottom line concept, social, environmental and economic performances were considered together to measure the impact of the previously mentioned seven variables on the sustainability performance of supply chain.

6.3. Findings from data analysis

Based on these above mentioned variables and the inter-linkages identified based on the literature evidences, a theoretical framework was formulated. A semi-structured questionnaire was prepared and data collection was completed by focusing on supply chain professional having fifteen plus years of experience from the tier 1 auto component manufactures in India. Data validation and testing was completed subsequently to go for the final data analysis stage. The objective of data analysis phase was to empirically validate the linkages between the variables that were mentioned in the theoretical framework formulated based on literature review and expert opinion in the previous stage.

6.3.1. Findings from quantitative analysis

Empirical analysis was carried to validate the proposed theoretical framework. Each linkage in the framework is considered as each hypothesis to be tested. Before starting with the analysis, common method biasness is tested. Harmon one-factor test suggested by Podsakoff and Organ (1986) was done for the 10 constructs, to check the common method biasness. But, common method of bias is not a significant problem with our data as the maximum covariance explained by any one of the factor is found to be less than 50% (Liang et al., 2007; Dubey et al., 2016). Some of the important findings from data analysis are concluded below:

6.3.1.1. Findings from confirmatory factor analysis

In the current research, a total of forty five items were identified against the selected ten variables of sustainability performance of supply chain through thorough literature review and expert opinion. A final matrix with no cross loadings and having ten factors was obtained after seven iterations. Loading and cross loading were found to be stable. All the loadings of the indicators are found to be significant with p value coming less than 0.05, except very few which were identified and removed. The lowest factor loading identified among all is found to be 0.55, which is greater than the required critical value of 0.50. Few variables such as ECOP2, SP4, SP5, SP6, SP6, SP7,
SP8, SP9, SP10 and CP4 were excluded from further analyses as the factor loadings were found to be less than 0.5 (Hair et al. 2010). All the variables pertaining to the ten factors are found to be interpretable and to get logically grouped based on the existing literature and past studies. And thus, the factor solution was found to be feasible and stable. Thus, the internal consistency and reliability of the questionnaire was found to be proven as the minimum value of Cronbach’s Alpha of variables was found to be 0.62, well above the critical required value of 0.60. Composite reliability values are also found to be satisfactory. So the scales used in the research were found to be stable and comparable with the scales used by the previous researchers and thus the factors identified can be further used confidently to go for the hypothesis testing stage. Convergent validity is tested and found to be established as the Average Variance Extracted (AVE) for all constructs are found to be greater than 0.5. Discriminant validity was also found to be prevailing as the correlation coefficients between constructs are found to be less than the square root of the AVE values. There are no cross loadings among the variables in the factor loadings, which also confirms the descriminant validity. Average Path Coefficient (APC); Average R - squared (ARS) and Average block VIF (AVIF) values are found to be well above the critical limits and are found to be significant. \( R^2 \) values are found to be varying from three percentages to 93% for the identified significant linkages. The study also point towards the need to have more focus on the sustainability performance of supply chain, rather than the traditional approach followed by most of the tier 1 Indian auto-component manufactures to simply focus only on the core economic matrices of supply chain performance.

6.3.1.2. Findings of hypotheses testing

Relationships between the variables of sustainability performance of supply chain based on resource based theory and institutional theory are explored in this study. Despite the growing literature on sustainable supply chain management, research attempts exploring the interrelationships among the variables of sustainability performance of supply chain based on triple bottom line concept with reference to small and medium scale auto component manufactures from developing nations like India are found to be very scant.

Consistent with many similar research findings like Lee and Whang (2000); Liang et al. (2007) and Prajogo and Olhager (2012), PLS regression analysis proved that coercive pressures have a
positive impact on the sustainability performance of supply chain. Sustainability performance of supply chain is also getting affected by top management commitment and belief, supply chain connectivity and information sharing effectiveness. Top management participation is found to be the most important enabler in ensuring the supply chain connectivity and effective supply chain information sharing. The findings from the research are very particular to the tier-1 auto component manufacturing industries from developing nations like India. From the study, it is well understood that coercive pressures act as the changing agents that stimulates top management to act effectively to ensure better supply chain connectivity and effective supply chain information sharing, which in turn are likely to have a positive impact on the social and environmental performance of supply chain. Based on the findings and the proven hypotheses, the final conclusive model of the sustainability performance of supply chain is given in figure 6.1. All the linkages shown in the model are proven based on the research empirical attempt and literature evidences.

![Figure 6.1 Conclusive sustainable supply chain performance model](image)

### 6.4. Research contributions

This study is unique in its kind focusing on tier 1 auto-component manufactures in India and has made significant theoretical and managerial contributions to the supply chain domain.
6.4.1. Theoretical contributions to the existing supply chain literature
The importance of sustainability concepts in supply chain is analyzed. Literature review and the gaps identified shows that the study is very relevant, unique and rare in its kind based on the features such as topic, focusing domain, dimension selection methodology etc. Through this study, we are addressing many research gaps identified in the sustainable supply chain domain. The adequate need of the time to club sustainability with supply chain is studied and concepts have been defined. In this research, a combination of most appropriate and well established theories were effectively used for the selection of variables of the sustainability performance of supply chain. This approach is found to be relatively new in the supply chain domain and it clearly helped to create a base for the selection of few handpicked variables based on the literature evidences. Along with the two well established theories the triple bottom line concept is also considered with equal importance, which justifies the call for more theory grounded empirical research works from the operations research community (Clemens and Douglas, 2006; Madhok, 2002; Winter and Knemeyer, 2013 and Touboulic and Walker, 2015). We are also addressing the call to have more research on sustainability issues in supply chain with respect to organizations from emerging nations (Silvestre, 2015a, 2015b; Jabbour et al., 2015 and Pagell and Shevchenko, 2014). Many relevant research gaps were identified throughout the literature review process and which will definitely act as a base for future research attempts in supply chain domain. A theoretical framework is formulated based on the literature review outcomes and was tested empirically. Based on the best knowledge of the researcher, very few have attempted to test the linkage between top management commitment and sustainability performance of supply chain through the effective usage of supply chain connectivity with reference to tier 1 auto-component manufactures from developing nations like India. The study has empirically proven the importance of top management commitment and belief in nurturing the sustainability practices in supply chain management. This is the major contribution of this study to the academic literature.

6.4.2. Contribution to tier 1 Indian auto component industry
The study will give a comprehensive list of empirically validated variables and an integrated theoretical framework to understand the levels of variables to the supply chain managers in tier 1 auto-component manufactures in India. Especially the measures required for achieving better supply chain integration are listed out and tested which will significantly improve the sustainability
performance of supply chain, where Indian auto component suppliers are lagging (Gopal and Thakkar., 2016; Xu et al., 2013). The findings emerging from the empirical investigations can help decision makers to clearly identify the measures of various broad variables that have a direct impact on both the firm and its environment. During the data collection interviews, it was clearly understood that the supply chain information and tracking systems in the companies are having a pathetic status. Top management is also not that cautious to improve the situation and the least priority was given due to investment related concerns. But it was understood that the managers were not clear on the potential outcome of the investment and in this context the research will clearly show the potential of these investments on the sustainability performance of supply chain. Based on the researcher’s best knowledge, such a research was not conducted by any other researchers in India.

Our results imply that coercive pressures influences the top management beliefs and top management participation in facilitating the supply chain connectivity and supply chain information sharing which in turn is having a significant impact on the improvement of the SSC performance. We also found that normative and mimetic pressures are not having any significant impact on the SSC performance in Indian context. This imply that only government rules and regulations are becoming effective drivers and social pressures and pressures from competition with respect to the sustainable supply chain performance are not having any significant driving power on the sustainable supply chain performance of Indian auto component manufactures in the current stage. From the analysis it is understood that 59 percentage of the total variance of the environmental performance, two percentage of economic performance and three percentage of social performance of supply chain is explained by the theoretical model. From this it can be concluded that Indian auto-component manufactures have reached somewhat good maturity level only in the case of environmental performance. Economic performance from sustainability initiatives are not that reflective for Indian organizations as it may take few more years to get reflected due to the initial investment requirements. It is also clear that Indian organizations have just started paying attention to the social performance of their supply chain. These findings are in line with the findings of Beske et al. (2008). Because, from a similar empirical research attempt conducted in automotive industry, Beske et al. (2008) conclude that environmental standards are well implemented where as social standards of organizations are still poor. From these findings,
it can be inferred that the sustainability initiatives in the supply chains of Indian auto-component manufactures are still in initial growing stage. And thus, the research is making its unique contribution is clearly understanding the current status of sustainability initiatives in the automotive industry in India.

6.4.3. Managerial Implications

Studies on sustainable development from emerging nations are found to be rare and managers working with organizations from developing nations can contribute significantly on this front (Gunasekaran et al., 2014). The study provides immense scope to Indian auto-component industry to maximize the benefits by clearly understanding the focus areas, viz., Supply chain connectivity; Supply chain information sharing and top management commitment and belief based on some external and internal factors to achieve better social, environmental and economic performance. This will also help supply chain professionals to focus their energy to few proven and critical components that will simultaneously enhance the environment, society it operates and the goodwill of the firm. Lot many times we have seen many of the Indian auto-component manufactures struggling to sustain in the business. Focusing and improving the sustainability part of supply chain may help them to improve the branding and can attempt to go global by acting locally. Based on the research, top management commitment and belief have a positive impact on the collaboration and connectivity of the supply chain as a whole. The study also point out that top management can focus on improving the supply chain information sharing and connectivity by which the sustainability performance can be improved, which in turn will help them to penetrate them to new markets by having better brand value. Implementation of effective information sharing systems and supply chain connectivity will help the companies to design robust processes, improve operational efficiency, increase responsiveness and to eliminate wastages. Unless robust information sharing systems are implemented, it is very difficult to integrate the end to end supply chain of auto-component manufactures, when the product varieties, quantities, suppliers and customers are large. Therefore the current study will help Indian-auto component manufactures to focus their energy to certain crucial areas like supply chain integration by which they can enjoy the benefits of high operational efficiency and better sustainability performance of supply chain to cope up with the highly matured competitors from other Asian economies like China, Japan and Korea. From the policy perspective, organizations can depend on the empirical evidences to drive
their sustainability performance of supply chain by ensuring better commitment from top management to achieve effective supply chain integration and ultimately better sustainability performance.

6.4.4. Limitations of the Study

Even though at most sincere efforts have been taken by the researcher still there are some limitations for the current research. Some of the limitations of the current study identified are listed below:

The first limitation may be the presence of response error associated with the questionnaire design. Effective pretesting of the questionnaire might have helped to minimize the response error to a certain extent. In the pretesting session, few supply chain professionals were approached and interviewed. These highly experienced professionals from tier 1 Indian auto-component industry were asked to interpret each question based on their understanding to evaluate whether the same meaning is getting conveyed by each of the questions for all of the respondents. A simple random sampling strategy was adopted in the research. Even though simple random sampling is a common research method, it requires a complete list of all members of the target population so that the sample is the real representation of the larger group. Researcher have attempted to collect a complete list of tier 1 auto-component manufactures in India by various means, but still some of them might have possibly missed out. This can be one of the other limitations. In this research, tier 1 Indian auto-component industry was the focus of the study. At most care was taken to define variables and values very specific to tier 1 Indian auto-component industry, and thus the generalization of conclusions drawn within the 1 Indian auto-component industries to other organizations needs to be qualified and evaluated further. Another limitation of the study is in the data collection time frame considered. Time can change the perceptions of people, which is not considered in the study. The study is based on the perceptions of employees contacted in 2016. Results can be confirmed again by collecting longitudinal data and further research is urged. Sustainable supply chain performance may be affected by various other internal and external variables that are not accounted for in this study. It would be better to examine sustainable supply chain performance by taking all these variables also into account.
6.4.5. Future Research Directions

The research can be considered as a single drop into an ocean of supply chain literature. There is scope to take the research ahead and the scope and future research directions are listed out below:

The research can be extended by adopting a mixed research methodology with a combination of alternate qualitative and quantitative research techniques. The time required to get some visible improvement in the sustainability performance of organizations based on the policy decisions made may be high. So there is immense scope to have a longitudinal study by collecting data from different phase of implementation to understand the investment requirements versus the sustainability performance improvement in supply chain with respect to Indian auto-component manufacturing industry. The order to make investments and the focus areas to get improved sustainability performance by minimizing the time to get visible results can also be considered as a potential research topic. The scope of the current research is restricted to only tier 1 automotive industry in India. Similar kind research can be extended to other industries from other developing and developed economies to have clear cut comparison of driving factors. This study is focused only on the sustainability performance of supply chain. This can be taken to the next level by considering the impact of new trends such as internet of things, artificial intelligence etc. on the sustainability performance of supply chain. Research can be also extended to analyze the sustainability performance of service supply chain rather than the traditional product based supply chains.

6.4.6. Chapter Summary

Over the time globalization has changed the picture and traditional viewpoints on the automotive industry. Intense competition, need to penetrate to new geographies and the need to create a global brand value made the sustainability oriented supply chain design a basic necessity for survival of organizations. This research is figuring out a theoretical framework for the sustainability performance of supply chain with reference to tier-1 auto-component manufactures in India. This chapter is mainly focused on the outcome of the research. All research questions set in the initial phase were answered and the results are discussed in a crisp manner in this chapter. Final theoretical framework drawn from the research is also included in this chapter. Theoretical and managerial implications of the study are also narrated in detail in the later sections of this chapter. Contributions of this research to the auto-component manufacturing industry in India are also
touched up on in this chapter. Last but not least, the next section of this chapter is talking about the limitations of this research. And finally scope and directions for future research are also explained to help the future research enthusiasts and academicians in supply chain domain.