4. Analysis And Results

The result of the study is described in two parts. In the first part, the consequence of COVID-19 on tourism is presented, and in the second part, the impact of various factors on crisis resilience in the tourism sector is examined. According to the CII report, till April 3, 2022, the critical organized sector is hotel industries, tours, and travel agencies, which may hit a projected loss of Rs 2.58 lakhs crore in 2025. The World Economic Forum (WEF) reported that this pandemic created a massive loss of 50 million jobs in the worldwide tourism sector and around 30 million in Asia. With a fear of the epidemic and the travel restrictions worldwide in February 2020, only 1.01 million overseas tourists visited in India in contrast to 1.08 million in February 2019, with visa registration decrease of 6.6 percent. A budding job cut of 38 million, almost 70% hits the industry, says the leading accounting and audit firm KPMG. It is observed that there is widely downfall in international tourist arrivals in Asian countries, including India. Indian international arrivals also decrease by 6.6% from the last year. Thus, the corona effect is evident in the Indian tourism sector. To understand the precise impact of coronavirus on the Indian tourism sector, we have also taken the data for international tourist arrival, tourism revenue and foreign exchange earnings.

During the novel coronavirus, international tourist arrivals in India have been low over time. India's No. of Foreign Tourist Arrivals data was reported to be less than 1050000 in Feb 2020. This records a decrease from the previous 1100000 for Jan 2020, which is again much less than December 2019. The no of international arrivals is sharply decline over the three months and it is true that overseas tourist comings growth hit a record low in February, 2020 in India. There is a huge variation in the revenue from tourism in India from December, 2019 to February, 2020. A major part of Indian revenue comes from the tourism sector. For which more importance is given by the government to produce more revenue. But the graphical presentation shows how there is a fall in revenue. When in December, 2019 the revenue was approximately 225000, in February it came to less than 200000. The data is before the lockdown so it can be clearly understood during lockdown where the revenue might stand. The Foreign Exchange Earning (FEE) from the Tourism sector in the Indian economy is also considered for the study. With the lowering of the foreign tourists' arrival, the FEE from the tourism sector will clearly decrease. Indian tourism is especially for tourists in India. But from starting of the epidemic the number of visitors is reduced as can be observed in the graph above. In December, 2019 it was above Rs. 20000 (in crore) and from January, 2020 it started declining.

To examine the relationships among the constructs in the model, EFA (Exploratory Factor Analysis) and CFA (Confirmatory Factor Analysis) were utilized, employing Structural Equation Modeling (SEM). The complete structural model was analyzed to determine the fit of the

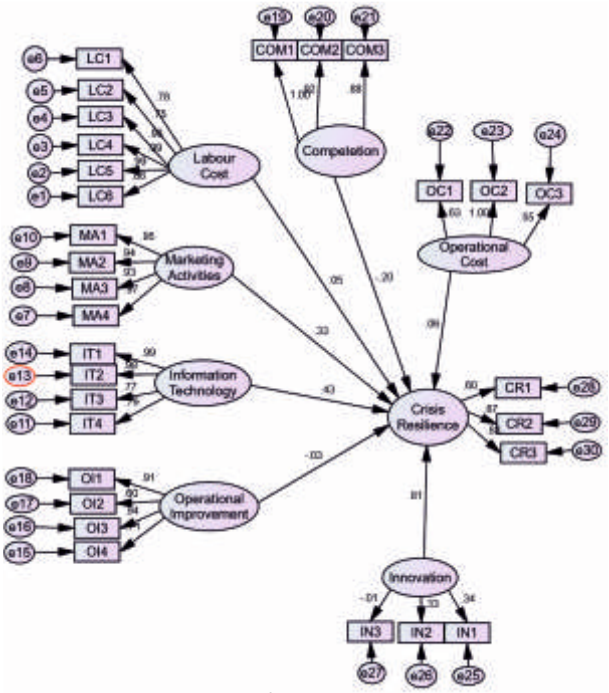

Figure-2 Crisis Resilience of Indian Tour and Travel companies

model and identify the causal relationships among the constructs. The χ^2 statistical probability, commonly used as a measure of SEM fit according to Martens (2005), should ideally be non-significant in a well-fitting model, as indicated by Hallak, et al. (2012).

Kline (2010) suggests that among several indices, five of them, namely χ^2, Comparative Fit Index (CFI), Normed Fit Index (NFI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR), are the most appropriate for evaluating and examining model fit.

The model fit for the current study is as follows: $\chi^2 = 605.403$, $df = 395$, $\chi^2/df = 1.533$ (acceptable value: $0 \leq \chi^2/df \leq 2$, as per Schermelleh-Engel, et al, 2003), CFI=0.939 (acceptable value: CFI close to 1.0, as per Weston & Gore, 2006), NFI=0.912, RMSEA=0.072 (acceptable value: RMSEA<0.5, as per Browne & Cudeck, 1993), and SRMR=0.72 (acceptable value: SRMR<0.8, as per Hu & Bentler, 1999). The present model explains the endogenous variables of the study. The R2 of labour cost is (0.05), marketing activities (0.33**), information technology (0.44**), operational improvement (-0.03), innovation (0.81**), operational cost (0.07*) and competition (-0.20).

Thus, from the above results of the model, it is crystal clear that the tour and tourism companies should give emphasis on the three major issues namely; marketing activities, use of information technology and development of some sort of innovativeness towards tourism services to revive in post-pandemic situation.

5. Practical Implications

The Corona infection (COVID-19) pandemic is the primary philanthropic emergency influencing individuals' ordinary life and has set off a worldwide financial emergency. The tourism industry has a very tangible impact, which is perilous for people, place and businesses. The most significant and prompt consequence of COVID-19 is found in the travel industry area in the entire globe - inbound, outbound, household, all verticals - relaxation, experience, legacy, MICE (Meetings, Incentives, Conference, Exhibition), voyage and corporate. In India, almost all the summer bookings are cancelled in Kerala, Goa, Rajasthan, other northern and eastern hilly region etc., thereby impacting on domestic tourism. India's complete outside vacationer arrivals (FTA) remained at 10.9 million and remote trade earnings (FEE) remained at Rs 210,971 crores during 2019. Presently with movement limitations in India for more than 80 nations and the greater part of the trips of major carriers being suspended in both residential just as outside movements. The imposition of travel restrictions in India for over 80 countries and the suspension of most flights by major airlines, both domestically and internationally, is anticipated to have a significant negative impact in 2020.

6. Limitations and Future Research Avenues

The present study has some limitations that need to be considered for future research studies. For instance, the study was based on limited sample and there was less scope to remind in an effective manner. Moreover, in the current study, seven dimensions were taken into accounts as crisis resilience measurement. Thus, it is needed to examine the effects of other dimensions like government roles, consumers intentions etc. in future research. Moreover, the study was based on quantitative survey; therefore, future studies may consider the qualitative measure to provide more rigorous and generalized results.

7. Conclusion

From the various research papers and the present situations all over the world clarifies that the critical measures are required to cope the loss of the tourism sector in India. Firms must adapt and renew and develop their strategic behavior to stabilize and increase the profit with permanent changes in the industry dynamics caused by recessions. The chance of recession because of COVID-19 is high as it has already stopped the life. Some disaster can be related as an unpredictable catastrophic change that can be identified only after the event, by the responses of the nature. The crisis management plans work as a framework for strategic management plans by the government or different organizations. Implementing appropriate remedial strategies, informed by a thorough understanding of the impact and risks posed by a crisis, can significantly mitigate the negative consequences on the economy or society as a whole. Taking proactive measures during a crisis can help to minimize its adverse effects and promote resilience. Current risk or crisis research is very strongly limited without any holistic perspective which can bring disaster to the mankind and the business. A more holistic view concerning risks and their future consequences from economic, environmental, and social points of view with a focus on the service business. Despite the expected impact on certain sectors due to ongoing COVID-19 concerns, India is also anticipated to benefit from it, particularly in the Meetings, Incentives, Conferences, and Exhibitions (MICE) industry. It is projected that demand for MICE events will be diverted to India, and the benefits of this diversion will be seen in the post-FY21 period. A positive sentiment towards domestic tourism and MICE, driven by social and industrial programs, is expected to result in a revenue growth of 3-5% for FY20-21.

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Enhancing Manufacturing Excellence through Integrated Process Excellence Methodologies

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ABSTRACT

In a highly competitive business environment, many manufacturing organizations around the world are deploying various Process Excellence Methodologies to improve the efficiency of processes, quality, and operational cost reduction of products. Indian manufacturing organizations are also following the same path and deploying PEMs such as Lean, Six Sigma, and the Theory of Constraints. This research mainly tries to study the implementation process of Lean, Six Sigma, and Theory of Constants in Indian manufacturing organizations and tries to find out how Indian manufacturing organizations are deploying these practices. Due to the nature of the project, it was decided to adopt an action-based research strategy and include both qualitative and quantitative techniques. An extensive literature review has been conducted to explore the various success factors responsible for the successful implementation of these methodologies. Based on this, a theoretical framework for the successful implementation of PEM has been formed. Hypotheses have been formed to test the association between the success dimensions and the organization's performance post-PEM implementation.

Through the chi-square, the hypothesis tests the association between two variables and the correlation coefficient to assess the strength of the relationship. The theoretical framework was empirically validated by testing all hypotheses derived from the theoretical framework and a conclusive research framework is therefore formed. Organizations will pay more attention to the success dimensions to ensure that the PEM implementation is successful. The results of the ordinal logistic regression analysis reflect the top success factors and top performance aspects, which increase the overall success rate of PE programs.

This study has contributed to the field of knowledge by including all three major PEMs in a survey of Indian manufacturing organizations. This is important because many organizations implement more than one methodology simultaneously and it is difficult to correlate post-implementation performance in a single methodology. The research gives guidelines to top management to prepare the organization for the implementation of PEM.

Key Words: Lean, Six Sigma, Theory of Constants, Process Excellence, Organization's Performance

1. Introduction

In today's globalized economy, companies are trying very hard to satisfy the customer's ever-increasing demands by improving the quality of products and services, and business success is being viewed in terms of better financial results. Therefore, quality management is the only way companies can survive in increasingly aggressive markets and take on a competitive edge (Dale, 1999). According to Juran (1988), quality is not an obligation of any individual but is each employee's responsibility in the organization; it is an integrated effort that results in building quality products, processes, and services.

However, to face the competition, Indian manufacturers have to concentrate on quality and process improvement. The study arises from the same need. It addresses the problem in front of Indian manufacturing organizations in selecting and implementing suitable Process Excellence Methodology. The study also tries to address Indian manufacturers' prominent query "How much success will be possible by adopting the Process Excellence Methodology in an organization?"

Achieving process excellence and attaining product quality is the top priority of organizations due to the tremendous pressure on cost-cutting and the quality of a

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final product. Process Excellence is not a fad but a necessity for an organization. There exist several Process Excellence methodologies such as Six Sigma, Theory of Constraints, Lean, Value Engineering, Total Quality Management (TQM), and Business Process Re-engineering, to name a few (Pulakanam and Voges, 2010; Andersson et al., 2006; Shah et al., 2008).

Of the various techniques mentioned above, authors Starbird and Cavanagh (2011); Delgado et al. (2010); Pulakanam and Voges (2010); De Koning et al. (2008a); Shah et al. (2008) and Arnheiter and Maleyeff (2005) contend that Theory of Constraints, Lean and Six Sigma are the three current, and most significant techniques that organizations attempt to implement to improve performance and compete globally.

Theory of Constraints, Lean, and Six Sigma techniques have a common goal of improving an organization's production and transactional processes even though it appears from the literature that they are operationally and distinctly different. Each technique uses different approaches and principles to effect improvement. Therefore, based on each technique's unique objective, TOC or Lean or Six Sigma as standalone techniques have limitations that could fall short of achieving overall operational excellence. For this reason, a rigorous alignment of these limitations and the development of a plan to build, improve and refine current theory on the dimensions of integrating TOC, Lean, and Six Sigma are prompted. The latest generation improvement technique integrates human and process elements into a program that links and sequences improvement tools to an overall innovation and business growth approach.

Although the Theory of Constraints, Lean, and Six Sigma have received recent attention and popularity to provide outstanding business results, there is no logical framework that organizations can adopt. Similarly, there appears to be no specific structure that integrates the Theory of Constraints, Lean, and Six Sigma techniques into a framework that complements each other from an Indian perspective. An investigation is needed for Indian manufacturing organizations to consider an approach that uses the best of these three techniques collaboratively to achieve better business results conceptually and operationally.

1.1 TLS (TOC, Lean, and Six Sigma)

Van Tonder (2011) argued that any organization's goal is value creation for the target market, society, and economy, and performance measures are included to enable alignment. According to Demchuk and Baitsar (2015), TOC, Lean Manufacturing, and Six Sigma Methodology are complementary and integrated methodology providing a systematic and focused approach to improvements. The benefits are:

- Comprehensive reform of the organization
- Better return on investment and higher profits
- Better strategic goal success through reduced variability in the process
- There is no need to change the methodology every time it lacks success but just for its implementation and deployment.

TOC, Lean Manufacturing, and Six Sigma have several overlapping elements to integrate and become one of the most promising improvement combinations that increase competition (De Jesus Pacheco, 2015; Demchuk & Baitsar, 2013). Demchuk and Baitsar (2015) suggested that, from the standpoint of quality assurance, the final step after lean manufacturing equipment should be Six Sigma, starting with TOC.

Pirsteh and Kannappan (2013) suggested that TOC, Lean Manufacturing, and Six Sigma should be combined into a 7 stage process. According to the TOC improvement model, most phases of the Pirasteh & Kannappan's (2013) model suggested training and omitted the elevate constraint step.

Woeppel's (2015) method of face value seems much more straightforward than Pirasteh & Kannappan's (2013) model.

The advantage of using the model of Woeppel (2015), in contrast to Pirasteh & Kannappan (2013), is that current TOC, Lean, and Six Sigma principles can be directly applied without any significant modification of these current practices through unlearning and relearning.

The literature review outcome found that limited research has been conducted on implementing Process Excellence Methodologies in India compared to developed countries. The gaps highlighted from these three techniques were used to critique the commonalities between the Theory of Constraints, Lean, and Six Sigma. The commonalities identified justified combining the Theory of Constraints, Lean, and Six Sigma into an integrated business improvement technique.

That is why, the present research study tried to plug the gaps by finding more points of overlap between the three approaches than exclusion to construct an integrated continuous process improvement system that may enhance competitiveness in the Indian manufacturing industry.

2. Research Methodology

The literature analysis indicates limited theory guiding the integration of the Theory of Constraints, Lean, and Six

Sigma techniques into a compatible Theory of Constraints, Lean, and Six Sigma framework. The study involved an extensive literature review to authenticate the development of the key concepts on how integrated Theory of Constraints, Lean, and Six Sigma strategy can improve business performance. Thus, it made the first part of the study exploratory in nature. Further, a descriptive research methodology is used to understand sample respondents' responses to understand the population. Upon considering the objectives and setting of the present study, it was decided to select the action research strategy as it concentrated on the intervention of the real world and focused the close examination of the effects of the action that was investigated. Research questions are one of several critical issues that the research process will address. Therefore, for the study, the following broad research questions:

How do Indian Manufacturing organizations select and implement a suitable Process Excellence Methodology from Lean, Six Sigma, and the Theory of Constraints?

- Which factors are responsible for successfully implementing Process Excellence Methodology in Indian Manufacturing Organizations?
- Which Process Improvement Methodologies have been preferred by Indian Manufacturing Organizations?
- What level of significance and benefit will an integrated Theory of Constraints, Lean, and Six Sigma framework provide for India's manufacturing organizations?

The study adopted Positivism research philosophy and deductive and inductive reasoning. The study is cross-sectional and adopted a survey as a research strategy. The researcher collected both forms of data at the same time.

The study adopted deductive reasoning (from theory to data), and hypotheses have been developed from the approach. Data collected through the survey were analyzed to test these hypotheses.

The research Objectives of the study are:

1. To analyse the possible benefits of integrated Theory of Constraints, Lean and Six Sigma under Process Excellence Methodology in Indian manufacturing organization performance.
2. To extract the key Process Excellence Methodology factors and related organization performance factors in an Indian manufacturing organization.

An extensive literature review has been carried out to find out various success factors. As observed in the literature review, various success factors have been identified as independent variables (with simplified names for planned survey purposes), and the dependent variable is an organization's performance. The independent variables are grouped into nine Success dimensions, and the dependent variables are clubbed under three dimensions to create a primary dependent variable, "Organization Performance." The theoretical framework is built on the assumption and research hypotheses developed from the theoretical framework, which has to be empirically tested.

The study questionnaire was developed to provide a baseline for the Theory of Constraints, Lean, and Six Sigma techniques within the sampled organizations and to understand their existing quality management practices. The questionnaire's essential characteristics were embodied into six parts to collect the information.

Both open-ended and close-ended type questions about organizations that practice the Process Excellence technique were formulated. The questions were set out to examine the current strengths and weaknesses of the Process Excellence technique from an Indian manufacturing perspective. Close-ended type questions grouped eighty-one variables into nine categories that represented the critical success factors of the Theory of Constraints, Lean, and Six Sigma. Also, close-ended type questions grouped thirty-three variables into three categories that represented the performance measures of the Theory of Constraints, Lean, and Six Sigma. The participants were required to rate each statement on a 5-point Likert-type scale to the extent of which they "Strongly Disagree" (1) to "Strongly Agree" (5) with the statements provided.

Pre-testing was done by distributing a questionnaire to 30 selected subjects and industry experts for questionnaire quality improvements. The questionnaire is modified after taking the input of pre-testing.

The present study included organized and unorganized sectors of manufacturing organizations in India as an infinite population. Assuming the percentage of manufacturing organizations using PEM to be 30 % (based on estimates by experts), the sample size is estimated as 500. As it was difficult to get a comprehensive list of all Indian manufacturing organizations based on PEM, the study used ACMA, SIAM, IBEF, CII, and IIMM industries directories and various other industry directories as the sampling frame. The survey assessed practical experience and knowledge instead of general perceptions. The target participants were employees working in Indian manufacturing organizations at a middle or senior management level and responsible for Process Excellence Methodology implementation. These include Quality Assurance

Managers, Manufacturing Engineers, Operations Managers, Production System Managers, Theory of Constraints Experts, Six Sigma Experts, and Lean Specialists and Consultants hired by organizations implementing of PEMs. The questionnaire has been filled out by various manufacturing industries in Maharashtra, New Delhi and NCR, and Uttar Pradesh. A purposive sampling technique was used for the study. A sample size of 500 has been selected for filling out the survey questionnaire. However, with a response rate of 45.4%, the total response received as effective sample units are 227.

3. Data Analysis and Findings

The data collected from the respondents were analyzed using SPSS version 25.0. Both descriptive and inferential statistical analyses have been carried out to analyze the data, test the hypotheses and validate the theoretical framework.

The statistical analysis was conducted after the re-verification of the coding and accuracy of the input data with 227 responses extracted suitable and complete after editing and filtering of data. The data analysis techniques related to the defined objectives of the present study are Correlation Analysis for Research objective-1 and Logistic Regression for Research objective-2.

Skewness and Kurtosis tests were conducted to check whether any outlier is present. Outliers were not observed in the data to be analysed.

The measure of internal consistency (reliability) has been tested through Cronbach's alpha. The Cronbach's Alpha values are 0.901 for the overall questionnaire and 0.921 for only the 124 five-point rating scale variables.

The Kolmogorov-Smirnov normality test is being used to check whether data follow a normal distribution or not. If $p < 0.05$ in the Kolmogorov-Smirnov normality test, the data is not normal. In the study, larger values for the Kolmogorov-Smirnov statistic ($p > 0.05$) indicate that the data did not follow the normal distribution. As the data collected for the research study was not normally distributed, non-parametric statistics were used to test the hypotheses.

3.1 Findings and Conclusion from Descriptive Statistical Analysis

- The findings show that the highest responses were from Process Excellence managers (46.3%) followed by Process Excellence engineers (20%), Head-Operations (16.2%), Foreman / Superintendent (8.7%), and Process Excellence Consultants (4.8%) followed by Process Excellence Auditors (2.1%) and Executives (1.9%). That was because these job titles have highly related to PEM tools in manufacturing processes.
- 41.4% of respondents had the experience of more than ten years, followed by 5-10 years (34.7%), 1-5 years experienced (15.3%), and less than one year (8.6%). That indicated that highly experienced employees have more preferred by Indian manufacturing organizations.
- 39.8% of respondents were working for organizations employing 501-1000 persons, followed by groups employing 101 to 500 employees (31.6%), employing more than 1000 (18.4%), and employing up to 100 (10.2%). That may be due to more substantial organizations having more function-specific staff and dedicated people for PEM implementation. All sizes of organizations are being started deploying PEMs.
- 31.3% of respondents were from the 501-1000 crores turnover group, followed by 30.7% from 101-500, 20.4% of respondents from the 1-100 crores turnover group, and 17.6% from the above 1000 turnover group.
- Lean was the most popular PEM, which was implemented by 62.2% of respondents, followed by Six Sigma (51.2%) and TOC (14.2%).
- Most organizations preferred implementing more than one process excellence methodology simultaneously.
- Lean Six Sigma was the most preferred combination of process excellence methodology by Indian manufacturing organizations. 33.1% of respondents implemented Lean Six Sigma; Lean follows this with 20.5% of respondents then Six Sigma 11%.
- 4.7% of organizations used all three process excellence methodologies (Lean, Six Sigma, and Theory of Constraints). That is an exciting and important finding, as it indicated the start of the integration of these three PEMs in Indian manufacturing industries, where further study is required.
- 3.1% of organizations used only the Theory of Constraint. That indicated that the Theory of Constraint has less preferred by Indian manufacturing organizations.
- For those who were planning to implement PEM in their organization, Lean manufacturing was preferred by 44.6% of organizations, followed by Six Sigma (35.8%) and the Theory of Constraints (17.2%).
- The highest priority area of organizations was improving processes (77.2%), followed by enhancing quality and productivity (60.6%) and becoming more competitive (55.9%), followed by reducing costs

(50.4%), and so on. That indicated that the specific process excellence tool as a standalone technique has limitations in improving an organization's overall performance. These limitations are the key focus areas of the other process excellence tool.

3.2 Hypothesis Testing and Conclusive Research Framework

The internal relationship among different variables is being examined using correlation analysis in SPSS 25. Spearman's rank correlation coefficient test was performed to determine whether there are statistically significant relationships between the variables in the study. In the present study, a strong positive relationship has been considered if r is +0.50 and above.

This analysis is performed for only those respondents who have implemented any of the PEM in their organization.

The following are the conclusions drawn from hypothesis testing:

1. There were statistically significant and moderately positive relationships between top management commitment and overall company performance after PEM implementation ($r=0.484$, $p<0.01$).
2. There were statistically significant, strong, and positive relationships between organization culture and overall company performance after PEM implementation ($r = 0.555$, $p < 0.01$).
3. There were statistically significant, strong and positive relationships between plant management and overall company performance after PEM implementation ($r= 0.561$, $p < 0.01$).
4. There were statistically significant and moderately positive relationships between product development management and overall company performance after PEM implementation ($r=0.443$, $p<0.01$).
5. There were statistically significant and slight positive relationships between logistics management and overall company performance after PEM implementation ($r= 0.416$, $p <.01$).
6. There was a statistically significant and positive relationships tendency between human resources management and overall company performance after PEM implementation ($r= 0.419$ and $p < 0.01$).
7. There were statistically significant and moderately positive relationships between training and development and overall company performance after PEM implementation ($r= 0.434$, $p < 0.01$).
8. There were statistically significant and indicative positive relationships between supplier relationship management and overall company performance after PEM implementation ($r= 0,375$, $p < 0,01$).
9. There were statistically significant, strong and positive relationships between customer relationship management and overall company performance after PEM implementation ($r=0.685$: $p<0.01$).

The Top management commitment, Organizational culture, Plant management, Product development management, Logistic management, Human resource management, training and development, Supplier relationship management and Customer relationship management attributes have positively correlated with individual level post-PEM implementation attributes.

The outcome of hypotheses testing showed that all dimensions mentioned in the theoretical framework, as shown in Fig. 3.1, have a statistically significant relationship with the overall company performance. Thus validating the conceptual framework and present the following conclusive research framework.

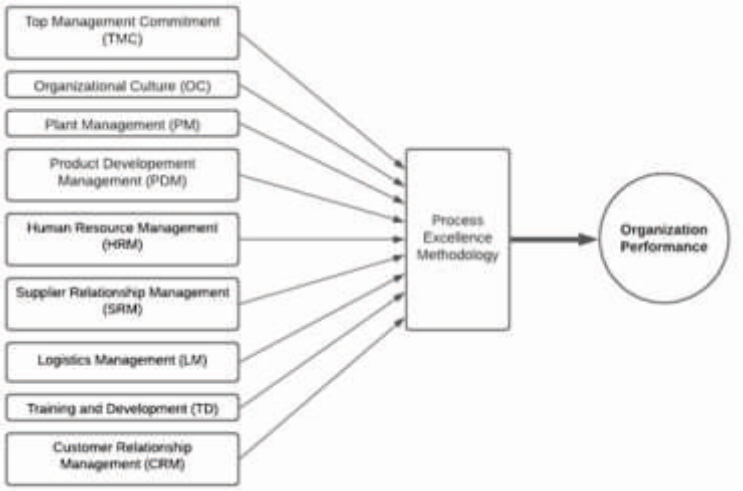

Fig. 3.1 Conclusive research framework

3.3 Findings from Ordinal Logistic Regression Analysis

Regression Analysis is the estimate of the strength of the relationship and contribution weight (towards the dependent variable) of each independent variable. From here, the key drivers have been outlined. The purpose of Ordinal logistic regressions (Link function: Logit) in this study is to learn more about the relationship between several independent or predictor variables and a dependent or criterion variable in the non-parametric data. The analysis provides the key success drivers of the PEM and performance.

Ordinal Logistic Regression - Model Summary

Table 3.1 R-Square- Success Factors

Cox and Snell	0.735
Nagelkerke	0.821
McFadden	0.587

Nagelkerke's R2 = 0.821 indicates that the model explains 82% of the variation in the outcome defined by the model. It is a good and acceptable level to continue examining the regression results further.

The value of VIF=3.06 has been calculated by Nagelkerke's R2. VIF<5 shows that multicollinearity does not affect the model.

Table 3.2 Model Fitting Information- Success Factors

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	287.180			
Final	188.663	98.516	33	0.000

The Model Fitting information told that there was a highly significant reduction in the chi-square statistics (p<.005), so the model is a substantial improvement over the intercept-only model.

The Parameter estimates table is the core of the output, telling explicitly about the relationship between our explanatory variables and the outcome.

Dependent variable: "Overall successful rate of Process Excellence Program" (to understand which attributes are the key drivers of Successful rate) (actual scale value, 5 points)

Independent Variables: "Success Factors of Process Excellence Program" (actual scale value of the attributes, 5 points)

The outcome of regression analysis showed that the top 15 (here 18 variables fall under the top 15 rank) the relative importance of success factors that drive the overall success rate of the PE Program implemented in the organization are the following:

1. The five M's (Man, Machine, Methods, Materials, and Money) are more responsible for uninterrupted process flow.
2. Linking advanced Statistical Process Control and analytical tools is diagnosing process improvement.
3. Shop floor employees fix minor quality problems as they occur.
4. Employees know their competitors.
5. Cross-functional training has been provided to multi-skill employees.
6. The constraints are continuously identified and evaluated for improvement opportunities.
7. The factory layout has been divided into manufacturing cells that encompass product families with similar processing requirements.
8. All employees are being trained on basic quality principles, understanding methodology, and statistical tools & techniques.
9. Quality data (error rates, defect rates, scrap, defects, cost of quality) are available throughout the plant to manage quality.
10. Management is working on improvement in working capital.
11. The organization uses the Single-Minute Exchange of Dies (SMED) technique to provide rapid change-over of tooling and fixtures.
12. Employees participate in problem-solving.
13. The organization uses Kanban systems to signal material requirements in each process.
14. The elimination of seven forms of production waste (overproduction, waiting, transportation, processing, inventory, motion, defects, and increases the constraints) are identified and highlighted in organization processes.
15. Management has arrangements to support skills, experience, and competence retention.
16. Established visual management techniques are useful in the manufacturing process.
17. Outsourcing Logistics Functions can increase flexibility.
18. Shop floor employees perform general maintenance of equipment.

Table 3.3 R-Square- Performance Measures

Cox and Snell	0.540
Nagelkerke	0.602
McFadden	0.343