CHAPTER -3
DESIGN OF STUDY

This chapter details out the research methodology for the present study. It explains overall design of study, which includes need for study, objectives, scope, phases of research and methodology adopted for carrying out the research work. The details of work done in each phase, tools, techniques and models used in the dissertation have also been presented in this chapter. The objectives of this study have been defined for studying the impact of manufacturing competency on strategic success.

3.1 NEED FOR THE PRESENT STUDY

Taking into account the literature survey, the need of the present study arose because impact of Manufacturing Competencies on Strategic Success of a firm has not been yet addressed. For this purpose, the present study has been designed to investigate and suggest manufacturing competencies that contribute to the strategic success of automobile manufacturing industry.

3.2 OBJECTIVES OF THE STUDY

The present research work has emphasized on the following objectives:

1. Synthesizing the concept of Strategic Success in automobile Industry.
2. Exploring Manufacturing Competencies in Automobile Industry.
3. Analyzing the impact of Manufacturing Competencies on Strategic Success in automobile Industry.


3.3 ISSUES EXPLORED IN THE STUDY

The following Issues have been explored in the present research work:

1. Strategic Success in the context of Automobile Industry has been defined.
2. Manufacturing competency and its components have been elaborated.
3. The various aspects of strategic success to manufacturing competency have been correlated.
4. The impact of manufacturing competency on strategic success has been analysed and modelled using suitable qualitative and quantitative techniques.

3.4 METHODOLOGY

For accomplishing the objectives of the proposed study, the following methodology has been followed:

1. The detailed literature review has been carried out to ascertain the significance of manufacturing competencies and strategic success.
2. Survey of several automobile manufacturing units has been completed through a specially prepared questionnaire for understanding and assessing the current situation.
3. Suitable qualitative and quantitative techniques have been employed to correlate manufacturing competencies and strategic success.
4. To authenticate the findings of survey, it has been followed by case studies in selected automobile manufacturing units of North India.
5. The results of survey and case studies have been synthesized to come out with a suitable model.
3.5 SCOPE OF WORK

The study has been conducted in automobile and autoparts manufacturing units in Northern part of the country. The study investigates the effect of manufacturing competency factors on strategic success in automobile manufacturing units. The key factors for realizing overall organisational objectives through various manufacturing competency attributes have been examined in the study. The research focussed on suggesting a Competency-Strategy model for North Indian automobile manufacturing industry.

The status of automobile manufacturing industry, with regards to various competitiveness and strategic success issues has been elaborated in the study. Firstly, the study involves investigation of Manufacturing Competency and Strategic Success initiatives towards realization of organisation performance enhancements and accruing of core competencies in Indian enterprises. Lastly, a comparative analysis of business performance enhancements will be done by studying manufacturing competency and strategic success.

For the purpose, key competency and strategy success parameters, and organisation performance attributes have been evolved in the study. The relationships of various parameters have been analysed and these were validated by using different statistical tools. Moreover, the study focused upon the impact of manufacturing competencies on strategic success thus improving organisation performance in Indian industry. Finally, competency-strategic model has been synthesized based upon extensive
literature review, learnings from detailed ‘Manufacturing Competency Questionnaire’ analysis and results from case study process.

3.6 PHASES OF RESEARCH

The study has been carried out with the objective of developing effective factors for manufacturing competency and strategic success in North Indian automobile manufacturing industry. Considering the complexity of theme and taking into view the fact that such studies can be carried out primarily by closely treading and analyzing the approaches adopted by various organisations and results thereof, it was considered appropriate to carry out the study under ‘Flexible Systems Methodology (FSM)’ framework.

The three basic components of FSM are actor, situation and process (Sushil, 1994). The ‘situation’ is to be managed by an ‘actor’ through an appropriately evolved management ‘process’, which recreates the situation. The ‘actor’ forms a part of the ‘process’ as well as the ‘situation’. The research work involves following phases:

(a) Clarifying the Context

The detailed literature review has been conducted regarding competency and strategy factors adopted by manufacturing organisations world-wide, from time to time in the past and issues involved with the same. The evolution of processes has been studied through various stages of manufacturing and strategy practices along with their relevance and shortcomings. The literature review illustrates tools, techniques employed in implementation processes of these factors and the potential benefits
accrued by Western world through effective Competency-Strategy implementation programs.

(b) Understanding and Assessing the Situation

A survey of large number of manufacturing organisations (118 manufacturing units) has been completed through a specially prepared questionnaire for understanding and assessing the present situation regarding manufacturing competencies of Indian entrepreneurs. The survey design and analysis involves following steps:

i. Design of a questionnaire on various aspects of competency as well as maintenance strategies including organisation policies, traditional quality and maintenance attributes, measures and components of manufacturing performance.

ii. Pre-testing and validation of questionnaire on the representative sample of industries.

iii. Data collection using detailed ‘Manufacturing Competency questionnaire’ through postal mail, E-mail, personal visits, interviews and other communication means.

iv. Summarizing and analyzing the data to investigate status of various traditional maintenance strategies, besides evaluating exploits of Indian entrepreneurs with proactive competency initiatives and strategy initiatives. Thus evaluating the benefits accrued in terms of manufacturing performance achievements.

v. Statistical analysis pertaining to status of various performance indicators as a result of implementations. Suitable qualitative and quantitative techniques have
been employed to analyze the contributions of various competency and strategy implementation dimensions towards realization of performance achievements in North Indian automobile manufacturing organisations.

vi. Identification of stumbling blocks for successful Competency-Strategy implementation in North Indian automobile manufacturing Enterprises.

vii. Identification of key success factors for manufacturing competency in North Indian manufacturing automobile units.

(c) Assessing the Actor’s Capability

The survey has been followed by case studies in selected Indian manufacturing organisations to ascertain the manufacturing performance exploits by Indian entrepreneurs. The case studies emphasize upon step-by-step implementation procedure adopted by the organisations towards achieving strategic success through manufacturing competencies.

The case studies have been developed to determine the tools and techniques adopted by manufacturing organisations towards ensuring effectiveness of competency and results accrued through successful strategies. The data thus obtained regarding key performance indicators has been analyzed for arriving at their role in improving effectiveness of quality and maintenance function in the organisations. The detailed case studies include: overview of manufacturing organisations, manufacturing competency factors, strategies adopted by organisations, their time frame, sequence and performance enhancements accrued by the organisations.
(d) **Evolving the Management Process**

Finally, the inferences drawn from the literature review, survey (analysis of questionnaire) and case studies have been effectively deployed to design the ‘Competency-Strategic model’ for Indian Manufacturing Organisations. Moreover, the guidelines for strategic measures for overcoming the barriers in implementation programs have also been evolved in the research.

### 3.7 RESEARCH METHODOLOGY

Figure 3.1 shows a block diagram for the methodology used for this research. This research has been conducted in automobile and autoparts manufacturing units in Northern part of the country for studying the impact of these competency factors on business performance. The aim is to describe the effect of competency factors on performance parameters of automobile manufacturing units. During this research, a large number of automobile units have been surveyed for establishing effects of competency drivers in the strategy making. Survey of various organisations has been conducted through a specially prepared questionnaire.

The approach has been directed towards analysing the effect of competency on strategies and thus, in improving firm’s performance. For completion of the survey effectively, the questionnaire was prepared through extensive literature review (Ahmad and Schroeder (2010); Alsudiri et al., (2013); Amoako-Gyampah et al., (2008); Armstrong (2013); Banjour and Micaelli (2010); Celik et al., (2012); Chaiprasit and Swierczek (2011); Emad Y. Masoud (2013); Ferna´ndez-Pe´rez et al., (2012); Ferna´ndez-Mesa et al., (2013); Haartman (2012); Halim Mad Lazim and T.
Ramayah (2010); Heiko Duinet et al., (2013)) and was validated through vast peer review from consultants in the industry and academicians. The questionnaire is based on four point likert scale. Each performance parameter and dimension is taken as a group of several related items.

An industrial database among the automobile manufacturing organisations across the Northern region of the country was created for the purpose of conducting survey of ‘Manufacturing Competency Questionnaire’. The questionnaires were forwarded to the organisations and they were subsequently contacted through various communication means like: postal mail, E-mail, telephonic interviews, besides personal interviews through visits to various manufacturing units to describe the

![Block diagram of Methodology](image)

Fig. 3.1: Block diagram of Methodology
purpose of the research work, its relevance and to clarify any doubts /queries to facilitate responses to the ‘Manufacturing Competency Questionnaire’.

Finalized Manufacturing Competency Questionnaire was forwarded to around 350 industries which are manufacturing automobiles and their parts. Around 150 calls were made to interact with the persons in industry and about 250 mails containing questionnaire were forwarded to various automobile units across the Northern region of the country. Along with this, interviews with the resource persons were made and clarifications were sort.

Furthermore, in case of organisations having multiple products, response for individual product has been received. The responses have been compiled and analysed to determine the performance of the North Indian automobile manufacturing industry. Most respondents to ‘Manufacturing Competency Questionnaire’ were from top level of management that included Vice Presidents, General Managers (GM), Head of Operations, Head of Maintenance, Head of Process Engineering, Head of Quality Assurance, Quality Managers, etc.

In response to all these efforts, 118 filled questionnaires have ben received. The simple, comprehensive and relevant questionnaire, covering different aspects of competency and strategy factors gathering data required for attaining objectives of the research. Detailed description of ‘Manufacturing Competency Questionnaire’ has been presented in Appendix – I.
The various sections of the questionnaire are:

I. **MANUFACTURING COMPETENCY**

1. **PRODUCT CONCEPT (IDEA GENERATION)**
   
   1.1 CREATIVITY
   1.2 INNOVATION
   1.3 INVENTION
   1.4 EVOLUTION

2. **PRODUCT DESIGN AND DEVELOPMENT**
   
   2.1 CAD (TECHNOLOGY)
   2.2 PRODUCT LIFE CYCLE
   2.3 FEM/FEA
   2.4 SIMULATION AND MODELLING
   2.5 AESTHETICS
   2.6 ERGONOMICS
   2.7 TECHNICAL SPECIFICATIONS

3. **PROCESS PLANNING**
   
   3.1 CAPP
   3.2 MACHINE SELECTION
   3.3 MATERIAL SELECTION
   3.4 STATISTICAL PROCESS CONTROL
   3.5 DEMAND ORDER INFORMATION
4. **RAW MATERIAL AND EQUIPMENT**

   4.1 MATERIAL AVAILABILITY
   4.2 IMPORT
   4.3 INVENTORY
   4.4 WAREHOUSING
   4.5 TRANSPORTATION
   4.6 AUTOMATED EQUIPMENT

5. **PRODUCTION PLANNING AND CONTROL**

   5.1 CAM
   5.2 PRECISION KNOWLEDGE
   5.3 GREEN MANUFACTURING
   5.4 SYSTEM INTEGRATION
   5.5 ROBOTICS
   5.6 HYDRAULICS AND PNEUMETICS
   5.7 ASSEMBLY
   5.8 FINISHING
   5.9 PROCESS CONTROL

6. **QUALITY CONTROL**

   6.1 INSPECTION
   6.2 PRODUCT TESTING
   6.3 LIFE CYCLE ANALYSIS
II. **STRATEGIC SUCCESS FACTORS**

1. **STRATEGY AGILITY**
   1.1 PRICE
   1.2 PROFIT
   1.3 MARKET SHARE
   1.4 CUSTOMER BASE

2. **MANAGEMENT**
   2.1 PLANNING
   2.2 CONTROL
   2.3 PROJECT MANAGEMENT
   2.4 INFORMATION MANAGEMENT
      a) INFORMATION STRATEGY
      b) INFORMATION ANALYSIS
      c) SYSTEM CO-ORDINATION
   2.5 RISK MANAGEMENT
   2.6 PERFORMANCE MANAGEMENT
   2.7 CRISIS MANAGEMENT

3. **TEAM WORK**
   3.1 LEADERSHIP:
      a) FOCUS:
         i. IMPACT
         ii. MOTIVATE
b) KNOWLEDGE:
   i. CONCEPTUAL
   ii. ANALYTICAL
   iii. STRATEGIC
   iv. EXPERTISE

c) MANAGE
   i. CHANGE
   ii. PERFORMANCE

3.2 COMMUNICATION:
   a) MARKETING
   b) PROMOTION
   c) PUBLIC RELATIONS
   d) INTERNAL CORPORATE

3.3 CO-OPERATION

3.4 KNOWLEDGE:
   a) KNOWLEDGE TRANSFER METHODOLOGY
   b) TECHNOLOGY TRANSFER
   c) INTERNATIONAL COLLABORATIONS

4 ADMINISTRATION

   4.1 MANAGEMENT
   4.2 POLICY FORMATION
   4.3 MANAGEMENT CONTROL
5 INTERPERSONAL

5.1 AWARENESS
5.2 SELF-CONFIDENCE
5.3 FLEXIBILITY
5.4 STRESS MANAGEMENT
5.5 INFLUENCE
5.6 LOGISTICS:
   a) IMPORT
   b) EXPORT
   c) WAREHOUSING
   d) WASTE MANAGEMENT
   e) PRODUCT STANDARDIZATION

III. OUTPUT FACTORS
1. SALES
2. PROFIT
3. COMPETITIVENESS
4. GROWTH AND EXPANSION
5. PRODUCTION CAPACITY
6. PRODUCTION TIME
7. LEAD TIME
8. PRODUCTIVITY
9. MARKET SHARE
10. QUALITY
11. RELIABILITY

12. CUSTOMER BASE

Figure 3.2 depicts the proposed model showing the competency factors and performance attributes for evaluating the relations between competency and strategy.

![Diagram showing Competency Factors and Manufacturing Performance Achievements](image)

**Fig. 3.2:** Competency factors and manufacturing performance achievements
For establishing the benefits realised by an effective manufacturing competency approach, it becomes important that the effect of competency approach on different strategic success factors and thus, on organisation performance be analysed carefully.

The various statistical tools like response analysis, Cronbach’s Alpha, percent point score, Multiple Regression Analysis, ANOVA, t-test and Pearson Correlation Coefficient have been employed to evaluate and validate contributions of competency initiatives towards building firm performance and realization of core competencies in the manufacturing organisations.

The above work has been extended by applying various qualitative techniques like AHP, TOPSIS, VIKOR and Fuzzy Logic. This further has been validated by applying Structural Equation Modelling to the above study. This study uses the confirmatory factor analysis (CFA) approach using Structural Equation Modeling (SEM) in Analysis of Moment Structures (AMOS) 21.0 software to deploy the interrelation between competency and strategic success variables involved in the study. The data for the study have been collected through ‘Manufacturing Competency Questionnaire’ from various North Indian automobile manufacturing industries.

Further, for assessing the actor’s capability, the multiple-descriptive case study method has been used in the research and the survey has been followed by case studies in selected manufacturing organisations. In the study, case study method has been preferred due to the following reasons:
i. The case study embodies more deep study of an organisation than data points covered under the survey.

ii. For proper research it was needed to use multiple sources of evidence as work cannot be relied on a single data collection method

iii. Distinctive strategies are needed for research design and analysis.

While selecting the organisations for detailed case studies, the following factors have been considered:

i. The selected set of organisations should represent the manufacturing sector in terms of competition, complexity and other aspects need to be included in the study.

ii. The selected set should include organisations, which have different manufacturing sectors.

iii. The organisations participating in the survey through ‘Manufacturing Competency Questionnaire’ responses have been given preference.

iv. There is the feasibility of getting authentic information and data related to competency from the units through personal interactions, observations and published data. Here it is pertinent to mention that although reasonably high numbers of questionnaire responses have been obtained from leading Indian entrepreneurs, very few organisations have come out openly and share their exploits and performance achievements.

v. The descriptive case studies have emphasized upon the step-by-step implementation procedure adopted by the organisations towards achieving the organisational objectives. The industrial support was sought from various
manufacturing organisations regarding the proposed research work and an encouraging response has been received from the industry. The industries confirming to support the proposed research work and which were selected for doing case studies were Honda, Gurgaon (two-wheeler sector); Suzuki, Manesar (diesel and petrol cars); Mahindra and Mahindra, Chandigarh (Tractors); SML Isuzu, Roopnagar (buses and trucks).

vi. The case studies have elaborated organisational information, need for implementation, strategies adopted, their time frame, sequence and impact of implementation strategies towards realization of improvements in firm’s performance.

Considering the extensive literature review, questionnaire survey, quantitative as well as qualitative analysis and case studies, a competency-strategy model for North Indian automobile manufacturing industry is developed by the authors in chapter 6. A summary of the research accomplishments has also been highlighted. Finally, limitations of the research have been presented and recommendations for future research directions have also been suggested.

### 3.8 CONCLUDING REMARKS

In this chapter, the methodology adopted along with step-by-step approach employed for the dissertation has been elaborated. The tools and techniques employed for analysis of various areas and activities for development of implementation strategy have also been briefly described. For the study of research propositions, a detailed survey and case studies have been carried out. The details of the survey, responses
obtained and correlations established between various variables have been described in the next chapter, while case studies have been presented in Chapter – 5.