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Influences of Project Management Practices in Manufacturing Industries through Structural Equation Modelling in India

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ABSTRACT
The manufacturing sector is identified as the growth-promoting sector for the Indian economy. Over time, with the advancement in technologies and rise in a competitive environment, the sector has undergone many revolutions. With the continuous change in the dynamics of the manufacturing sector, firms need to consciously assess project management and performance practice. Keeping this in mind, the current study analyzes the role of project management practices constructs in determining the performance of the project. Wherein, in this study, the analysis is done usingthe primary method. Using a close-ended questionnaire 268 respondents were collected to capture demographic characteristics of employees and their perception of the role of project management practices. Models for SEM models were developed in the current study using SPSS. The software is used to test and validate different hypotheses usingthe SEM model's path coefficients and goodness of fit indices. The findings of the study suggest that target, budget, delivery, risk, HRM, quality, communication, procurement, learning, and stakeholder management practices influence project performance indicators like project performance, consumer satisfaction, and project success. The results showed validation of 25 out of 36 hypotheses. Thus,project management practices have a role in influencingthe project performance of Manufacturing Projects.

Keywords: Project performance, project management, manufacturing projects, SEM

I. INTRODUCTION

The manufacturing sector traversed from building an industrial foundation during the 1950s and early 1960s, license–permit Raj through 1965-1980, the liberalization phase of 1990s, and the current global competitive phase; thus has a major role in India's economic development (CII, 2020). With rapid changes taking place across businesses worldwide, assessing the performance of project management is integral for these industries to perform effectively and gain continual growth and competitive advantage (Unegbu, Yawas, and Dan-asabe, 2020). Thus, it becomes necessary to evaluate project performance for the Indian manufacturing sector through project management concepts.

a) India's Manufacturing Industry Background

Manufacturing Industry in India has undergone various phases of development since independence. The industrial sector has a major role to play in the development of the Indian economy, in addressing challenges related to general poverty, unemployment, or low productivity(Sharma, 2014). Industrialization was a very important aspect of India's post-independence economic development. The year 1950-51 saw the manufacturing sector in Indiacontribute 8.98% to GDP, increasing at 14.23% by 1965-66 (Sadhana, 2015). Till 1980, based on the Soviet Union industrial development concept, India also focused on large and heavy industries under state control and central planning. Import substitution, stringent price controls, and restricting privatization were the main tactics applied, which failed to aid growth across the manufacturing industry in India. The sector's contribution to GDP was at 16.18% at the start of the 1980s, which remained somewhat constant until 1990-91(Delong, 2015).

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Post-1980, there was some stabilization in the Indian political scenario, making the government come up with a pragmatic industrial policy loosening its state controls, showing keenness to import technology and foreign private capital for modernizing the Indian manufacturing sector (Sharma, 2014; Delong, 2015). Liberalization reforms were introduced during 1991 which set the pace for the manufacturing industry in India, through the abolition of industries licensing, and automatic FDI investment of 51% allowed across 35 key and technology-basedsectors, that jumped to 100% during 1997(Jahanshahi et al., 2011). Currently, FDI on MSME industries has been raised to 100% (Rao et al., 2014). During 2014-15, the manufacturing sector contributed 16% to GDP (Sadhana, 2015), while it was 17.4% during the fiscal year 2020 (Dhawan and Sengupta, 2020). For the third quarter of FY 2020-21, the Indian manufacturing sector capacity utilization stood at 66.6%(IBEF, 2021). Thus, the Indian manufacturing sector is on a growth trajectory owing to several reforms introduced over the years.

b) Measures of Manufacturing Project Performance

Project performance impliesdeveloping, implementing, and monitoring projects that aidcompany performance and the development of key strategies. For ensuring the success of future projects, it becomes necessary to implement standard practices. Such frameworks are called project success criteria or project performance measures (Unegbu, Yawas, and Dan-asabe, 2020). Project output measures relate to cost and schedule variables, whereas project outcome measures speak of scope, budget, timelines, and safety-based performance(Digalwar and Sangwan, 2007). A manufacturing key performance indicator (KPI) or metric would help to monitor, analyze and maximize production processes concerning the quantity, quality, and various costs. Manufacturers gain key business insights towards achieving their broader organizational objectives. The traditional method for authenticating the success of a project related to factors of cost, time, and quality; did not consider important stakeholders of the project, so was limiting in scope (Shahu, Pundir, and Ganapathy, 2012).

Today, the global business environment is robust and technology-driven, so it becomes imperative for project managers to be aware of the contemporary challenges in project management. Today, important performance measures for projects across streams like manufacturing are project performance, the satisfaction of the customer, and the success of the project (PMI, 2021). Project performance considers time, cost, and quality performance measures (Sarfo, 2007). Customer satisfaction is now a key criterion for evaluating a project's success, with their satisfaction levels based on timely delivery of projects(Williams et al., 2015). Project success has a strong connection with key project management practices like Scope management, Budget/Cost management, Time management, Risk management, or Stakeholder management(Fraz et al., 2016). Project success measure is also attributed to meeting the needs and expectations of key project stakeholders for performance and functions (Unegbu, Yawas, and Dan-asabe, 2020). Thus, a project performance measure for the manufacturing sector enables efficient plans execution and successful completion.

c) Manufacturing Project Management Strategies

Project management enables a manufacturer to plan every process carefully for delivering the final product; and also keep track of the heavy backend work (Meredith, Shafer, and Mantel, 2021). With changing business dynamics globally, there has been a paradigm shift in managing operations across sectors including manufacturing(PMI, 2021). Information technology/information systems (IT/IS) and outsourcing in managing operations have led to alteration in operations management (OM) strategies, methods, and technologies, with manufacturing operations becoming more service-oriented, including project management (Gunasekaran and Ngai, 2012). The adoption of a lean manufacturing system (LMS) as a key manufacturing project management strategy has led to change in the competitive landscape in India. Cost reduction, better quality products indicating greater performance, wide range of products, qualitative services, get delivered at the same timefor enriching customer value (Upadhye, Deshmukh and Garg, 2013).

KPIs like Scope management, Budget/Cost/Quality management, Time/Risk management, Stakeholder management, HR management, and other project-related KPIs are considered critical indicators for measuring a project's success (Unegbu, Yawas, and Dan-asabe, 2020). Sustainable strategies in project management have also gained greater importance over time. Projects now are designed to deliver sustainable development in organizations and society by bringing in sustainable project performance measures for managing time, budget and quality, social, environmental, and economic impact (Silvius and Schipper, 2014). Hence, Project Management and Manufacturing, both heavily process-oriented, are complementary to each other, thus needing strategies to be properly aligned for their success.

d) Defining Success of Manufacturing Projects

Evolving management sciences have resulted in advanced project management practices, increasing its efficiency making it integral to project success across industries (Unegbu, Yawas, and Dan-asabe, 2020). Project management is thus important for manufacturing companies globally, wherein advanced manufacturing technology (AMT) has a huge role in project success (Slavkovic and Simic, 2020) Indian manufacturing industry has to bring in the latest manufacturing strategies which have economies of cost to gain competitive advantage (Siddique and Ganguly, 2019). The adoption of LMS as a key manufacturing project management strategy has led to change in the competitive landscape in India. Reduced cost, improved quality products with higher performance, an elaborate array of products, qualityservices, are now all being delivered simultaneously for enhancing overall customer value and project success (Upadhye, Deshmukh and Garg, 2013).

Effective leadership; efficient project team; project management tools like budgeting, costing, time management, or quality management; effective communication; learning and development, and engaging stakeholder; are relevant factors for manufacturing project success (Ojha and Venkatesh, 2021). Also, such success relies on elements like efficient allocation of resources, training, knowledge transfer, and agile decisions (Pacagnella et al., 2019). Thus, project managers need to evaluate the influence of different aspects on project management decision-making and implement the same for project success.

e) Empirical review: project management practices impact on project success

According to Gunasekaran and Ngai (2012), changes in project management practices like the use of Information technology/information systems (IT/IS) and outsourcing in managing operations have led to alterations in operations management (OM) strategies, methods, and technologies. This has been made with manufacturing operations including project management. become more service-oriented.

A study by Shanmugapriya and Subramanian (2015) applies a structured equation model (SEM) to highlight the effect of quality performance on construction projects in India. The research findings highlighted the strong impact of leadership on the qualified performance of a project. Altarawneh and Samadi (2019), considered ordinary least squares understanding the link between critical success elements and the project success parameters. The study indicated that human-oriented elements tend to have a huge impact on the success of a project apart from project traits and project environment-related factors. De Carvalho, Patah, and de Souza Bido (2015) in their study investigated the effect of project management on project success via SEM. The factors evaluated were scheduling, cost, and margins. The study implied a strong correlation between training and KPI upskilling with the success of a project.

Badewi, (2016) investigated benefits management (BM) and project management (PM) concept impact on project outcome via SEM testing. Combining these two integrated factors highly influenced project success. Another research by Ojha and Venkatesh (2021) indicates the viability of LMS for the Indian manufacturing industry, through enhancement of plant capacity acrossthe original shop floor area aiding increased product demand from customers. Upadhye, Deshmukh, and Garg (2013) in their research study. have also shown how LMS practice has resulted in shorter product development and manufacturing lead-time, team-oriented organizations, low setup/changeover times, multitasking employees, and a robust supply chain leading to project success (Upadhye, Deshmukh and Garg, 2013). Thus, evolving business environments call for implementing applying project management concepts for the success of a project.

II. METHODOLOGY

a) About Structural Equation Modelling

SEM is a statistical methodology used for representing, predicting, analyzing, and testing various relationships between measured and latent variables (Hair and Sarstedt, 2019). Though a linear statistical model like traditional methods including correlation, regression, and analysis of variance, this technique analyses linear causal relationships among variables and accounts for measurement error at the same time (Tripathi and Jha, 2018). It tests hypothesized patterns of directional and nondirectional relationships among such variables. SEM considers multivariate normality and multiple tests like chi-square, CFI is applied to arrive at the best strategy for the research study, as such SEM is more comprehensive and flexible for testing hypotheses to evaluate relations between observed and latent variables (Xiong, Skitmore and Xia, 2015). The main aims of SEM are to evaluate the correlation/covariance patterns amongst the given set of variables and to explain their variance with the model specified. The SEM approach gives theoretical insight into individual factors which work together to influence the effectiveness of project planning efforts(Tripathi and Jha, 2018). Thus, due to the technical relevance and efficiency of the approach, this study will also consider SEM for evaluating the impact of project management practices on manufacturing project success.

b) Step-wise process followed

As SEM comprises measurement and structural models, the measurement model measures the composite or latent variables, while the structural model is a path-based analysis of hypothetical dependencies. The SEM analysis0020model consists of five steps, first, the model is specified, then identification, the third process is based on estimation of the relationships, in the next step evaluation of the original model is conducted, and finally, modification of the SEM model to improve reliability and stability(Fan et al., 2016). Thus, herein based on the hypothesis, the model would be formulated and with an examination of specified model fitness, the linkage between variables would be assessed.

c) Data type

In this study,the primary method of analysis is selected for the quantitative data gathered from the respondents. The data provides information on the perception of respondents to help examine the role of project management practices in manufacturing projects in India on project performance. The variables considered for representing project success measurement include project performance,customer satisfaction, andproject success are analyzed for a relationship with measures of project success measurement. The measures of project success management comprise the parameters of scope, budget, time, HR, target, benefit, quality, risk, communication, learning, integration, procurement, and stakeholder management.

d) Variables: Project success measurement variables table

Construct	Indicator	Label
Project Performance	Cost performance was always met	PP1
	Quality performance was always met	PP2
	The change order was frequent	PP3
	Scope Changes were frequent	PP4
	The risk of Failure was reduced	PP5
Customer Satisfaction	Customers' expectation was always met	CS1
	Customers were satisfied with project quality	CS2
	Customers were satisfied with the project schedule	CS3
	Customers were satisfied with the service quality of the contractor	CS4
Project Success	Projects were completed as per the timeline	PS1
	Projects were completed within the given budget	PS2
	Project Quality aspects were met	PS3
	Stakeholder satisfaction was met	PS4
	Effective communication criteria were met	PS5

Table 1: Variables for Project success measurement (Unegbu, Yawas and Dan-asabe, 2020)

e) Sample size

Targeting respondents from different manufacturing companies across India, the sample size for the current study is determined using Cochran's formula i.e.

$$n = \frac{z^2 * p * (1 - p)}{e^2}$$

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$n = \frac{1.96^2 * 0.775 * (1-0.225)}{0.05^2} = 267.95 \approx 268$ approx.
wherein,
n: sample size
z: z score value denotes confidence level (is assumed at 1.96 with a confidence level of 95%)
p: population proportion participating in study (0.93 i.e. 93%)
e: margin of error or desired level of precision (is assumed at 0.05)
The current study will survey 268 respondents to understand the perception of full-time and part-time employees, who are working in the manufacturing sector of India.

f) Data Collection Method
For the collection of the data, respondents working in the manufacturing sector were selected through purposive and snowballing methods to reach the target population. Herein, using a close-ended questionnaire, responses of employees are collected using a survey method.

g) Variables: Project Management practices

Factors	Indicator	Labeling
Scope Management(SM)	Does scope management strategy influence SM?	PM1
	Clear definition of scope influenced SM?	PM2
	Validation of scope influenced SM?	PM3
	Work schedule influenced SM?	PM4
	Variance analysis influenced SM?	PM5
	Identification of alternatives influenced SM?	PM6
Budget/Cost management	Cost plan influenced cost performance?	PM7
	Cost estimation influenced cost performance?	PM8
	Budget allocation influenced cost performance? Controlling of costs influenced cost performance?	PM9
	Budgeting constraints influenced cost performance?	PM10
	Monitoring budget influenced cost performance?	PM11
Delivery schedule/Time management	Specifying activities influenced time management?	PM12
	Scheduling activities influenced time management?	PM13
	Controlling schedule influenced time management?	PM14
	Availability of resources influenced time management?	PM15
	Delivery of resources for activities enhanced delivery schedule?	PM16
	Estimating timeline of activities enhanced time mgt?	PM17
HR Management	Organization charts enhanced HRM?	PM18
	Networking enhanced HRM?	PM19
	Scheduling of tasks influenced HRM?	PM20
	Manager’s communication skills impact HRM?	PM21
	Implementing projects via relevant tools influenced HRM	PM22
	Appraisal of project performance influences HRM?	PM23
Target Benefits management (TBM)	Formulating project targets will influence TBM?	PM24
	Reducing operating costs will enhance TBM?	PM25
	Improved project performance will enhance TBM?	PM26
	TBM structuring will influence TBM?	PM27

	Implementing TBM will enhance TBM?	PM28
	Managerial interpersonal skills will enhance TBM?	PM29
Quality management (QM)	Managing quality in project influenced QM?	PM30
	Maintaining quality throughout the project influenced QM?	PM31
	Taking corrective quality management action enhanced QM?	PM32
	Applying advanced quality management tools and techniques enhanced QM?	PM33
	Implementing regular quality checks enhanced QM?	PM34
	Monitoring quality in project influenced QM?	PM35
Risk Management (RM)	Identifying project risk influenced RM?	PM36
	Evaluating project risk influenced RM?	PM37
	Mitigating project risk enhanced RM?	PM38
	Applying advanced risk management tools and techniques enhanced RM?	PM39
	Risk management techniques were effective enhanced RM?	PM40
Communication Management (CM)	Use of Communication technology-enhanced CM?	PM41
	Communication needs assessment to influence CM?	PM42
	Are communication methods and models being effective influenced CM?	PM43
	Information management system enhanced CM? Performance modules influence CM?	PM44
	Leadership and effective communication enhanced CM?	PM45
Learning Management (LM)	Adapting to learning techniques influenced LM?	PM46
	Learning programs influenced LM?	PM47
	Planning learning programs enhanced LM?	PM48
	Integrating learning programs enhanced LM?	PM49
	Configuring learning programs enhanced LM?	PM50
	Implementing a learning management system enhanced LM?	PM51
Integration Management (IM)	Proper Coordination of tasks influenced IM?	PM52
	Proper Coordination between stakeholders enhanced IM?	PM53
	Proper allocation of resources enhanced IM?	PM54
	Proper management of conflicts influenced IM?	PM55
	Coordination between various elements of the project enhanced IM?	PM56
	Coordination between various activities of the project enhanced IM?	PM57
Procurement	Procurement analysis influenced PM?	PM58

Management (PM)	Market research influenced PM?	PM59
	Proposal techniques influenced PM?	PM60
	Procurement performance review influenced PM?	PM61
	Inspections and audits influenced PM?	PM62
	Payment and records management system influenced PM?	PM63
Stakeholder Management(SM)	Stakeholder analysis influenced SM?	PM64
	Planning Stakeholder management with requisite tools influenced SM?	PM65
	Delivery of Project influenced SM?	PM66
	Communication methods were appropriate? Communications skills influenced SM?	PM67
	Information management systems influenced SM?	PM68

Table 2: Project Management practices variables(Unegbu, Yawas and Dan-asabe, 2020)

h) Questionnaire format

The responses are captured using a close-ended questionnaire that is designed to capture demographic information. Further, the questionnaire collects inferential information measuring the respective variables' linkage. This is done by asking for the perception of the employees on parameters of project success measurement and project management practices. Herein, the Likert scale of 1 – 5 is used (1 representing strongly disagree to 5 representing strongly agree).

i) Data analysis method

The responses thus gathered are examined using frequency analysis for the demographic data. Also, the inferential analysis is done using SPSS Amos software. In the first step, proposed relationships among the variables are specified in the SEM model specification based on the hypothesis of the study. In the second step, model identification is conducted. In the next step, parameter estimation is done for the just or over-identified models. The proposed model is evaluated based on testing of the quantitative indices. This allows the researcher to understand the model's overall goodness of fit. In this study, the goodness of fit is determined using the Cronbach alpha test. The tests ensure that the results derived would be valid, ethical, and reliable. In the last step, the final, model is modified, toenhance reliability and stability of the model.

III. DATA ANALYSIS

The demographic and inferential analysis is conducted on the data gathered from the 268 respondents. The findings from the analysis are presented in the study below:

a) Demographic Analysis

To shed light on the characteristic of the sample surveyed for the study, a demographic analysis of the population is conducted. These include the parameters of age, gender, employment type, experience, and income of the respondent. Findings of the same areshown with the help of the frequency chart below

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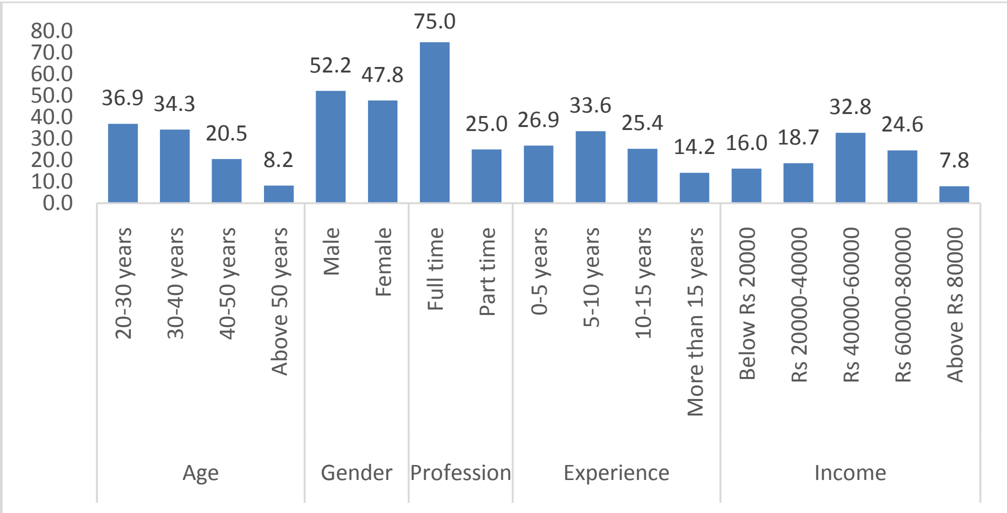

Figure 1 Demographic analysis based on age, gender, profession type, experience, and income

Based on the age of the employees, it was found that maximum employees are of the age group 20-30 years 36.9%, followed by those of 30-40 years 34.3%, 20.5% in the age group 20.5%, and least 8.2% above 50 years. Male respondents comprise the higher population of respondents surveyed making a total of 52.2%, while 47.8% are female. On the nature of employment of the survey population, 75% are employed full time, while 25% are part-time employed. Based on the experience, maximum respondents have been employed for 5-10 years comprising 33.6% of the population, followed by those employed for 0-5 years26.9%, 25.4% have been working in the manufacturing segment for 10-15 years, and least or 14.2% have been on the job for more than 15 years. Further, on the grounds of income level, maximum employees earn Rs 40000-60000 32.8%, those earning between Rs 60000-80000 are 24.6%, between Rs 20000-40000 are 18.7%, those earning below Rs 20000 is 16%, and least of the respondent earn above Rs 80000 of 7.8%. Thus, the demographic survey findings show that the sample contains the highest numbers of malessurvey participants, between the age group of 20-30 years, full time employed, have experience of minimumof 5years, and earn between Rs. 40,000 to 60,000.

b) Inferential Analysis

For analysis, the data accumulated using a close-ended questionnaire is put to inferentialanalysis. In this study, the inferential analysis is done using SEM. This will allow the researcher to ascertain the linkage between project success measurement variables and project management practices on the project performance of manufacturing. Based on these linkages, an effective model is built to ascertain path-based values of the coded statements for the selected variables of project performance in the manufacturing sector in India and project success measures. The project success measurement constructs chosen in this study include project performance,customer satisfaction, andproject success. Also, the constructs forproject management practices include the variable of management of scope, budget, time, HR, target, benefit, quality, risk, communication, learning, integration, procurement, and stakeholder. A path-based analysis is built using the latent variables of project success measurement and project management practices and their respective components on the project performance of manufacturing projects. The initial path diagram developed using SEM analysis for the current study is depicted in the figure below:

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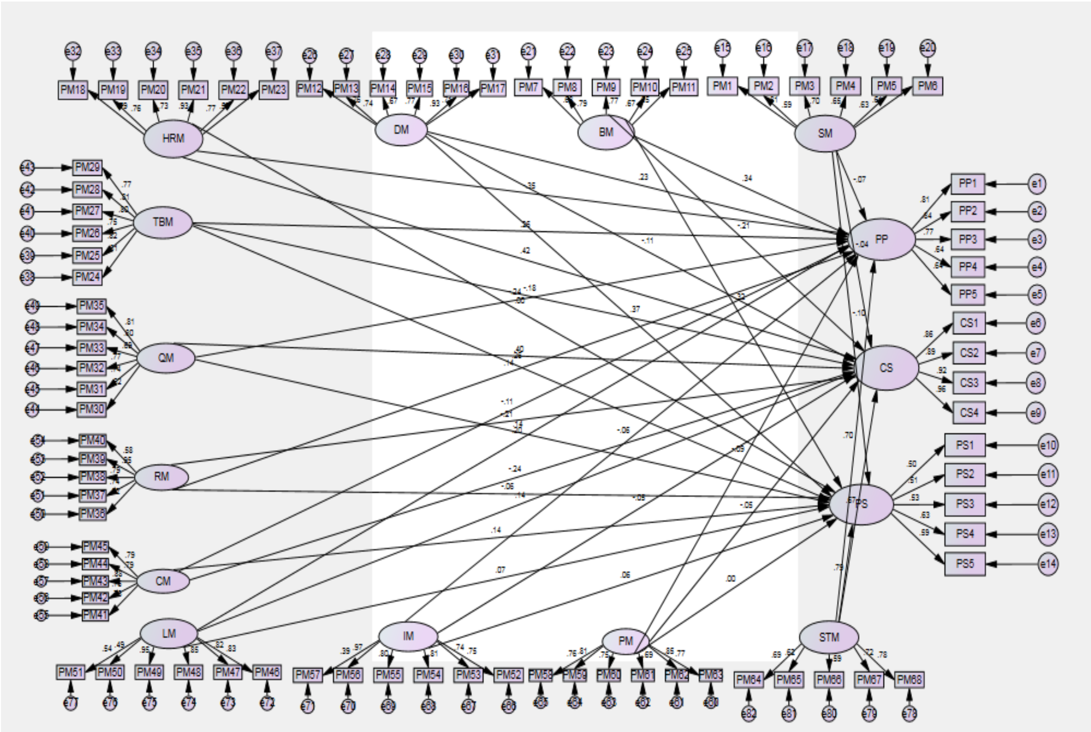

Figure 2 Initial Path Diagram

The initial path diagram shown in figure 2 specifies the linkage between the constructs under study. The linkages between the variables of project management practices and performance in manufacturing are determined. Herein, the model is developed to find linkages between 14 measures of project success. These are grouped into three constructs (PP, CS, and PS). Also, for project management's performance measures 12 constructs (SM, BM, DM, HRM, TBM, QM, RM, CM, LM, PM, STM, PP, CS, and PS) are used to group 68 related variables. The following null hypotheses will be tested at the 5% level of significance wherein the z-value of the model would be 1.96.i.e.

H_{01}: Scope management has a significant effect on the performanceof the manufacturing project

H_{02}: Scope management has a significant effect on the satisfaction of the customer

H_{03}: Scope management has a significant effect on project success

H_{04}: Budget management has a significant effect on project performance

H_{05}: Budget management has a significant effect on customer satisfaction

H_{06}: Budget management has a significant effect on project success

H_{07}: Delivery management has a significant effect on project performance

H_{08}: Delivery management has a significant effect on customer satisfaction

H_{09}: Delivery management has a significant effect on project success

H_{10}: Human resource management has a significant effect on project performance

H_{11}: Human resource management has a significant effect on customer satisfaction

H_{12}: Human resource management has a significant effect on project success

H_{13}: Target benefits management has a significant effect on project performance

H_{14}: Target benefits management has a significant effect on customer satisfaction

H_{15}: Target benefits management has a significant effect on project success

H_{16}: Management of quality has a significant effect on project performance

H_{17}: Quality management has a significant effect on customer satisfaction

H_{18}: Quality management has a significant effect on project success

H_{19}: Risk management has a significant effect on project performance

H_{20}: Risk management has a significant effect on customer satisfaction

H_{21}: Risk management has a significant effect on project success

H_{22}: Communication management has a significant effect on project performance

H_{23}: Communication management has a significant effect on customer satisfaction

H_{24}: Communication management has a significant effect on project success
H_{25}: Learning management has a significant effect on project performance
H_{26}: Learning management has a significant effect on customer satisfaction
H_{27}: Learning management has a significant effect on project success
H_{28}: Integration management has a significant effect on project performance
H_{29}: Integration management has a significant effect on customer satisfaction
H_{30}: Integration management has a significant effect on the success of the manufacturing project
H_{31}: Procurementmanagement has a significant effect on the performanceof the manufacturing project
H_{32}: Procurement management has a significant effect on the satisfactionof the customer
H_{33}: Procurement management has a significant effect on project success
H_{34}: Stakeholder management has a significant effect on project performance
H_{35}: Stakeholder management has a significant effect on customer satisfaction
H_{36}: Stakeholder management has a significant effect on the success of the manufacturing project

For the above hypotheses, the relationships derived are presented in the path diagram in Fig. 2. These will facilitate the model assessment in the study further. The syntax used for the model is as follows.

Latent Variables PP CS PS SM BM DM HRM TBM QM RM CM LM IM PM STM
Relationships
PP = PP CS PS SM BM DM HRM TBM QM RM CM LM IM PM STM
CS = PP CS PS SM BM DM HRM TBM QM RM CM LM IM PM STM
PS = PP CS PS SM BM DM HRM TBM QM RM CM LM IM PM STM
PP1-PP5 = PP
CS1-CS4 = CS
PS1-PS5 = PS
PM1-PM6 = SM
PM8-PM11 = BM
PM12-PM17 = DM
PM18-PM23 = HRM
PM24-PM29 = TBM
PM30-PM35 = QM
PM36-PM40 = RM
PM41-PM45 = SM
PM46-PM51 = LM
PM52-PM57 = IM
PM58-PM63 = PM
PM64-PM68 = STM
Path Diagram
End of Problem

IV. RESULTS

This section works towards presenting the findings of the study. Herein, the responses, preliminary analysis, impact of practices on project success, and SEM model developed is presented.

a) Responses

A total of 268 valid responses were gathered in the present study. The demography of the surveyed population shows that maximum respondents were employed full-time (75%) and have experience of atleast five years (73.2%), which is an important aspect representing the background of the respondents' experience with project management. According to Unegbu et al., (2020), professionals with work experience in the domain of project management are targeted for a better response to questions on manufacturing project management.

b) Preliminary analysis

Preliminary statistical tests for the data collectedare done in the study. In this, the reliability and validity of the variables are measured. Herein, the reliability analysis is done using Cronbach's alpha tests. The results are depicted in tabular form below.

Constructs	Cronbach's Alpha	CR	AVE
SM	0.82	0.68	0.58
BM	0.83	0.72	0.66
DM	0.88	0.84	0.69
HRM	0.88	0.83	0.66
TBM	0.91	0.87	0.70
QM	0.88	0.81	0.65

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RM	0.88	0.83	0.67
CM	0.90	0.85	0.70
LM	0.89	0.83	0.68
IM	0.88	0.87	0.72
PM	0.90	0.83	0.66
STM	0.83	0.73	0.60
PP	0.85	0.77	0.60
CS	0.83	0.87	0.76
PS	0.88	0.80	0.69

Table 3 Reliability and Validity Test for the model

The table above shows that all constructs were found to have Cronbach alpha valuesgreater than 0.7. As the constructs have values of more than 0.7, there is reliability and consistency in the construct and related variables. The tests further show that values of AVE and CRfor all the have values greater than 0.5. Hence, the entire construct is included from the model for SEM.

c) Impact of Practices on Project Success

The result for SEM analysis is shown in Figure 2, to examine good performance based on the terms of the goodness of fit. The experimental model is modified based on the goodness of fit and low factor constructs are deleted if any. Based on the model fit parameters the final model will be developed. This is done by validating or recommending changes in the hypotheses based on the strength of p-values(Unegbu, Yawas and Dan-asabe, 2020).

d) SEM Model and table

Having derived the efficiency of constructs selected in the SEM model, its adequacy is examined. This is done bythe calculation of the model fit. It is because most of the indices in the proposed model may have too many biases. This makes it difficult to judge if the indices are a useful part of the proposed model or not. The adequacy of the original model is checked in the present study by using fitness indices. The results are shown in a tabular form below.

Sr. No.	Index	Value of the Measurement Model	Recommended Value
1	CMIN/DF	3.765	≤ 5
2	TLI	0.558	Between 0 and 1 (closer to 1)
3	PNFI	0.482	≥.50
4	PCFI	0.553	≥.50
5	RMSEA	0.102	≤.10

Table 4:Original model fitness examination

The value measurement model based on the recommended values shows that all indices of fitness are not derived as the actual value differs from the recommended value. For, CMIN/Df (normed/relative Chi-Square) value is 3.765. For a reasonably fit model the value of CMIN/Df should beless than 5, TLI (Tucker Lewis index) value is 0.558, is closer to 0 rather than the required value of 1. PNFI (Parsimony normed fit Index) has a value of 0.482, while the requirement is more than 0.50, PCFI (Parsimony comparative fit index) has a value of 0.553. The index is close to its recommended value of more than 0.50, and the RMSEA (root mean square of approximation) value was derived at 0.102, which is more than the required value of 0.10. For the original model, the values of TLI, PNFI, and RMSEA do not achieve the required criteria. Thus, it can be said that the model is not satisfactory and modification is required for the derivation of an efficient model.

V. DISCUSSION

This section will present the modified SEM model with the examination of its goodness of fit. Further, the hypothesis results are presented in the section.

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a) Modified SEM model & goodness of fit

The modified SEM table is presented below. It is derived by modifying the original model with the help of a modification index. The covariance is established error terms is established for the derivation of a new model.

Sr. No.	Index	Value of the Measurement Model	Recommended Value
1	CMIN/DF	3.478	≤ 5
2	TLI	0.604	Between 0 and 1 (closer to 1)
3	PNFI	0.517	≥.50
4	PCFI	0.592	≥.50
5	RMSEA	0.096	≤.10

Table 5Final model fitness examination

The examination of the final model is conducted to check if the value of fitness indices is close to the recommended value. The values for fitness index CMIN/Df (normed/relative Chi-Square) for the final model is 3.478 which is less than the reasonably fit value of 5., PNFI (Parsimony normal fit index) value derived is 0.517, this is more than the required value of 0.50, PCFI (Parsimony comparative fit index) has the value of 0.592, this is more than the requirement of 0.50, and RMSEA (root mean square of approximation) has the value of 0.096 although the value is less than 0.10. TLI (Tucker Lewis index) value for the SEM model is though 0.604, which is not very highbut still the value is close to 1 and far from 0 and is considered to satisfy the requirement, based on the finding of Kumeto Jönköping, (2015). Based on these values, fitness is derived for the final model, and linkages are derived for variables of project success measurement and project management practices for manufacturing projects in India.

b) Hypothesis results

The linkage between the parameters is obtained for the measures of constructs of performance measures and success measures in manufacturing projects in India. The proposed hypothesis is tested and the results of the analysis for the above hypothesis is shown in the below table

Hypothesis	Dependent Variable	Independent Variable	Estimate	S.E.	C.R. (z-value)	p (sig) value
H_{01}	Project performance	Scope management	-0.02	0.05	-0.49	0.63
H_{02}	Customer Satisfaction	Scope management	0.00	0.04	0.06	0.95
H_{03}	Project Success	Scope management	-0.07	0.03	-1.87	0.06
H_{04}	Project performance	Budget Management	0.52	0.07	7.19	0.00
H_{05}	Customer Satisfaction	Budget Management	-0.32	0.06	-5.48	0.00
H_{06}	Project Success	Budget Management	0.28	0.05	5.14	0.00

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H_{07}	Project performance	Delivery Management	0.24	0.04	5.73	0.00
H_{08}	Customer Satisfaction	Delivery Management	-0.19	0.04	-5.06	0.00
H_{09}	Project Success	Delivery Management	0.22	0.04	5.70	0.00
H_{10}	Project performance	HR Management	-0.28	0.04	-6.72	0.00
H_{11}	Customer Satisfaction	HR Management	0.56	0.05	11.40	0.00
H_{12}	Project Success	HR Management	0.02	0.03	0.62	0.54
H_{13}	Project performance	Target Benefit Management	0.23	0.04	5.59	0.00
H_{14}	Customer Satisfaction	Target Benefit Management	-0.26	0.04	-6.71	0.00
H_{15}	Project Success	Target Benefit Management	0.11	0.03	3.54	0.00
H_{16}	Project performance	Quality Management	-0.29	0.06	-4.69	0.00
H_{17}	Customer Satisfaction	Quality Management	0.43	0.06	6.64	0.00
H_{18}	Project Success	Quality Management	0.09	0.04	2.14	0.03
H_{19}	Project performance	Risk Management	0.10	0.04	2.84	0.00
H_{20}	Customer Satisfaction	Risk Management	-0.10	0.03	-3.05	0.00
H_{21}	Project Success	Risk Management	-0.01	0.03	-0.41	0.68
H_{22}	Project performance	Communication Management	0.08	0.04	1.98	0.05
H_{23}	Customer Satisfaction	Communication Management	-0.32	0.04	-7.69	0.00
H_{24}	Project Success	Communication Management	0.18	0.04	4.93	0.00

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H_{25}	Project performance	Learning Management	0.10	0.04	2.54	0.01
H_{26}	Customer Satisfaction	Learning Management	0.20	0.04	5.17	0.00
H_{27}	Project Success	Learning Management	-0.05	0.03	-1.85	0.07
H_{28}	Project performance	Integration Management	-0.04	0.04	-1.08	0.28
H_{29}	Customer Satisfaction	Integration Management	-0.07	0.04	-1.87	0.06
H_{30}	Project Success	Integration Management	0.04	0.03	1.22	0.22
H_{31}	Project performance	Procurement Management	0.03	0.04	0.74	0.46
H_{32}	Customer Satisfaction	Procurement Management	0.19	0.04	4.76	0.00
H_{33}	Project Success	Procurement Management	0.12	0.03	3.75	0.00
H_{34}	Project performance	Stakeholder Management	0.69	0.06	10.82	0.00
H_{35}	Customer Satisfaction	Stakeholder Management	0.99	0.07	13.48	0.00
H_{36}	Project Success	Stakeholder Management	0.41	0.06	6.94	0.00

Table 6 Estimation results for hypotheses

In the table depicting estimation results for hypotheses, the values of standard error for various linkages is close to 0.05. As this value is very low, the level of biasness in the results computed is found to be low. Also, based on the p-value,ahypothesis whose p-value is more than 0.05 is not rejected. Based on the table above, relationships are validated (hypothesis of no linkage is rejected) and not considered in the SEM. The findings are presented in the table below

Hypothesis	Validated	Not considered
H_{01}		Yes
H_{02}		Yes
H_{03}		Yes
H_{04}	Yes	
H_{05}	Yes	

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H_{06}	Yes	
H_{07}	Yes	
H_{08}	Yes	
H_{09}	Yes	
H_{10}	Yes	
H_{11}	Yes	
H_{12}		Yes
H_{13}	Yes	
H_{14}	Yes	
H_{15}	Yes	
H_{16}	Yes	
H_{17}	Yes	
H_{18}	Yes	
H_{19}	Yes	
H_{20}	Yes	
H_{21}		Yes
H_{22}		Yes
H_{23}	Yes	
H_{24}	Yes	
H_{25}	Yes	
H_{26}	Yes	
H_{27}		Yes
H_{28}		Yes
H_{29}		Yes
H_{30}		Yes
H_{31}		Yes
H_{32}	Yes	
H_{33}	Yes	
H_{34}	Yes	
H_{35}	Yes	
H_{36}	Yes	

Table 7 Hypotheses Validated and Rejected

The table above reveals the relationships between the variables that are validated and rejected based on the analysis of hypotheses in the derived SEM model. Out of the 36 hypotheses, 11 are accepted with no influence of respective variables, and 25 are validatedwith the presence of respective component influence. The first three hypotheses (H_{01}, H_{02}, andH_{03})are not considered in the SEM model. This suggests scope management was not found to significantly impact all three parameters of project success measurement, including project performance, customer satisfaction, and project success. Based on an analysis of hypotheses fora budget management role, hypotheses H_{04}, H_{05}, and H_{06} werevalidated. This shows that the null hypothesis of no relationship is rejected. Hence it was found that budget management impacts all project performance variables i.e. project performance (0.52), customer satisfaction (-0.32), and project success (0.28). Further, hypotheses H_{07},H_{08},and H_{09}confirm delivery management's role in the success of a manufacturing project. This indicates a positive relationship between the role of delivery management in influencing project performance (0.24),customer satisfaction (-0.19), and project success (0.22).

Human resource management was found to influence only project performance (-0.28) andcustomersatisfaction(0.56) in the SEM model, as hypotheses H_{10} and H_{11} are validated. While H_{12}wasnot considered and the null hypothesis of human resource management has no significant effect on project success is accepted. In the SEM model, with regards to the role of target benefits on project success variables, the hypothesis of H_{13}, H_{14}, and H_{15} are validated. Thus, this signifies that target benefits management has a significant effect on project performance (0.23), customer satisfaction (-0.26), and project success (0.11) measures were confirmed. Similarly, concerning quality management impact on project success variables, the null hypotheses H_{16},H_{17},and H_{18} are rejected. The validation of the alternate hypotheses, thus suggests quality management is imperative for project performance (-0.29),customer satisfaction (0.43),and project success (0.09). Risk management hypotheses H_{19} andH_{20} are validated. This suggests that the measures of risk management have a significant effect on project performance (0.10) and customer satisfaction (-0.10). However, the null for H_{21} was accepted denoting risk management has no significant effect on project success.

Similarly, for the parameter of communication management, hypothesis $H_{22}$is not considered and hence null hypothesis $H_{22}$is accepted indicating communication management has no significant effect on project performance. For communication management, the hypothesis H_{23} and H_{24} in the model was validated for a significant effect on customer satisfaction (-0.32) and project success (0.18). Regarding the learning management role in the success of projects, it was found that hypotheses H_{25} and H_{26},are validated. This highlights that learning management has a significant role to play in impacting project performance (0.10) and customer satisfaction (0.20). However, with the not consideration of H_{27}, the role of learning management in project success was not found to be significant. However, the impact of integration management was found not to be significant for project performance, customer satisfaction, and project success with the acceptance of null hypotheses H_{28}, H_{29}, and H_{30}. Also, hypothesis H_{31} is not consideredwhich denotes acceptance of the null hypothesis or procurement management having no impact on the project performance. Validation of H_{32} and H_{33} represent thatcustomer satisfaction (0.19) and project success (0.12) are significantly impacted by procurement management.Finally, the H_{34}, H_{35}, and H_{36} denoting the role of stakeholder management on project performance, customer satisfaction, and project success validated. This suggests that a significant role played by stakeholder management on the parameters of project performance (0.69), customer satisfaction (0.99), and project success (0.41). Hence, project management practices have a role in influencing manufacturing project performances.

VI. CONCLUSION

Manufacturing projects are exposed to a range of variables with the changing business dynamics globally and the paradigm shift that keeps happening in managing operations across sectors including manufacturing. Also, these variables influence the success of project management in relationship with each other. A total of 14 measures of performance in the manufacturing industries in India is drawn from literature and grouped under three constructs of project performance (PP), customer satisfaction (CS), and project success (PS); and 68 project management practices grouped under 12 constructs of scope management (SM), budget management (BM), delivery management (DM), human resource management (HRM), target benefits management (TBM), quality management (QM), risk management (RM), communication management (CM), learning management (LM), integration management (IM) procurement management (PM), and stakeholder management (STM). The data collected from 268 respondents are analyzed using 36 hypotheses developed for the SEM model. Altogether, 25 out of the 36 hypotheses were validated with a p-valueless than 0.05. The validated hypotheses indicate the existence of relationships among the project management practices (budget, delivery, HRM, target, quality, risk, communication, learning, procurement, and stakeholder management) and the project success measures. Thus the study recommends

- Manufacturing firm management is exposed to an array of relationships based on strategies of project management and project success. There is aneed to recognize this relationship management properly. This will allow the firms and their project management team manage their projects efficiently.
- Apart from practicing best project management practices among the firms in the manufacturing industry in India. The understanding of the underlying relationships between project management practices and the project success measures will allow the enhancement of project performance of manufacturing projects in India.
- The findings of the study suggest that it is imperative to understand the variables impacting project outcomes independently as well as together in a relationship. The management of the manufacturing companies needs to identify the right resources to positively impact the implementation of the projects.
- Estimating the nature of relationships between the constructs of manufacturing project success constantly is a must. These assessments should be carried out for different projects to enhance the utilization of resources in the manufacturing projects.

With theresults of the research presented alongwith recommendations based on them, it is important to report on the limitations of this study. The current study due to the limitation of time and resources has a limited sample size of 268 respondents only. These respondents were selected using the purposive sampling method of snowballing. For generalization of the results of the findings from this study, a higher representative sample needs to be analyzed. In addition, this research study centered on manufacturing projects executed in India. This focused approach may lead to bias in the findings of the study.This poses a limitation to the study and prevents the generalization of the findings. Furthermore, the current study is based on a quantitative analysis of data gathered.,A qualitative analysis of data would allow the researcher to inspect the role of project management practices on the performance of manufacturing projects in India.

Recognizing the challenges met during this study in terms of limited sample size and area of the study, future studies can be conducted with a higher number of respondents. In addition, for future endeavors, survey respondents from different countries can also be included in the survey. This will allow comparative research findings on the role of project management practices in developed vs. developing economies. These inclusions will allow the researcher to generalize the findings derived from the study. To address the issue of bias, the random sampling method can be adopted in future studies. This will allow the researcher to attain results without any bias. Further endeavors can also be taken to quantitatively analyze the role of project performance in manufacturing companies in India. This will allow the researcher to understand in depth the perception of the respondents working in manufacturing projects. Studies can also be taken up for the identification of critical success factors for project performance measures in the manufacturing industry in India.

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