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EFFECTS OF INNOVATION ON NEW PRODUCT DEVELOPMENT IN INDIAN AUTOMOBILE INDUSTRY: AN EMPRICAL APPROACH

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ABSTRACT

Aim of Study: *The aim of study is to explore the Innovations in New Product Development in Indian Automobile Manufacturing Industry and an Empirical Investigation of Innovations in NPD in Indian Automobile Manufacturing Industry.*

Scope of the Study

The integration of innovation along with NPD process is particularly an under-researched subject in the overall NPD research field. Most of the manufacturing organizations strongly believe that more emphasis on NPD is required due to rapidly growing technology and increased global competition.

Research Objectives

The broad objectives of study are to explore the Innovations in New Product Development in Indian Automobile Manufacturing Industry and an Empirical Investigation of Innovations in NPD in Indian Automobile Manufacturing Industry.

Research Methodology

In order to reach the desired objectives of the study, a step by step scientific research procedure was adopted. In the first step, the research articles published in the period of 10 years were selected starting from the year 2004 – 2014 and on the basis of these published articles 80 constructs or the Innovations in NPD were identified and considered for the study. A self-constructed well-structured questionnaire is used for the collection of data. It is designed in such a manner to explore the general opinion about the Innovations in NPD in Indian Automobile Manufacturing Industry. Simple random sampling technique was used to gather data from the respondents, because of which respondents diverged from various automobile manufacturing organizations in India. IBM SPSS 20 (Statistical Package for the Social Sciences) and Amos 4.0 was used for data analysis.

Key Words: Automobile Industry, Innovation, New Product Development.

I. INTRODUCTION

Improving and updating products is an ongoing task as consumer needs and wants continuously change. A failure to develop products could result in a reduction in sales if consumers decide to buy competitor products. Developing a new product shouldn't feel like you're fighting in the dark. There's an easier way. What you need is a structured road-map that gives your business a clear path to follow.Actually developing the tangible product

or service is only a small part of the new product development process, which includes the complete journey from generating the initial idea to bringing the product to market.The development of a product will start with the concept. The rest of the process will ensure that ideas are tested for their viability, so in the beginning all ideas are good ideas (To a certain extent!). Ideas can, and will come, from many different directions. The best place to start is with a SWOT analysis, (Strengths, Weaknesses, Opportunities and Threats), which incorporates current market trends. To create the next product in a company's product line a design team goes through product development process steps. Starting with a product idea, the team moves through several stages to generate all the details and documents needed to get the product built. A new product development (NPD) process goes through the same steps, however as this product has not been developed by the team before, new risks and uncertainties are introduced and often additional information is documented and shared with manufacturing.

a. INNOVATION AND NPD

The link between successful innovation and the ability to focus on customer needs is clear.Leading manufacturers demonstrate a strong ability to get closer to their market needs and togenerate, understand and evaluate ideas.Innovation and product development require a combination of creativity and scientific analysis. Some companies have great new product concepts but struggle to put them into the marketplace; others have an efficient process for commercialization but struggle to find their next big idea. Achieving a combination of inspiration and execution is difficult.New products and services should be a valuable path to growth, but with over 80 per cent of launches failing, a new approach is needed.For any organization NPD innovation is a competitive advantage and is considered important to become successful in the current highly competitive environment. NPD innovation also has become a necessity in order to meet the expectations of the customers.Innovativeness is often referred to a measure of the degree of newness in an innovation. An invention is a new idea or technology that is assumed to be utilized for developing a tangible outcome, such as a product or a system. An innovation is the conversion of an invention into revenues and profits in the market. An idea that looks like a great invention in the laboratory may terribly fail in the market and vice versa.

II. REVIEW OF LITERATURE

Research, over the last 50 years, has consistently linked innovation with business success. Innovation is shown as a major contributory factor in the growth of firms **(Mansfield, 1968, 1971)**; new products and processes, the fastest growing product groups or 'clusters' **(Freeman, 1974)**; rise and dominance of large corporations ascribed to the use of new technology **(Temin, 1979)**; better business performance related to the higher measures of innovation **(Cavanagh and Clifford, 1983)**; levels of competitiveness linked with the levels of innovativeness **(Dosi, 1988);** firms using innovation to differentiate their products from competitors, *twice* as profitable **(Pavitt, 1991);** innovation a key element of business success **(Nonaka and Takeuchi, 1995);** high growth companies getting a higher percentage of sales from new products relative to competitors, **(O'Gorman, 1997);** new product development leading to greater sales volume and enhanced profitability **(Kotler, 1999);** innovating firms having lower probability of stagnant or declining employment in comparison to non-innovating firms **(Frenz*et al*, 2003)** and innovative businesses growing more than non-innovative businesses **(European Commission, 2004).**

Shenet. al. (2000)argued that the IPD process requires an understanding of continuously changing customer wants and needs, and proposed an integrated approach to IPD using Kano's model and quality function deployment (QFD).**Shehab and Abdalla (2002)** proposed IPD system which comprises a computer aided design (CAD), a material selection module, a knowledge-based system, a process optimization module, a design for assembly module, a cost estimation module and a user interface. **Hsiao and Chou (2004)** considered innovative product design equivalent to a creativity-based design process which is the integration of creativity method and systematic design approaches. **Hajime et. al. (2002; 2005)** proposed that systematic integration of QFD with TRIZ enables the effective and systematic creation of technical innovation for new products and named it as innovative product development process.

New product development (NPD) is recognized as one of the most critical areas of firm's competence related to business success **(Guo, 2008).** Product Development & Management Association (PDMA) best practices surveys **(Barczak et. al. 2009)** concluded that, although firms had implemented a number of new methods and techniques to improve the way new products were developed, new product success rates continue to be remain stable at around 60%.

Montoya and Calantone, (1994) concluded that new product performance literature content, research methodology, data set characteristics and variable operations are highly diverse and research on new product performance is not highly consistent in terms of which factors are to be included in each study and which statistics are to be reported. On the other hand **Henard and Szymanski (2001)** discussed about significant and non-significant drivers of performance, dominant drivers of performance, breadth of performance drivers and prior emphasis in performance modeling and concluded that giving more emphasis on market place, strategy, and product characteristics than process characteristics is more appropriate for augmenting success levels. **Pattikawaet. al. (2006)** reviewed new product performance research at the project level by investigating the variables associated with new product project performance.

III. OBJECTIVES OF STUDY

The broad objectives of study are as follows:-

(1) To Explore the Innovations in New Product Development (NPD) in Indian Automobile Manufacturing Industry.

(2) To Empirically Investigatethe Innovations in NPD in Indian Automobile Manufacturing Industry.

a. HYPOTHESES OF STUDY

The following Hypotheses were formulated as follows:-

Here HO represents Null Hypothesis and HA represents Alternative Hypothesis.

Hypothesis 1:-

H01: There is no significant relationship between NPDInnovations and NPD performance in automobile industry.

HA1: There is a significant relationship between NPD Innovations and NPD performance in automobile industry.

Hypothesis 1.1:-

H01.1: There is no significant relationship between productInnovations and NPD performance in automobile industry.

HA1.1: There is a significant relationship between product Innovations and NPD performance in automobile industry.

Hypothesis 1.2:-

H01.2: There is no significant relationship between Procedural Innovations and NPD performance in automobile industry.

HA1.2: There is a significant relationship between Procedural Innovations and NPD performance in automobile industry.

Hypothesis 1.3:-

H01.3: There is no significant relationship between Marketing Innovations and NPD performance in automobile industry.

HA1.3: There is a significant relationship between Marketing Innovations and NPD performance in automobile industry.

Hypothesis 1.4:-

H01.4: There is no significant relationship between Servicing Innovations and NPD performance in automobile industry.

HA1.4: There is a significant relationship between Servicing Innovations and NPD performance in automobile industry.

Hypothesis 1.5:-

H01.5: There is no significant relationship between Attitudinal Innovations and NPD performance in automobile industry.

HA1.5: There is a significant relationship between Attitudinal Innovations and NPD performance in automobile industry.

Hypothesis 1.6:-

H01.6: There is no significant relationship between Quality and Technology Innovations and NPD performance in automobile industry.

HA1.6: There is a significant relationship between Quality and Technology Innovations and NPD performance in automobile industry.

b. STUDY MODEL

On the basis of above objectives and hypothesis, a study model has been formed which is shown as under: -

Fig. 1: Study Model

IV. RESEARCH DESIGN

As the study is explorative in nature so in order to reach the desired objectives of the study, a step by step scientific research procedure was adopted. In the first step, the research articles published in the period of 10 years were selected starting from the year 2004 to 2014 and on the basis of these published articles 80 constructs or the Innovations in NPD were identified and considered for the study.

a. About the Questionnaire

A self-constructed well-structured questionnaire is used for the collection of data. It is designed in such a manner to explore the general opinion about the Innovations in NPD in Indian Automobile Manufacturing Industry. The questionnaire was divided into two parts: First part contains questions related to the basic back ground information about industry and respondents which includes performance measures of NPDetc. Second part of the questionnaire is for NPD innovation in an organization, which includes 80 items that are generated from the identified constructs. The questionnaire was developed on five point Likert's scale (1- Not important, 2- Less Important, 3- Important, 4- More Important and 5-Most Important) from Not Important to Most Important.

b. Sources of Data

As far as the research gap is concerned to explore the factors of NPD innovations in automobile manufacturing industry. The researchers have used primary data through self-constructed structured Questionnaire and as far as the secondary data is concerned that was obtained from various reports web sites, and journals etc. to explore the various Innovations in NPD in the Indian automobile manufacturing industry. The target population for collecting the data was Managers, Directors and CEOs of 50Indian automobile manufacturing industries.The automobile sector includes those companies which produce light and heavy duty vehicles and their spares.

c. Data Collection Technique

A cross–sectional study using survey research is performed on automobile manufacturing industry. The database was extracted from Society of Indian Automobile Manufacturers (SIAM) which consists of 48 companies and Confederation of Indian Industries (CII). Online method using SurveyMonkey, Google Forms, a survey software & questionnaire tool which enables to create own surveys quickly and easily has been used.A total of 178 completed questionnaires together are received from both by hand and online response of Managers, Directors and CEOs of 50 Indian automobile manufacturing industries.

d. Sampling Technique

Simple random sampling technique was used to gather data from the respondents, because of which respondents diverged from various automobile manufacturing organizations in India.

e. Statistical Tools Used

IBM SPSS 20 (Statistical Package for the Social Sciences) and Amos 4.0 was used for data analysis.

V. DATA ANALYSIS AND INTERPRETATION

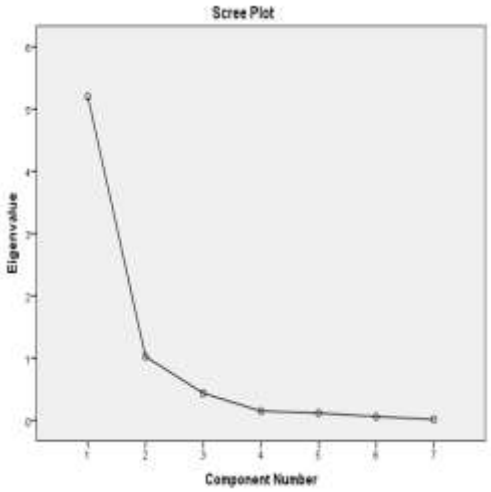
Principal component analysis is carried out on all the 80 underlying elements of innovations in NPD as this is done to analyze the interrelationship among a large number of variables. If we analyze in our study, it is observed that the subject to variable ratio is more than 3:1 which makes the PCA to implement favorably. Table 1 shows the eigenvalue of different components extracted from the varimax analysis in which the eigen value must be greater than unity as per the Kaiser's criteria.

Table 1: Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	32.428	41.605	41.605	32.428	41.605	41.605	21.805	27.976	27.976
2	13.024	16.709	58.314	13.024	16.709	58.314	6.021	7.725	35.701
3	12.436	15.955	74.269	12.436	15.955	74.269	21.285	27.308	63.009
4	6.148	7.888	82.157	6.148	7.888	82.157	9.462	12.140	75.149
5	3.118	4.000	86.157	3.118	4.000	86.157	5.267	6.758	81.907
6	3.059	3.925	90.082	3.059	3.925	90.082	6.363	8.163	90.069
7	1.016	1.304	91.386	1.016	1.304	91.386	1.026	1.316	91.386

Extraction Method: Principal Component Analysis.

Kaiser's criterion is considered to be good for number of variables between 20 to 50 (Hair et al., 2006), hence in our case scree plot is generated to identify the underline elements. The scree plot shown in Figure 1 identifies the break between the components with relatively large eigenvalues and those with small eigenvalues at the seventh component.



The underlying elements could be categorized as Innovations in Product, Procedural Innovations, Marketing innovations, servicing innovations, attitudinalinnovation and Quality and Technologyinnovations. All elements met the first three interpretability criteria. To verify the simple structure criteria, it is required that most of the variables have relatively high factor loadings (above 0.4) on only one component and near zero loadings on the other components and most components have relatively high factor loadings for some variables and near zero loadings for the remaining variables. To achieve this factor loading (from rotated component matrix) of variables above 0.4 are assigned less than one element by removing the variables which has meaningful loading on more than one element. If communalities are high, recovery of population factors in sample data is normally very good, almost regardless of sample size, level of over determination, or the presence of model error **(MacCallum et al., 2001).**MacCallumet. al. (1999) also suggested communalities should all be greater than 0.6, or the mean level of communality to be at least 0.7. In the present case all the communalities are greater than 0.6 (ranging from 0.719 to 0.992) and the mean value of communalities was 0.915.So, finally the PCA resulted in reducing the variable size from 80 to 62, which are distributed into six elements of NPD innovation in an organization namely Innovations in Product, Procedural Innovations, Marketing innovations, Servicing innovations, Attitudinal innovation and Quality and Technology innovations.

Internal Consistency and Reliability

Table 2: Reliability Statistics

Construct	Cronbach's Alpha	No. of Items
Innovations in Product	**0.87**	**13**
Procedural Innovations	**0.72**	**11**
Marketing Innovations	**0.79**	**7**
Servicing Innovations	**0.83**	**7**
Attitudinal Innovations	**0.69**	**9**
Quality and Technology Innovations	**0.71**	**15**
Total		**62**

In order to check the reliability of the questionnaire, the Cronbach's Alpha test was applied. The value of Cronbach's alpha is found to be 0.87 in Innovations in Product, 0.72 in Procedural Innovations, 0.79 in Marketing Innovations, 0.83 in Servicing Innovations, 0.69 in Attitudinal Innovations and 0.71 in Quality and Technology Innovations of the part of questionnaire on Innovations in NPD, which is well above than 0.6. As the value of Cronbach's Alpha is more than 0.6, which consider the instrument to be reliable for the study. Therefore, the high Cronbach's Alpha coefficient in this study represents a high consistency and reliability among statements in questionnaire.

Confirmatory Factor Analysis

Confirmatory factor analysis is basically used to test the fit of the measured model which basically explains the relationship between the latent factors and their indicator variables. AMOS version 4.0 is used in the processing of responses and the method of maximum likelihood estimation is used.

Construct Validity

Construct validity is the extent to which a set of measured items actually reflects the theoretical latent construct those items are designed to measure **(Hair et al., 2006).** Hence, in order to establish construct validity of the analysis, confirmatory factor model was carried out in multiple stages.It is found that for the 62 variables and six constructs the initial indices are $\chi 2$= 10176, df= 1720, $\chi 2$/df = 5.916,GFI= 0.627, AGFI= 0.714, RMSEA=0.097, CFI=0.0359, RMR= 0.081.It is appeared from the values that there is a need to re – specification in order to fit it better with that of the sample. The modifications were done like in the initial estimates the variables having either low regression weight or the poor square multiple correlations were removed and also the variables having high error variance were also deleted. Apart from that the variables which were cross loaded in more than one element of NPD innovation were also deleted. Thus out of 62 variables on NPD innovations, the re – specification process eliminated 28 variables and best model fit obtained with the 34 observed variables. Thus the modified six elements and 34 observed variables having confirmatory factor analysis model fit indices as: $\chi 2$= 1240.05, df = 459, $\chi 2$/df = 2.702, GFI = 1.045, AGFI = 0.969, RMSEA = 0.094, CFI = 1.000,RMR = 0.082. Thus the new Cronbach's alpha values are given in table 3.

Table 3: New Reliability Statistics

Construct	Cronbach's Alpha	No. of Items
Innovations in Product (IP)	**0.92**	**7**
Procedural Innovations (PI)	**0.87**	**5**
Marketing Innovations (MI)	**0.82**	**6**
Servicing Innovations (SI)	**0.86**	**4**
Attitudinal Innovations (AI)	**0.78**	**5**
Quality and Technology Innovations (QTI)	**0.81**	**7**
Total		**34**

The list of 34 observed variables and their factor loadings with respect to the latent variables (elements of NPD innovation in an organization)

Table 4: Factor loadings along with their respective element of NPD innovation in an automobile industry

Element	Observed Variables	Coding	Loading
Innovations in Product (IP)	Unique Product	**IP1**	0.821
	Originality in Product	**IP3**	0.775
	Cost Effectiveness	**IP4**	0.961
	Value for Money	**IP7**	0.542
	Flexible for up gradation	**IP9**	0.862
	Variety of product	**IP10**	0.854
	Product Utility	**IP12**	0.794
Procedural Innovations (PI)	Methods of Production	**PI1**	0.721
	Flexible Procedures	**PI2**	0.802
	Cost of Production	**PI4**	0.891
	Material cost and handling	**PI6**	0.882
	Efficient process	**PI8**	0.781
Marketing Innovations (MI)	Identification of New Market	**MI1**	0.793
	Advertisement and Promotion	**MI2**	0.803
	Competitors Strategies	**MI3**	0.828
	Capturing New Customers	**MI4**	0.624
	Identification of New Geographical Areas	**MI5**	0.837
	Marketing Research	**MI7**	0.738
Servicing Innovations (SI)	Cost of Servicing	**SI2**	0.627
	After Sales Service	**SI3**	0.827
	Customer Care Support	**SI4**	0.718
	Warranty and Cost of Spares	**SI5**	0.871
Attitudinal Innovations (AI)	Individual Innovations	**AI1**	0.728
	Team Innovations	**AI2**	0.992
	Effective Communication	**AI3**	0.895
	Interpersonal Relationship	**AI4**	0.850
	Informal Relationship	**AI7**	0.438
Quality and Technology Innovations (QTI)	Quality of Product	**QTI1**	0.882
	Quality in Production Process	**QTI13**	0.890
	Best use of New Technology	**QTI4**	0.825
	Cost of Quality	**QTI6**	0.754
	Cost of Technology	**QTI9**	0.772
	Flexible Up gradation of Technology	**QTI11**	0.659
	Technology Advancement	**QTI12**	0.852

Convergent Validity

Convergent validity is demonstrated when different instruments are used to measure the same construct, and scores from these different instruments are strongly correlated (Hatcher, 2006). If all factor loadings for the variables measuring the same construct (latent variable) are statistically significant (greater than twice their standard errors), then convergent validity is achieved (Hatcher, 2006).Convergent validity of the model is also assessed by determining the path estimates between the measurement items and the significance of their respective latent variables. The standardized estimates of all the measured variables are given in Table 5.

Table 5: Standardized estimates of all the measured variables

Measured Variable		Latent Variable	Estimate	S. E.	C. R.	P
IP12	<---	IP	1.000			
IP10	<---	IP	1.082	.214	5.271	***
IP9	<---	IP	1.162	.216	5.226	***
IP7	<---	IP	1.092	.201	5.761	***
IP4	<---	IP	1.183	.249	5.091	***
IP3	<---	IP	1.163	.221	5.339	***
IP1	<---	IP	1.031	.208	5.619	***
PI8	<---	PI	1.000			
PI6	<---	PI	.915	.062	14.772	***
PI4	<---	PI	.991	.055	17.629	***
PI2	<---	PI	1.000	.058	17.882	***
PI1	<---	PI	.926	.051	17.820	***
MI7	<---	MI	1.000			
MI5	<---	MI	.993	.158	5.662	***
MI4	<---	MI	.885	.142	6.824	***
MI3	<---	MI	1.002	.156	5.428	***
MI2	<---	MI	.927	.139	6.129	***
MI1	<---	MI	.831	.147	5.239	***
SI5	<---	SI	1.000			
SI4	<---	SI	1.034	.115	10.281	***
SI3	<---	SI	1.092	.102	9.328	***
SI2	<---	SI	1.071	.111	10.027	***
AI7	<---	AI	1.000			
AI4	<---	AI	1.092	.092	10.926	***
AI3	<---	AI	1.027	.091	11.528	***
AI2	<---	AI	1.041	.094	10.821	***
AI1	<---	AI	1.044	.098	11.338	***

QTI12	<---	OI	1.000			
QTI11	<---	OI	1.037	.064	15.932	***
QTI9	<---	OI	.981	.072	12.339	***
QTI6	<---	OI	.992	.069	13.246	***
QTI4	<---	OI	.938	.062	12.398	***
QTI3	<---	OI	1.082	.071	13.621	***
QTI1	<---	OI	.927	.078	12.931	***

SE, standard error of regression weights; CR, critical ratio for regression weights * Significant at p <0.01**

.**Discriminant Validity**

Discriminant is the extent to which a construct is truly distinct from other constructs (Hair et al., 2006). Discriminant validity is demonstrated when different instruments are used to measure the different constructs, and the correlations between the measures of these different constructs are relatively weak (Hatcher, 2006). In this study to check the discriminant validity, variance extracted test is used as shown in table 6. Inter-construct squared correlations are given in Table 7. It can be seen from both the tables that AVE's are greater than the inter-construct squared correlations which supports the discriminant validity.

Table 6: Average variance explained

Constructs of NPD Innovations	**Average Variance Explained (AVE)**
Innovations in Product (IP)	**58.932**
Procedural Innovations (PI)	**62.771**
Marketing Innovations (MI)	**49.032**
Servicing Innovations (SI)	**55.692**
Attitudinal Innovations (AI)	**52.702**
Quality and Technology Innovations (QTI)	**58.023**

Table 7: Inter-construct squared correlations

			Correlation Estimate	Squared Correlation Estimates
IP	<-->	PI	0.505	0.26
IP	<-->	MI	0.438	0.19
IP	<-->	SI	0.339	0.11
IP	<-->	AI	0.671	0.45
IP	<-->	QTI	0.349	0.12
PI	<-->	MI	0.528	0.28
PI	<-->	SI	0.446	0.2
PI	<-->	AI	0.397	0.16

PI	<-->	QTI	0.469	0.22
MI	<-->	SI	0.631	0.4
MI	<-->	AI	0.428	0.18
MI	<-->	QTI	0.261	0.07
SI	<-->	AI	0.420	0.18
SI	<-->	QTI	0.526	0.28
AI	<-->	QTI	0.391	0.15

HYPOTHESIS TESTING

Table 8: t-Test for NPD innovation to NPD performance

Elements of Innovations in NPD	**NPD performance**	
	t - value	**p -value**
Innovations in Product (IP)	**3.429**	**0.003*** **
Procedural Innovations (PI)	**1.926**	**0.002*** **
Marketing Innovations (MI)	**4.229**	**0.000*** **
Servicing Innovations (SI)	**2.168**	**0.000*** **
Attitudinal Innovations (AI)	**2.462**	**0.006*** **
Quality and Technology Innovations (QTI)	**2.227**	**0.000*** **

***P<0.01

It has been observed from table 7, the p – value in Innovations in product, Procedural innovations, Marketing Innovations, Servicing Innovations, Attitudinal Innovations and Quality and Technology innovations is 0.003, 0.002, 0.000, 0.000, 0.006 and 0.000 which is below than 0.01 in all the cases. Thus in all the cases the null hypothesis is summarily rejected and the alternative hypothesis is accepted. Thus there is significant relationship between Innovations in product, Procedural innovations, Marketing Innovations, Servicing Innovations, Attitudinal Innovations and Quality and Technology innovations with that of the NPD performance.

VI. VALIDATED MODEL NPD PERFORMANCE MODEL

On the basis of above study and analysis, the model is developed and is named on the name of authors/researchers as **NPD Performance Model** already validated by statistical evidencesis as follows: -

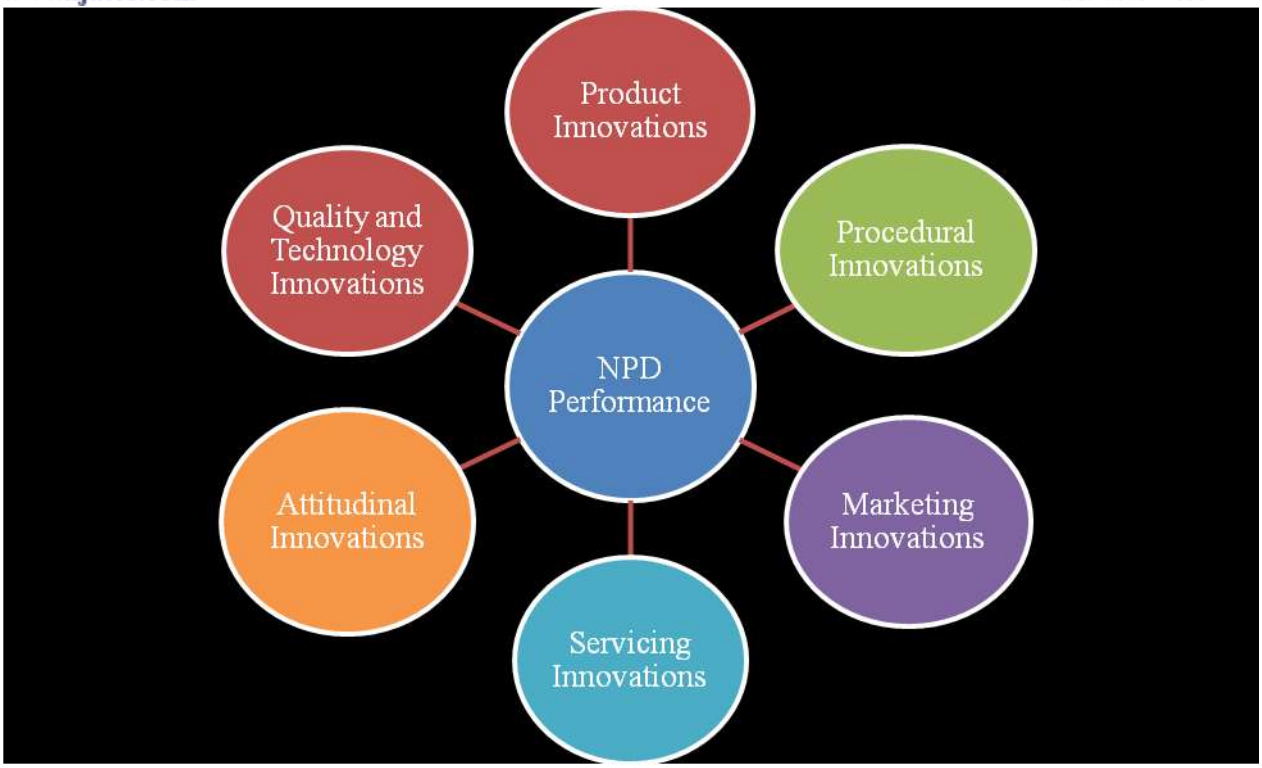


Fig. 2: NPD Performance Model

Assumptions: It is to be presumed that performance of New Product Development affected by other factors also apart from given above and it depends on personal desire to get satisfied with services offered. While constituting this model it is assumed that other factors are kept constant due to which the satisfaction of customers may have been affected which can be considered as one of the limitation of this model.

VII. CONCLUSION

The framework for Innovations in NPD in automobile industry have total 34 elements which are divided into six elements of the NPD innovations in automobile industry.

(1)In the automobile industry the manufacturers are giving more importance to the various constructs like newness in product, cost of product, feature of up gradation in existing product, quality, differentiation and technology.

(2) In automobile industry in the production process, efficiency in procedures, process and cost is very important along with the process flexibility as the product in new stage can be not acceptable so it is necessary to have process flexibility. When the product is accepted by the customers then next stage comes that is growing competition, increase in production volume and the standardization of product. All these can be achieved only when the operational flexibility in production process is there.

(3) Marketing innovations play vital role in the exploitation of the target market. Innovations in Marketing involves identification of new markets, advertising, competition analysis, new geographical areas, customer relationship management etc. Now in this study these variables are highly loaded compared to other NPD innovation elements in the automobile industry.

(4) The variables in the element servicing innovations of NPD in automobile industry are reduction in servicing cost, after sales services, service administration etc. In service innovation after-sales support become a key process to support customer learning. It underlines the importance of efficient communications to follow customer's experiences of innovations and help them to develop valuable use to increase the customer loyalty.

(5) In this study attitudinal innovations are those basically that occur in the social system of the automobile industry which includes like individual innovativeness, team innovativeness, communication, interpersonal communication etc. Attitudinal innovation does not provide a new product or a new service, but it indirectly influences the introduction of new products or services or the process of producing them.

(6) Thestronger the NPD innovation in an automobile industry, with defined NPD best practices, the better the NPD performance.

REFERENCES

[1] Barczak, G., Griffin, A., and Kahn, K. B. (2009). PERSPECTIVE: Trends and Drivers of Success in NPD Practices: Results of the 2003 PDMA Best Practices Study. Journal of Product innovation Management, 26(1), 3-23.

[2] Cavanagh R. E., and Clifford, D. K. (1983). Lessons from America's Mid-Sized Growth Companies. The Mckinsey Quarterly, Autumn, 2-23.

[3] Dosi, G. (1988). Sources, Procedures and Microeconomic Effects of Innovation. Journal of Economic Literature, XXVI, 23 - 35.

[4] Freeman, C. (1974). "The Economics of Industrial Innovation", New york, Penguin Books.

[5] Kotler, P. (1999). "Marketing Management", 10th Ed., Glencoe, IL Free Press.

[6] Mansfield, E. (1968). "The Economics of Technological Change", W. W. Norton

[7] Mansfield, E. (1971) "Research and Innovation in the Modern Corporation", W. W. Norton.

[8] Nonaka, I., and Takeuchi, H. (1995). "The Knowledge Creating Company", Oxford University Press, Oxford.

[9] O'Gorman, C. (1997). Success Strategies in High Growth Small and Medium-Sized Enterprises, in Jones-Evans, Dylan and Klofsten, Magnus (Eds.) Technology, Innovation and Enterprise The European Experience.

[10] European Commission (2004). Innovation in Europe: Results for the EU, Iceland and Norway. Data 1998–2001.

[11] Frenz, M., Jonathan, M., and Oughton, C. (2003). Regional Dimension of Innovation: Results from the Third Community Innovation Survey. International Workshop Empirical Studies on Innovation in Europe, Faculty of Economics, University of Urbino.

[12] Guo, L. (2008). PERSPECTIVE: An Analysis of 22 Years of Research in JPIM. Journal of Product Innovation Management, 25(3), 249-260.

[13] Hajime, Y., Ito, T., and Kawada, H. (2002). Innovative Product Development Process by Integrating QFD and TRIZ. International Journal of Production Research, 40(5), 1031-1050.

[14] Hajime, Y., Kenichi, I., and Hajime, M. (2005). An Innovative Product Development Process for Resolving Fundamental Conflicts. Journal of the Japan Society for Precision Engineering, 71(2), 216-222.

[15] Henard, D. H., and Szymanski, D. M. (2001). Why Some New Products are More Successful than Others. Journal of Marketing Research, 38(3), 362-375.

[16] Hsiao, S. W., and Chou, J. R. (2004). A creativity-based design process for innovative product design. International Journal of Industrial Ergonomics, 34(5), 421 - 443.

[17] Montoya, W. M. M., and Calantone, R. (1994). Determinants of New Product Performance: a Review and Meta-analysis. Journal of Product Innovation Management, 11(4), 397-417.

[18] Pattikawa, L. H., Verwaal, E., and Commandeur, H. R. (2006). Understanding New Product Project Performance. European Journal of Marketing, 40(11/12), 1178-1193.

[19] Pavitt, K. (1991). Key Characteristics of the Large Innovative Firm. British Journal of Management, 2(1), 55 - 72.

[20] Shehab, E. M., and Abdalla, H. S. (2002). A Design to Cost System for Innovative Product Development. Proceedings of the Institution of Mechanical Engineers, Part B: Journal of Engineering Manufacture, 216 (7), 999-1019.

[21] Shen, X. X., Tan, K. C., and Xie, M. (2000). An Integrated Approach to Innovative Product Development using Kano's model and QFD. European Journal of Innovation Management, 3(2), 91-99.

[22] Temin, P. (1979). Technology, Regulation and Market Structure in the Modern Pharmaceutical Industry. Bell Journal of Economics, 10, 73 – 85.