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The study of effect and evaluation of modular product design on manufacturing processes

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ABSRTACT
Basically involvement of modularity in the manufacturing of products produced some effects extensively in development. This Paper presents a methodology of modular based design in different conceptual stages of manufacturing system to support modularity. The results of the study will identify that how the modularity also influence the time and cost factors by functional changes in process planning ,productivity and manufacturing processes, Which will be intuitive and provide resolutions of modularity in formation of strategy of manufacturing and working processes to improve delay of production and reduce the product investment .
Firstly, the function will be classified into different types of modules according to the consideration of manufacturing and assembling of the products with parts as designs. Then modules will be utilize to make changes of results of efficiency, productivity and overall cost to represents the modularity concept of product development and evaluation of effect and modular product design of manufacturing process

INTRODUCTION
In this first chapter of dissertation basically the discussion will start for the purpose to study of effect and evaluation of modular product design on manufacturing processes. The impact or effect of modularity concept on manufacturing process with the help of automobile industry and its modules will be explained in this dissertation. On another part the evaluation for concept of modularization in auto industry through manufacturing process and some other parameters are also include in this exercise of dissertation.
The concept of modular product design, the effect of modularity, the need of modular product design, and the reasons for requirement of modularization in auto industry for vehicles and process to evaluate the effect the modularity will discuss on the basis of various methods and different logics.
Modularity is an important key issue nowadays in industry. Although it is not a new issue, it has growing in importance in recent years in the auto industry. The aim of this dissertation is not to discuss modularity theoretically, but to discuss some new production arrangements and new design strategies for wide selection by customers in market, which are based on new forms of relationship between assemblers and suppliers through improved manufacturing processes with customers in respect of automobile industry as well as on the use of modular products..
This paper is analyzes the modularization in the world auto industry with previous reviews on manufacturing, sales, costs and designing of multiple products. We can say that following fact suggests that there are at least three important and considerable factors in the phenomenon called “modularization”: Any fixed and traditional factors cannot be mention in favor of automobile industry and their vehicles. 1) “Modularization in product architecture” (modularization in design) which has been discussed quite often in the field of the management of technology; 2) “Modularization in production;3) “Modularization in inter-firm system” (outsourcing subsystems in larger units to outside suppliers).

LITERATURE REVIEW
The literature reviews are always considered as very important part of dissertation work. Any research cannot be proceeding without this section The related topics and points are includes and provide a direction for further work for paper. One by one the all points are mention separately for acknowledgement of report in this chapter.

2.1 Automotive supply chain
This is the first point of this chapter for discussion in this dissertation. There are many theoretical reviews can be possible. This automotive supply chain is very much important to discuss in respect of automobile industry. After 1973, the year of the first oil shock, the growth rate declined to about 1% per year until 2002, and came to a halt in 2003.The automotive supply chain can be discussed as schematic diagram also. This diagram will help to represent the all important steps and points of automotive supply chain system. The all steps in whole system of supply chain are also involved.

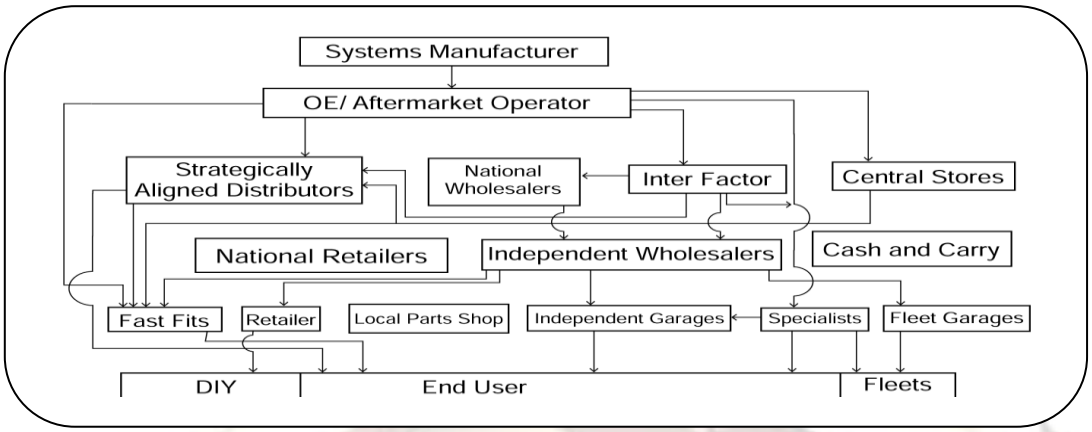


Fig-Flow diagram of automobile supply chain

In this diagram, complete system of automotive supply chain is discussed in detail. From first to lat factors of this supply chain system are focused especially. Through this diagram the different types of suppliers and vendors and their contribution in automotive supply chain system can be understand.
1) The cost of stock holding
2) Incentives offered to final customers to move the stock.

2.2 New product development
Improving and updating product lines is crucial for the success for any organization. Failure for an organization to change could result in a decline in sales and with competitors racing ahead.
Stage 1: Idea Generation-New product ideas have to come from somewhere. But where do organizations get their ideas for NPD? Sources include: **Stage 2: Idea Screening-**This process involves shifting through the ideas generated above and selecting ones which are feasible and workable to develop. Pursing non feasible ideas can clearly be costly for the company. This step is important step for the new product development process for any kind of organization, **Stage 3: Concept Development and Testing-**The organization may have come across what they believe to be a feasible idea, however, the idea needs to be taken to the target audience. **Stage 4: Marketing Strategy and Development-** A proposed marketing strategy will be written laying out the marketing mix strategy of the product, the segmentation, targeting and positioning strategy sales and profits that are expected. These kinds of market strategies are necessary for the customers. **Stage 5: Business Analysis-**The Company has a great idea, the marketing strategy seems feasible, but will the product be financially worthwhile in the long run? The business analysis stage looks more deeply into the Cash flow the product could generate, what the cost will be, **Stage 6: Product Development-**At this stage the prototype is produced. The prototype will clearly run through all the desired tests, and presented to a selection of people made up of the target market segment to see if changes need to be made. **Stage 7: Test Marketing-** Test marketing means testing the product within a specific area. The product will be launched within a particular region so the marketing mix strategy can be monitored and if needed modified before national launch. **Stage 8: Commercialization-**If the test marketing stage has been successful the product will go for national launch. There are certain factors that need to be taken into account before a product is launched nationally.
These eight stages of product development may seem like a process but they are designed to save wasted time and resources. New product development ideas and prototypes are tested to ensure that the new product will meet target market needs and wants. There is a test launch during the test marketing stage as a full market launch is expensive.

2.3 Modularity
In an increasingly competitive and segmented global marketplace, the need to diversify is greater than ever before. Advances in production technologies has rendered out many of the differences in product quality, and thus changed the competitive environment companies find themselves in. Traditional mass production has in the past decade been replaced by the concept of mass customization, mass production of customized products. To overcome the great complexity that customization potentially creates in the manufacturing systems,

modularization is used as a tool to break the product structure into smaller, manageable units. Under the change of consuming type the lifecycle of a product becomes short while used. How to follow the need of the market to develop new products is increasingly important. CE is regarded as an efficient approach to meet the production requirements.

It is generally recognized as a practice for integrating various life-cycle values into the early stage of the designing. These values include not only the product's function, but also its aesthetics, manufacturing, assembly, serviceability and recyclability, etc. Its goal is to reduce the product development time, to promote the competition in the market and to provide a product that better matches the customer's expectation. If modularity is identified and exploited in the initial conceptual or reverse engineering effort, the immediate product design reaps benefits in several strategically important areas to be described later in the article.

2.7 Automobile Industry in India

The Indian automotive industry has emerged as a 'sunrise sector' in the Indian economy. India is emerging as one of the world's fastest growing passenger car markets and second largest two wheeler manufacturer. It is also home for the largest motor cycle manufacturer and fifth largest commercial vehicle manufacturer. India is fourth largest passenger car market in Asia also. In recent years there has been a marked rise in the number of international industrial concern setting up a base in India. The automotive industry is well represented among them.

2.8 Effect of Modular Design in Automobile Industry

A. Aircraft Design-In developing the Boeing 777 aircraft, the modular product architecture specified at the beginning of the development process created a positive environment for efficient "localized learning" in developing specific components. A localized learning environment is possible when development of components can be carried out through autonomous processes. Modular product architectures also provide a framework that supports expanded involvement of lead users in product development.

B. Furniture Design-Romero-Sub iron and Rosado described the design of a low cost hierarchical shop floor control system for the modular furniture industry. The system allows for the addition of line resource management modules, such as tools, fixtures, personnel, etc. Those modules that have not been actually developed can be critical to other industries, e.g., the mechanical product industry.

C. Circuit Design-An electrical circuit system as a combination of modules. A module here is a hierarchically nested collection of components and their interconnecting nets. At its lowest level, a module may contain only a single component, e.g., a logic gate. A similar concept is the configurable system concept.

D. Software-The processes of software design involve planning, preliminary design, detailed design, implementation, and testing (Sanchez, 1993). A module is usually formed in the planning and preliminary design process, and is implemented with objects in object-oriented programming, e.g., C++ and Java, in the implementation process

PROBLEM STATEMENT

As we know that, we are discussing the effect and evaluation of modular product design on manufacturing process with the study of automobile modules. The automobile industry is fastest growing industry in Indian market. Every human being desirable to be the part of this industry as a customer and in other respects. Some of the people are desirable but some of them already associated with this industry also. In previous time, the automobile sector was having the limited choice and options but in this time many of companies with a lot of options are available in the market for customers.

In this chapter of dissertation we are discussing the main concept of modularization in our auto industry with some problems of customers and customization. The concept of modularity as the modular product design can be related to bottom to top products and parts of car. In the duration of assembling of a car and of its parts the changes are possible and changes should be as the demand of our market and customers.

It's going to be much more important to watch the middle of the market and see how consumers there are thinking about or rethinking their purchases of durable goods and looking ahead for the next six months or so. It's going to be interesting, as the new models come in, to see whether people will feel.

(1) A problem of selection related to the design of a vehicle as per choice of customer.

(2) Another is related according required power and efficiency of a vehicle in different respect.

(3) The features of comfort and convenience of a car also important and required indicates another problem of automobile industry.

(4) Some times a problem of customers related to cost features and expenses for maintenance of vehicle in limited criteria.

(5) The problem in selection of vehicle also can be related with performance and present additional features also possible as per desire and requirements.

(6) Some of customers are choose their vehicle as per record analysis of sales figures and demand ratio in market focus a part of serious problem.
(7) In some cases, customers required many of features in vehicle less budget and high demand of them arise a new problem.
(8) The customers are also gathered information about result of the vehicle's overall specifications and structured design to avoid the futuristic problem.
(9) In some other cases, the atmospheric conditions and fulfillment of purpose to purchase the vehicle also important in the selection, which creates a great confusion as a problem
(10) In study of few cases, the users are also affected with modularity; they are affectionate about requirements of advancement in vehicle also generate some problems.
(11) Another factor is behavior of utilization of the vehicle as per demand also produced a focus on vehicle selection by customer and problem of confusion arise.
(12) One of the major problem in selection of also related to reliability on that particular automobile company according reputation in market between customers
(13) The one more factor of problem can be result of a particular automobile company with a specific segments of car and their features are advanced or not in comparison with other segment vehicle of same and other companies at almost same costs. So the problems of customers are important and these are having a right to prove them correct with a proper solution. The statement of this kind of problem is important to solve for growth of a company.

METHODOLOGY

In this chapter as mention on the top, we will discuss some of the steps and ideas to find out many new results and solutions for some specific problems of customers in respect of automobile industry. The selection of steps and ideas for methodology of any dissertation due to purpose of new research and results are very important. On the basis of nature in this methodology and subject, this dissertation can be classified as a case study and survey based research with based on a literature review including a classification and its analysis. It is imperative to any research project that the field being researched is defined and understood, which involves identifying the current theoretical and empirical state of knowledge in the subject.

In this chapter of methodology of dissertation, the effect and evaluation of modular product design on manufacturing process can be discuss by some of exercise on modules of automobile industry. The modules of such automobile companies will be well known and important symbols for their reputation and prestige in market between customers. The selections of customers are based on utilization of following modules in assembling and formations of vehicles.
After the processing of the classification, identification and utilization of modules by automobile companies for customers in Indian market with the help of justification in sale figures and production costs will be helpful to make an appropriate result of all work with various analyses. Every module will be discussed in details to differentiate the useful and useless from them for automobile companies of Indian auto industries. This classification will be possible after certain valuation of modules by different steps of analysis. These considerations are become so wide and detailed after generation of some results and conclusions in basic steps for further steps of methodologies. All types of methods and ideas will be used for finding of the final result of this research. These all steps can be discuss and listed one by one as-

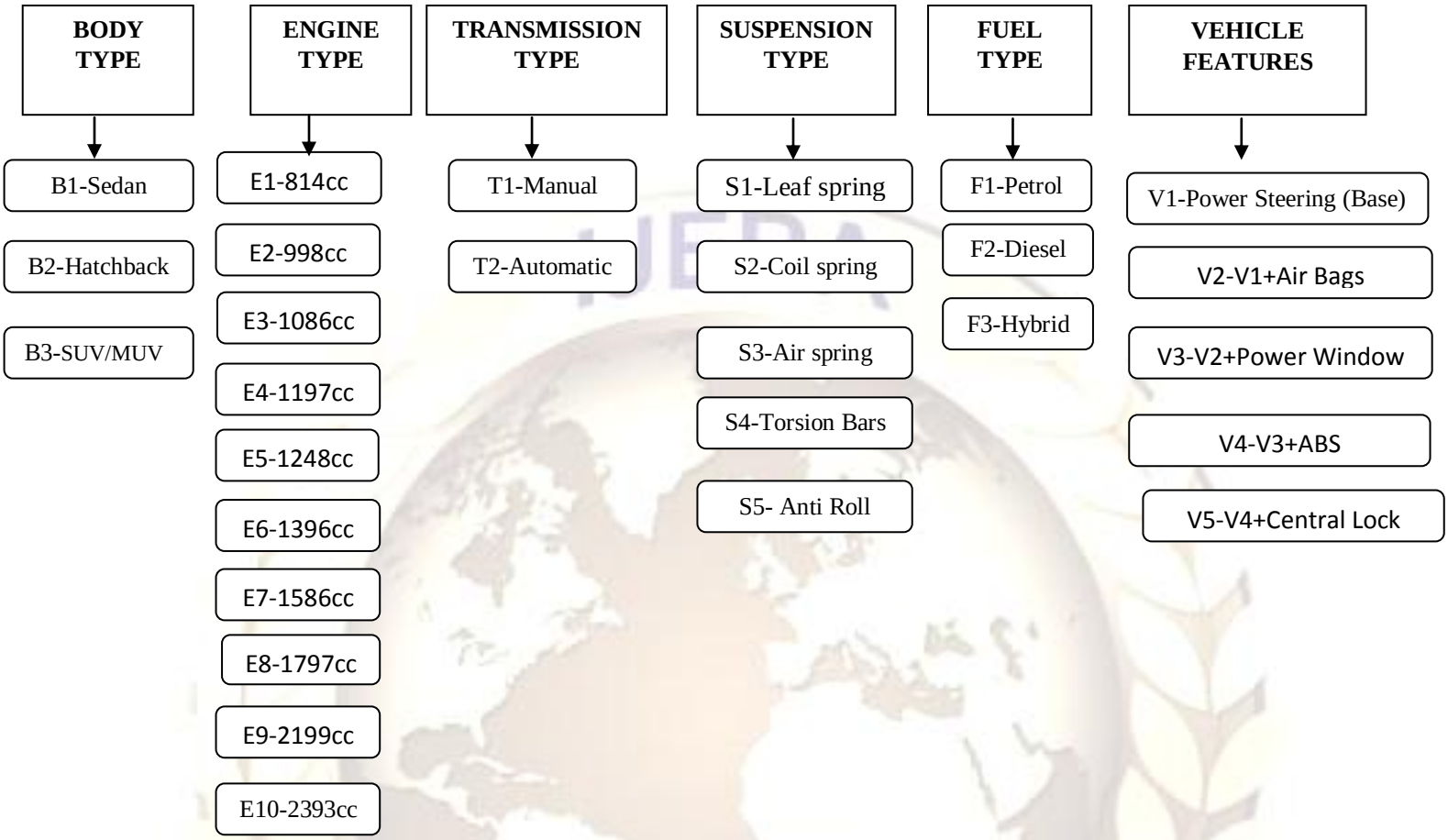
4.1 Dividing automobile into various modules

The all exercise of dissertation to understand the concept of modular product design in manufacturing processes with its effects can be possible with module-factor. The six major modules of a car can be as-

A. Body Types	(Module M1)
B. Engine Types	(Module M2)
C. Transmission Types	(Module M3)
D. Suspension Types	(Module M4)
E. Fuel Types	(Module M5)
F. Vehicle Feature Types	(Module M6)

The classification of modules is considered as different parts of automobile. The automobile module (vehicle) is having many parts and following parts are consider as modules. The high and low rate of utilization is based on sales figures in market by customers. The sale figure is varies according the costs of the modules. That's by these all modules can be classified as multiple options for following modules.

(AUTOMOBILE MODULES)



4.2 Identifying various options for each modules (from leaflets/brochures of five automobile companies of Indian market)

This is another step of methodology for this dissertation. This is having the important role for study of effect and evaluation of modular product design on manufacturing processes. As we know that the automobile is already divided into different modules and those modules are categories as different options in previous step of methodology. There are many automobile companies are available in the Indian automobile market but the selection of highly demanded and reliable companies is important for this work. These main automobile five companies will be involved are as-

(I) **Maruti** Suzuki Limited (II) Hyundai (III) Tata Motors (IV)Chevrolet (V) Honda

These all automobile companies are very famous and well known companies in Indian market between customers. The highest models of cars are used by customers of these five involved companies. The all class families is using the cars of these automobile companies widely. They are also providing the all classes of choices in cars for Indian market. As we now, in this step after listing and division the all options, this is very necessary to for all to identifying them. These all modules will be identified and than arranged in a symmetric way for next step of classification.

4.3 For each of company, classifying each model (variant) as an equation of various modules

In this section, we will classify the all models (different variants) as a mathematical equation for each company. So that all cars of different models and different companies can be express in a similar way. Firstly the combination of vehicle parts will be noted according to the considered options of the flow chart. Small values of engine capacity are decrease and increase to arrangement and matching with other engine types. According the flow chart, we consider

only 6 Major Modules and their 28 options for complete and effective comparison between them. The nominations and symbols are as-

S.N	NAME OF MDOULE	SYMBOLS	NAME OF SUB- MODULES	SYMBOLS
1	BODY TYPE	M1	SEDAN TYPE	B1
			HATCHBACK TYPE	B2
			SUV/MUV TYPE	B3
2	ENGINE TYPE	M2	814 CC	E1
			998 CC	E2
			1086 CC	E3
			1197 CC	E4
			1248 CC	E5
			1396 CC	E6
			1586 CC	E7
			1797 CC	E8
			2199 CC	E9
			2393 CC	E10
3	TRANSMISSION TYPE	M3	MANUAL	T1
			AUTOMATIC	T2
4	SUSPENSION TYPE	M4	LEAF SPRING TYPE	S1
			COIL TYPE	S2
			AIR SPRING TYPE	S3
			TORSION TYPE	S4
			ANTI ROLL TYPE	S5
5	FUEL TYPE	M5	PETROL TYPE	F1
			DIESEL TYPE	F2
			HYBRID TYPE	F3
6	VEHICLE FEATURE TYPE	M6	POWER STEERING TYPE	V1
			AIR BAGS TYPE	V2
			POWER WINDOW TYPE	V3
			ANTI BRAKING SYSTEM TYPE	V4
			CENTRAL LOCK TYPE	V5

TABLE- (MARUTI SUZUKI SEGMENT'S-SPECIFICATIONS OF DIFFERENT MODELS)

S.N	Name of Car	Model	Body Type	Engine	Transmission	Suspension	Fuel Type	Vehicle Features	Equations
1	ALTO	LX	Hatchback (B2)	814 CC (E1)	Manual (T1)	Torsion (S4)	Petrol (F1)	None	B2+E1+T1+S4+F1
2		LXI	Hatchback (B2)	814 CC (E1)	Manual (T1)	Torsion (S4)	Petrol (F1)	Power Steering	B2+E1+T1+S4+F1+V1
3		VXI	Hatchback (B2)	998 CC (E2)	Manual (T1)	Torsion (S4)	Petrol (F1)	Power Steering, Power Window, Central Lock	B2+E2+T1+S4+F1+V1+V3+V5
4		K 10	Hatchback (B2)	998 CC (E2)	Manual (T1)	Torsion (S4)	Petrol (F1)	Power Steering, , Power Window, Central Lock, ABS	B2+E2+T1+S4+F1+V1+V3+V4+V5
5		CNG	Hatchback (B2)	998 CC (E2)	Manual (T1)	Torsion (S4)	Hybrid (F3)	Power Steering	B2+E2+T1+S4+F3+V1
6	A-STAR	LXI	Hatchback (B2)	998 CC (E2)	Manual (T1)	Coil (S2)	Petrol (F1)	Power Steering, Power Window	B2+E2+T1+S2+F1+V1+V3
7		VXI	Hatchback (B2)	998 CC (E2)	Manual (T1)	Coil (S2)	Petrol (F1)	Power Steering, Power Window, Central Lock	B2+E2+T1+S2+F1+V1+V3+V5
8		ZXI	Hatchback (B2)	998 CC (E2)	Manual (T1)	Coil (S2)	Petrol (F1)	Power Steering, , Power Window, Central Lock, ABS	B2+E2+T1+S2+F1+V1+V3+V4+V5
9		VXI AT	Hatchback (B2)	998 CC (E2)	Automatic (T2)	Coil (S2)	Petrol (F1)	Power Steering, , Power Window, Central Lock, ABS, Air Bags	B2+E2+T2+S2+F1+V1+V2+V3+V4+V5
10	WAGON R	LX	Hatchback (B2)	998 CC (E2)	Manual (T1)	Coil (S2)	Petrol (F1)	None	B2+E2+T1+S2+F1
11		LXI	Hatchback (B2)	998 CC (E2)	Manual (T1)	Coil (S2)	Petrol (F1)	Power Steering	B2+E2+T1+S2+F1+V1
12		VXI	Hatchback (B2)	998 CC (E2)	Manual (T1)	Coil (S2)	Petrol (F1)	Power Steering, , Power Window	B2+E2+T1+S2+F1+V1+V3
13		AT	Hatchback (B2)	998 CC (E2)	Automatic (T2)	Coil (S2)	Diesel (F2)	Power Steering, , Power Window, Central Lock, ABS, Air Bags	B2+E2+T2+S2+F2+V1+V2+V3+V4+V5
14		DUO	Hatchback (B2)	998 CC (E2)	Manual (T1)	Coil (S2)	Hybrid (F3)	Power Steering, , Power Window, Central Lock	B2+E2+T1+S2+F3+V1+V3+V5
15	RITZ	LXI	Hatchback (B2)	1197 CC (E4)	Manual (T1)	Torsion (S4)	Petrol (F1)	Power Steering, , Power Window	B2+E4+T1+S4+F1+V1+V3
16		VXI	Hatchback (B2)	1197 CC (E4)	Manual (T1)	Torsion (S4)	Petrol (F1)	Power Steering, , Power Window, Central Lock	B2+E4+T1+S4+F1+V1+V3+V5
17		ZXI	Hatchback (B2)	1197 CC (E4)	Manual (T1)	Torsion (S4)	Petrol (F1)	Power Steering, , Power Window, Central Lock, ABS, Air Bags	B2+E4+T1+S4+F1+V1+V2+V3+V4+V5
18		LDI	Hatchback (B2)	1248 CC (E5)	Manual (T1)	Torsion (S4)	Diesel (F2)	Power Steering, , Power Window, Central Lock	B2+E5+T1+S4+F2+V1+V3+V5
19	SWIFT	LXI	Hatchback (B2)	1197 CC (E4)	Manual (T1)	Torsion (S4)	Petrol (F1)	Power Steering	B2+E4+T1+S4+F1+V1
20		VXI	Hatchback (B2)	1197 CC (E4)	Manual (T1)	Torsion (S4)	Petrol (F1)	Power Steering, , Power Window, Central Lock	B2+E4+T1+S4+F1+V1+V3+V5
21		ZXI	Hatchback (B2)	1197 CC (E4)	Manual (T1)	Torsion (S4)	Petrol (F1)	Power Steering, , Power Window, Central Lock, ABS	B2+E4+T1+S4+F1+V1+V3+V4+V5
22		LDI	Hatchback (B2)	1248 CC (E5)	Manual (T1)	Torsion (S4)	Diesel (F2)	Power Steering, Power Window	B2+E5+T1+S4+F2+V1+V3
23		VDI	Hatchback (B2)	1248 CC (E5)	Manual (T1)	Torsion (S4)	Diesel (F2)	Power Steering, , Power Window, Central Lock, ABS, Air Bags	B2+E5+T1+S4+F2+V1+V2+V3+V4+V5
24	SWIFT DEZIRE	LXI	Sedan (B1)	1197 CC (E4)	Manual (T1)	Torsion (S4)	Petrol (F1)	Power Steering, Power Window	B1+E4+T1+S4+F1+V1+V3
25		VXI	Sedan (B1)	1197 CC (E4)	Manual (T1)	Torsion (S4)	Petrol (F1)	Power Steering, Power Window, Central Lock	B1+E4+T1+S4+F1+V1+V3+V5
26		LDI	Sedan (B1)	1248 CC (E5)	Manual (T1)	Torsion (S4)	Diesel (F2)	Power Steering, Power Window, Central lock, ABS	B1+E5+T1+S4+F2+V1+V3+V5
27		ZXI	Sedan (B1)	1197 CC (E4)	Manual (T1)	Torsion (S4)	Diesel (F2)	Power Steering, , Power Window, Central Lock, ABS, Air Bags	B1+E4+T1+S4+F2+V1+V2+V3+V4+V5
28		AUTO.	Sedan (B1)	1197 CC (E4)	Automatic (T2)	Torsion (S4)	Petrol (F1)	Power Steering, , Power Window, Central Lock	B1+E4+T2+S4+F1+V1+V3+V5
29	SX 4	VXI	Sedan (B1)	1586 CC (E7)	Manual (T1)	Torsion (S4)	Petrol (F1)	Power Steering, , Power Window	B1+E7+T1+S4+F1+V1+V3
30		ZXI	Sedan (B1)	1586 CC (E7)	Manual (T1)	Torsion (S4)	Petrol (F1)	Power Steering, , Power Window, Central Lock, ABS	B1+E7+T1+S4+F1+V1+V3+V4+V5
31		VDI	Sedan (B1)	1248 CC (E5)	Manual (T1)	Torsion (S4)	Diesel (F2)	Power Steering, , Power Window, Central Lock	B1+E5+T1+S4+F2+V1+V3+V5
32		ZDI	Sedan (B1)	1248 CC (E5)	Manual (T1)	Torsion (S4)	Diesel (F2)	Power Steering, , Power Window, Central Lock, ABS	B1+E5+T1+S4+F2+V1+V3+V4+V5
33		ZXI AT	Sedan (B1)	1586 CC (E7)	Automatic (T2)	Torsion (S4)	Petrol (F1)	Power Steering, , Power Window, Central Lock, ABS, Air Bags	B1+E7+T2+S4+F1+V1+V2+V3+V4+V5
34	ERTIGA	LXI	MUV (B3)	1396 CC (E6)	Manual (T1)	Torsion (S4)	Petrol (F1)	Power Steering, , Power Window	B3+E6+T1+S4+F1+V1+V3
35		VXI	MUV (B3)	1396 CC (E6)	Manual (T1)	Torsion (S4)	Petrol (F1)	Power Steering, , Power Window, Central Lock	B3+E6+T1+S4+F1+V1+V3+V5
36		LDI	MUV (B3)	1248 CC (E5)	Manual (T1)	Torsion (S4)	Diesel (F2)	Power Steering, , Power Window, Central Lock .Air Bags	B3+E5+T1+S4+F2+V1+V2+V3+V5
37		ZXI	MUV (B3)	1396 CC (E6)	Manual (T1)	Torsion (S4)	Petrol (F1)	Power Steering, , Power Window, Central Lock, ABS, Air Bags	B3+E5+T1+S4+F1+V1+V2+V3+V4+V5
38		VDI	MUV (B3)	1248 CC (E5)	Manual (T1)	Torsion (S4)	Diesel (F2)	Power Steering, , Power Window, Central Lock, ABS,	B3+E5+T1+S4+F2+V1+V3+V4+V5
39		ZDI	MUV (B3)	1248 CC (E5)	Manual (T1)	Torsion (S4)	Diesel (F2)	Power Steering, , Power Window, Central Lock, ABS, Air Bags	B3+E5+T1+S4+F2+V1+V2+V3+V4+V5
40	VITARA	MT	MUV (B3)	2393 CC (E10)	Manual (T1)	Torsion (S4)	Petrol (F1)	Power Steering, , Power Window, Central Lock, ABS, Air Bags	B3+E10+T1+S4+F1+V1+V2+V3+V4+V5
41		AT	MUV (B3)	2393 CC (E10)	Automatic (T2)	Torsion (S4)	Diesel (F2)	Power Steering, , Power Window, Central Lock, ABS, Air Bags	B3+E10+T2+S4+F2+V1+V2+V3+V4+V5

TABLE- (HYUNDAI SEGMENT'S-SPECIFICATIONS OF DIFFERENT MODELS)

S.N	Name of Car	Model	Body Type	Engine	Transmission	Suspension	Fuel Type	Vehicle Features	Equations
1	**SANTRO XING**	LX	Hatchback (B2)	1086 CC (E3)	Manual (T1)	Torsion (S4)	Petrol (F1)	None	B2+E3+T1+S4+F1
2		GL +	Hatchback (B2)	1086 CC (E3)	Manual (T1)	Torsion (S4)	Hybrid (F3)	Power Steering, , Power Window	B2+E3+T1+S4+F3+V1+V3
3		GLS	Hatchback (B2)	1086 CC (E3)	Manual (T1)	Torsion (S4)	Hybrid (F3)	Power Steering, , Power Window, Central Lock	B2+E3+T1+S4+F3+V1+V3+V5
4		GLS LPG	Hatchback (B2)	1086 CC (E3)	Manual (T1)	Torsion (S4)	Petrol (F1)	Power Steering, , Power Window, Central Lock, ABS	B2+E3+T1+S4+F1+V1+V3+V4+V5
5	**I 10**	D LITE	Hatchback (B2)	1086 CC (E3)	Manual (T1)	Torsion (S4)	Petrol (F1)	Power Steering	B2+E3+T1+S4+F1+V1
6		ERA	Hatchback (B2)	1086 CC (E3)	Manual (T1)	Torsion (S4)	Petrol (F1)	Power Steering, , Power Window	B2+E3+T1+S4+F1+V1+V3
7		MAGNA	Hatchback (B2)	1086 CC (E3)	Manual (T1)	Torsion (S4)	Petrol (F1)	Power Steering, , Power Window, Central Lock	B2+E3+T1+S4+F1+V1+V3+V5
8		M + LPG	Hatchback (B2)	1086 CC (E3)	Manual (T1)	Torsion (S4)	Hybrid (F3)	Power Steering, , Power Window, Central Lock	B2+E3+T1+S4+F3+V1+V2+V3+V5
9		ASTA	Hatchback (B2)	1197 CC (E4)	Manual (T1)	Torsion (S4)	Diesel (F2)	Power Steering, , Power Window, Central Lock, ABS, Air Bags	B2+E4+T1+S4+F2+V1+V2+V3+V4+V5
10		KAPPA	Hatchback (B2)	1197 CC (E4)	Manual (T1)	Torsion (S4)	Petrol (F1)	Power Steering, , Power Window, Central Lock	B2+E4+T1+S4+F1+V1+V3+V5
11		SPORTZ	Hatchback (B2)	1197 CC (E4)	Manual (T1)	Torsion (S4)	Petrol (F1)	Power Steering, , Power Window, Central Lock, ABS	B2+E4+T1+S4+F1+V1+V3+V4+V5
12		SPZ. AT	Hatchback (B2)	1197 CC (E4)	Automatic (T2)	Torsion (S4)	Petrol (F1)	Power Steering, , Power Window, Central Lock, ABS, Air Bags	B1+E4+T2+S4+F1+V1+V2+V3+V4+V5
13	**I 20**	ERA	Sedan (B1)	1197 CC (E4)	Manual (T1)	Torsion (S4)	Petrol (F1)	Power Steering,	B1+E4+T1+S4+F1+V1
14		MAGNA	Sedan (B1)	1197 CC (E4)	Manual (T1)	Torsion (S4)	Petrol (F1)	Power Steering, , Power Window	B1+E4+T1+S4+F1+V1+V3
15		ASTA	Sedan (B1)	1248 CC (E5)	Manual (T1)	Torsion (S4)	Petrol (F1)	Power Steering, , Power Window, Central Lock	B1+E5+T1+S4+F1+V1+V3+V5
16		SPORTZ	Sedan (B1)	1248 CC (E5)	Manual (T1)	Torsion (S4)	Petrol (F1)	Power Steering, , Power Window, Central Lock, ABS	B1+E5+T1+S4+F1+V1+V3+V4+V5
17	**ACCENT**	EX.	Sedan (B1)	1586 CC (E7)	Manual (T1)	Coil(S2)	Petrol (F1)	Power Steering, , Power Window, Central Lock, ABS, Air Bags	B1+E7+T1+S2+F1+V1+V2+V3+V4+V5
18		EX.LPG	Sedan (B1)	1586 CC (E7)	Manual (T1)	Coil(S2)	Hybrid (F3)	Power Steering, , Power Window, Central Lock, ABS, Air Bags	B1+E7+T1+S2+F3+V1+V2+V3+V4+V5
19	**EON**	DLITE	Hatchback (B2)	814 CC (E1)	Manual (T1)	Torsion (S4)	Petrol (F1)	Power Steering	B2+E1+T1+S4+F1+V1
20		DLITE +	Hatchback (B2)	814 CC (E1)	Manual (T1)	Torsion (S4)	Petrol (F1)	Power Steering, , Power Window	B2+E1+T1+S4+F1+V1+V3
21		ERA +	Hatchback (B2)	814 CC (E1)	Manual (T1)	Torsion (S4)	Petrol (F1)	Power Steering, , Power Window, Central Lock	B2+E1+T1+S4+F1+V1+V3+V5
22		MAGNA	Hatchback (B2)	814 CC (E1)	Manual (T1)	Torsion (S4)	Petrol (F1)	Power Steering, , Power Window, Central Lock	B2+E1+T1+S4+F1+V1+V3+V5
23		SPORTZ	Hatchback (B2)	814 CC (E1)	Manual (T1)	Torsion (S4)	Petrol (F1)	Power Steering, , Power Window, Central Lock, ABS, Air Bags	B2+E1+T1+S4+F1+V1+V2+V3+V4+V5
24	**VERNA**	VTVT	Sedan (B1)	1248 CC (E5)	Manual (T1)	Torsion (S4)	Petrol (F1)	Power Steering, , Power Window, Central Lock, ABS	B1+E5+T1+S4+F1+V1+V3+V4+V5
25		CRDI	Sedan (B1)	1248 CC (E5)	Manual (T1)	Torsion (S4)	Diesel (F2)	Power Steering, , Power Window, Central Lock, ABS, Air Bags	B1+E5+T1+S4+F2+V1+V2+V3+V4+V5
26		VTVT SX	Sedan (B1)	1586 CC (E7)	Manual (T1)	Torsion (S4)	Petrol (F1)	Power Steering, , Power Window, Central Lock, ABS, Air Bags	B1+E7+T1+S4+F1+V1+V2+V3+V4+V5
27		CRDI AT	Sedan (B1)	1586 CC (E7)	Automatic (T2)	Torsion (S4)	Diesel (F2)	Power Steering, , Power Window, Central Lock, ABS, Air Bags	B1+E7+T2+S4+F2+V1+V2+V3+V4+V5
28		CRDI SX	Sedan (B1)	1586 CC (E7)	Manual (T1)	Torsion (S4)	Diesel (F2)	Power Steering, , Power Window, Central Lock, ABS, Air Bags	B1+E7+T1+S4+F1+V1+V2+V3+V4+V5
29	**SONATA**	GDI MT	Sedan (B1)	2393 CC (E10)	Manual (T1)	Torsion (S4)	Petrol (F1)	Power Steering, Power Window, Central Lock, ABS. Air Bags	B1+E10+T1+S4+F1+V1+V2+V3+V4+V5
30		GDI AT	Sedan (B1)	2393 CC (E10)	Automatic (T2)	Torsion (S4)	Petrol (F1)	Power Steering, Power Window ,Central Lock, ABS, Air Bags	B1+E10+T2+S4+F1+V1+V2+V3+V4+V5
31	**ELANTRA**	S	SUV (B3)	1797 CC (E8)	Manual (T1)	Coil(S2)	Petrol (F1)	Power Steering, Power Window, Central Lock, ABS, Air Bags	B3+E8+T1+S2+F1+V1+V2+V3+V4+V5
32		BASE	SUV (B3)	1586 CC (E7)	Manual (T1)	Coil(S2)	Diesel (F2)	Power Steering, Power Window, Central Lock, ABS, Air Bags	B3+E7+T1+S2+F2+V1+V2+V3+V4+V5
33		SMT	SUV (B3)	1586 CC (E7)	Manual (T1)	Coil(S2)	Diesel (F2)	Power Steering, Power Window, Central Lock, ABS, Air Bags	B3+E7+T1+S2+F2+V1+V2+V3+V4+V5
34		SX MT	SUV (B3)	1797 CC (E8)	Manual (T1)	Coil(S2)	Petrol (F1)	Power Steering, Power Window, Central Lock, ABS, Air Bags	B3+E8+T1+S2+F1+V1+V2+V3+V4+V5
35	**SANTA FE**	2 WD	SUV (B3)	2199 CC (E9)	Manual (T1)	Torsion (S4)	Diesel (F2)	Power Steering, Power Window, Central Lock, ABS, Air Bags	B3+E9+T1+S4+F2+V1+V2+V3+V4+V5
36		4 WD	SUV (B3)	2199 CC (E9)	Manual (T1)	Torsion (S4)	Diesel (F2)	Power Steering, Power Window, Central Lock, ABS, Air Bags	B3+E9+T1+S4+F2+V1+V2+V3+V4+V5
37		4 WD AT	SUV (B3)	2199 CC (E9)	Automatic (T2)	Torsion (S4)	Diesel (F2)	Power Steering, Power Window, Central Lock, ABS, Air Bags	B3+E9+T2+S4+F2+V1+V2+V3+V4+V5
38		4 WD VT	SUV (B3)	2199 CC (E9)	Automatic (T2)	Torsion (S4)	Diesel (F2)	Power Steering, Power Window, Central Lock, ABS, Air Bags	B3+E9+T2+S4+F2+V1+V2+V3+V4+V5

4.4 Calculating percentage utilization of each module.

In all previous sections we worked as the theoretical exercises and explanations of modules in different ways like the classification, identification and after arrange them in mathematical equations.

TABLE - (MARUTI SUZUKI SEGMENT'S-UTILIZATION OF EACH MODULE)

S.N	Module Options		Code	No. of models using the modules	Total no. of modules	Percentage of Utilization
(A)	(B)	(C)	(D)	(E)	(F)	(F)=E/F * 100
1	Body Type	Sedan	B1	10	41	24.39%
2		Hatchback	B2	23	41	56.10%
3		SUV/MUV	B3	08	41	19.51%
4	Engine	814 CC	E1	02	41	4.87%
5		998 CC	E2	12	41	29.26%
6		1197 CC	E4	10	41	24.39%
7		1248 CC	E5	10	41	24.39%
8		1396 CC	E6	02	41	4.87%
9		1586 CC	E7	03	41	7.31%
10		2393 CC	E10	02	41	4.87%
11	Transmission	Manual	T1	36	41	87.80%
12		Automatic	T2	05	41	12.19%
13	Suspension	Coil	S2	09	41	21.95%
14		Torsion	S4	32	41	78.04%
15	Fuel Type	Petrol	F1	29	41	70.73%
16		Diesel	F2	11	41	26.82%
17		Hybrid	F3	01	41	2.44%
18	Vehicle Features	Power Steering	V1	39	41	95.12%
19		Air Bags	V2	14	41	34.14%
20		Power Window	V3	35	41	85.36%
21		Anti-Braking System	V4	19	41	46.34%
22		Central Lock	V5	29	41	70.73%

TABLE - (HYUNDAI SEGMENT'S-UTILIZATION OF EACH MODULE)

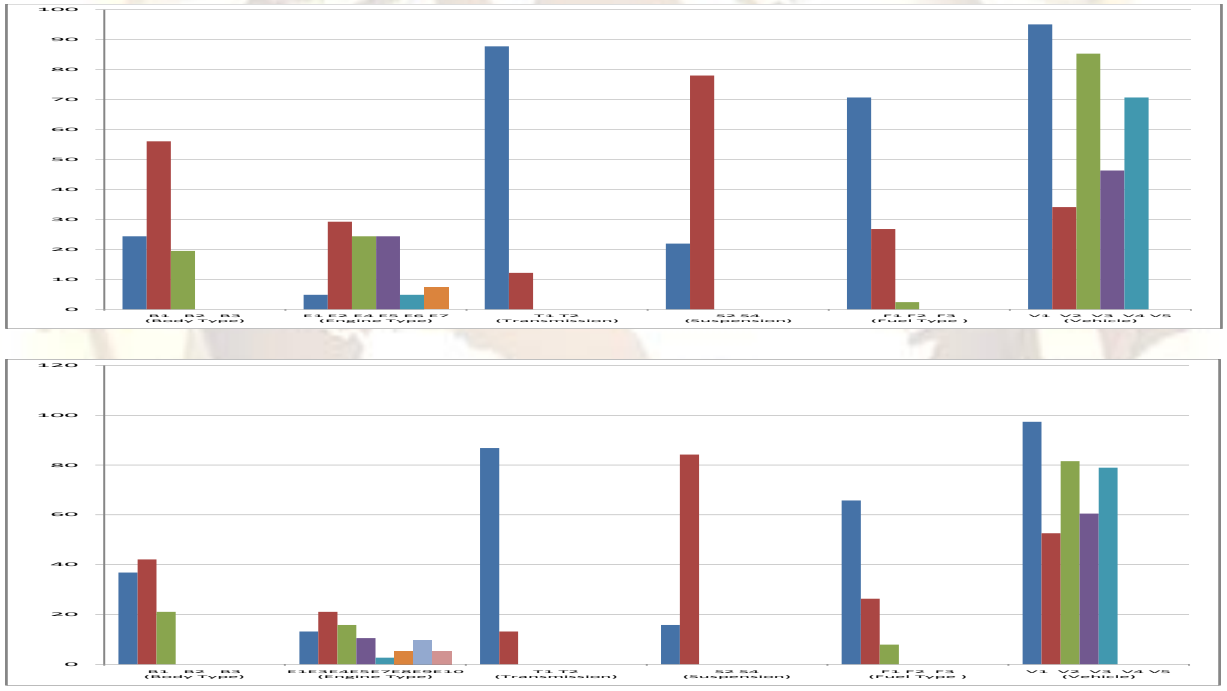
S.N	Module Options		Code	No. of models using the modules	Total no. of modules	Percentage of Utilization
(A)	(B)	(C)	(D)	(E)	(F)	(G)=E/F * 100
1	Body Type	Sedan	B1	14	38	36.84%
2		Hatchback	B2	16	38	42.10%
3		SUV/MUV	B3	08	38	21.05%
4	Engine	814CC	E1	05	38	13.15%
5		1086CC	E3	08	38	21.05%
6		1197CC	E4	06	38	15.78%
7		1248CC	E5	04	38	10.52%
8		1586CC	E7	07	38	18.42%
9		1797 CC	E8	02	38	5.26%
10		2199 CC	E9	04	38	10.52%
11		2393 CC	E10	02	38	5.26%
12	Transmission	Manual	T1	33	38	86.84%
13		Automatic	T2	05	38	13.15%
14	Suspension	Coil	S2	06	38	15.78%
15		Torsion	S4	32	38	84.21%
16	Fuel Type	Petrol	F1	25	38	65.78%
17		Diesel	F2	10	38	26.31%
18		Hybrid	F3	03	38	7.89%
19	Vehicle Features	Power Steering	V1	37	38	97.36%
20		Air Bags	V2	20	38	52.63%
21		Power Window	V3	31	38	81.57%
22		Anti-Braking System	V4	23	38	60.52%
23		Central Lock	V5	30	38	78.94%

This table represents the details of car and models for Hyundai Company. In the table all the columns are provide the details for different parameters. Column B is for selected representation of selected modules for dissertation work. Column C is for available modules options for exercise. Next Column D is for coding and symbols notification of options. Another Column E is providing the quantity ratio of modules and using among all model of car in that company. Column F Says that how many modules are using for the analyses. The last column G is providing final result of in form of percentage of utilization for each module and options. This result is helpful to evaluate the demanding and non demanding modules as the percentage values in the market between customers for that car company and car models.

4.5 Identifying important modules for using graphical representation.

This step of methodology is helpful to understand the clear positions of the modules that they are using to express the concept of effect with modular product design. The graphical representation of the modules can easily define the exact percentage of their utilization by customers. At one axis we consider the percentage of utilization of modules and at another axis name of that particular module to express the position of utilization among customers. There are some of the general benefits considered for the graphical representation of some values or mathematical equations.

1. Graphical Representations makes it easy to understand and interpret data at a glance.
2. It also helps to do comparisons among many things.
3. Moreover it makes data easy to recall.



4.6 Calculating sales and cost data for each variant for all five companies.

The effect of modularization concept can be justified by exercises of some data related to different cases of specification and equations. The exercises and analyses should be related to cost and sales factors of car with different models. The study by different cases of vehicle studies at different stage and methods can be expressed as the success and failure rates of the all exercises. The permanent results of success and failure rate are possible by a specific method of exercise of related topics. These tables are provides exact idea about demand ratio of customers in market for each car model and every automobile company. The variations are possible due to multiple available options for customers in market. The growth and loss rates are justified by following figures of sales of car in market.. These figures play an important role in selection of popular car model & company.

TABLE- (MARUTI SUZUKI SEGMENT'S-COSTS FIGURES & PERCENTAGE)

Name of Car	Model	Price	Differences in Cost from Base Model	Percentage Increase (Cost)
ALTO	LX	2,81,738	00	00.00%
	LXI	3,00,403	18,665	6.21%
	VXI	3,17,135	35,397	12.56%
	K 10	3,23,443	41,705	14.80%
	CNG	3,48,895	67,157	23.83%
A-STAR	LXI	3,82,961	00	00.00%
	VXI	4,14,200	31,239	8.16%
	ZXI	4,40,899	57,938	15.12%
	VXI AT	4,65,797	82,836	21.64%
WAGON-R	LX	3,58,152	00	00.00%
	LXI	3,87,701	29,549	8.25%
	VXI	4,13,063	54,911	15.34%
	AT	4,44,899	86,747	24.22%
	DUO	4,48,512	90,360	25.23%
RITZ	LXI	4,22,923	00	00.00%
	VXI	4,25,532	2,609	0.62%
	ZXI	4,26,485	3,562	0.85%
	LDI	5,15,245	92,322	21.82%
SWIFT	LXI	4,56,029	00	00.00%
	VXI	4,97,156	41,127	09.01%
	ZXI	5,82,268	1,26,239	27.68%
	LDI	5,64,865	1,08,836	23.86%
	VDI	6,10,157	1,54,128	33.79%
SWIFT DEZIRE	LXI	5,00,585	00	00.00%
	VXI	5,52,896	52,311	10.44%
	LDI	6,11,391	1,10,806	22.13%
	ZXI	6,44,451	1,43,866	28.73%
	AUTO.	6,77,286	1,76,701	35.29%
SX 4	VXI	7,32,223	00	00.00%
	ZXI	8,11,297	79,074	10.79%
	VDI	8,38,120	1,05,897	14.46%
	ZDI	9,28,470	1,96,247	26.80%
	ZXI AT	9,22,684	1,90,461	26.01%
ERTIGA	LXI	7,08,976	00	00.00%
	VXI	7,34,565	25,589	03.60%
	LDI	7,56,765	47,789	06.74%
	ZXI	7,87,654	78,678	11.09%
	VDI	8,76,567	1,67,591	23.63%
	ZDI	8,56,654	1,47,678	20.08%
VITARA	MT	1034567	00	00.00%
	AT	1076786	42,219	04.80%

TABLE- 4.12 (HYUNDAI SEGMENT'S- COSTS FIGURES & PERCENTAGE)

Name of Car	Model	Price	Differences in Cost from Base Model	Percentage Increase (Cost)
SANTRO XING	LX	2,93,956	00	00.00%
	GL +	3,63,503	69,547	23.65%
	GLS	3,86,141	92,185	31.36%
	GLS LPG	3,87,191	93,235	31.72%
I 10	D LITE	3,70,492	00	00.00%
	ERA	4,05,108	34,616	9.45%
	MAGNA	4,20,080	49,588	13.38%
	MAGNA + LPG	4,48,702	78,210	21.10%
	ASTA	5,45,559	1,75,067	47.25%
	KAPPA	4,72,880	1,02,388	27.64%
	SPORTZ	5,00,306	1,29,814	35.04%
	SPORTZ AT	5,27,274	1,56,782	42.32%
I 20	ERA	4,80,146	00	00.00%
	MAGNA	5,04,383	24,237	5.05%
	ASTA	6,29,848	1,49,702	31.18%
	SPORTZ	7,08,027	2,27,881	47.47%

ACCENT	EXECUTIVE	5,21,022	00	00.00%
	EXE. LPG	5,60,175	39,153	7.52%
EON	DLITE	2,78,838	00	00.00%
	DLITE +	3,07,956	29,118	10.45%
	ERA +	3,22,409	43,571	15.62%
	MAGNA	3,53,383	74,545	26.74%
	SPORTZ	3,82,290	1,03,452	37.10%
VERNA	VTVT	7,20,766	00	00.00%
	CRDI	8,44,187	1,23,421	17.12
	VTVT SX	8,59,281	1,38,515	19.21%
	CRDI AT	11,41,138	4,20,372	58.32%
	CRDI SX	12,45,124	5,24,358	72.75%
SONATA	GDI MT	16,76,908	00	00.00%
	GDI AT	17,90,765	1,13,857	16.82%
ELANTRA	S	9,23,098	00	00.00%
	BASE	9,35,456	12,358	1.33%
	SMT	9,78,675	55,577	6.02%
	SX MT	10,78,765	1,55,667	16.86%
SANTA FE	2 WD	11,89,897	00	00.00%
	4 WD	11,95,675	5,778	0.48%
	4 WD AT	12,87,675	97,778	8.21%
	4 WD VT	13,80,675	1,90,778	16.04%

In this basically price or cost of particular model is using to differentiate with another model. Firstly all models of Honda Company and their prices are listed then comparison between two models is expressed.

TABLE- (MARUTI SUZUKI SEGMENT'S-SALES FIGURES & PERCENTAGE)

Name of Car	Model	Record of Monthly Sales & Variation from Base Model (January - August) 2012																		Percentage Increase (Sales)
		January		February		March		April		May		June		July		August		September		
ALTO	LX	2556	00	2676	00	2790	00	2846	00	3046	00	3215	00	3354	00	3641	00	3876	00	00.00%
	LXI	3234	678	3345	669	3567	777	3924	1078	4241	1195	4359	1144	4412	1058	4554	913	4790	914	26.52%
	VXI	3456	222	3678	1002	3897	1107	3902	1056	4412	1366	4665	306	4792	1438	5128	1487	5476	1600	35.21%
	K 10	1245	-2211	1456	-1220	1565	-1225	1634	-1212	1845	-1201	2045	-2620	2241	-1113	2421	-1220	2565	-1311	-51.29%
	CNG	1123	-122	1265	-191	1390	-175	1436	-198	1687	-158	1754	-291	1542	-699	1925	-496	1809	-756	-56.06%
A-STAR	LXI	376	00	413	00	498	00	539	00	656	00	665	00	654	00	751	00	876	00	00.00%
	VXI	698	322	786	373	777	279	895	356	754	98	921	256	845	-191	954	-203	1012	-136	85.64%
	ZXI	409	-289	462	-324	545	-232	696	-199	554	-200	485	-438	413	432	505	449	638	-374	11.86%
	VXI AT	105	-304	113	-349	145	-400	195	-501	148	-406	189	-296	202	211	267	238	197	-441	-74.58%
WAGON-R	LX	3098	00	3243	00	3456	00	3512	00	3454	00	3624	00	3545	00	3721	00	3876	00	00.00%
	LXI	3779	681	3845	602	4671	1215	4924	1412	4852	1398	4998	1374	4715	-1170	5158	-1437	5342	-1466	21.98%
	VXI	3435	-344	3547	-298	3356	-1315	3511	-1413	3145	-1707	3645	-1353	3841	874	3012	2146	3389	1953	10.88%
	AT	897	-2538	997	-2550	876	-2480	1152	-2359	879	-2266	1241	-2404	952	2889	1123	1889	1209	-2180	-71.04%
	DUO	2676	1779	2340	1343	2431	1555	2778	1626	2954	2075	2845	1604	2754	-1802	3142	-2019	3225	-2016	-13.62%
RITZ	LXI	1876	00	1980	00	2098	00	2058	00	2256	00	2112	00	2378	00	2345	00	2245	00	00.00%
	VXI	1987	111	2154	174	2060	-35	2245	187	2187	-69	1845	1634	1542	836	1925	420	2141	104	5.58%
	ZXI	1768	-225	1890	-264	2234	174	2145	-100	2153	-34	1954	109	2021	-479	2445	-520	2257	-116	-5.91%
	LDI	2453	685	2343	453	2786	552	2542	397	2451	298	2914	960	2865	-844	2641	-196	2876	-619	65.86%
SWIFT	LXI	6035	00	6145	00	5678	00	6045	3503	6245	00	6341	00	6541	00	6504	00	6434	00	00.00%
	VXI	6345	310	5674	-471	5484	-194	6349	304	6265	20	6841	500	6142	399	6741	-237	7098	-664	5.13%
	ZXI	4132	-2213	4234	-1440	4676	-808	5034	-1315	4885	-1380	4541	-2300	4842	1300	4385	2356	5064	2034	-31.53%
	LDI	7765	3633	7546	3312	7234	2558	7348	2314	7356	2471	7902	3361	8217	-3375	8128	-3743	8356	-3292	28.66%
	VDI	7567	-202	7654	08	6876	-358	7251	-97	7314	-42	7589	-313	7745	472	7558	570	7876	480	25.35%
SWIFT DEZIRE	LXI	4908	00	4653	00	4456	00	4815	-2436	4987	00	4571	00	4685	00	5140	00	5324	00	00.00%
	VXI	5231	323	5345	692	4890	434	4717	-101	5165	178	5241	-2130	5365	680	5412	-272	5098	226	6.58%
	LDI	5432	201	5564	219	5198	308	5645	928	5254	89	5512	271	5745	380	5615	-203	5790	-692	10.67%
	ZXI	3856	-1576	4532	-1032	4003	-1195	4478	-1167	4241	-1013	4548	-964	4351	-1394	4812	803	5134	656	-21.44%
	AUTO.	3791	-95	3546	-986	3407	-596	3312	-1166	3010	1231	3254	-1294	3345	-1006	3180	1632	3564	1570	-22.75%
SX 4	VXI	232	00	256	00	303	00	341	-2971	312	00	381	00	290	00	354	00	365	00	00.00%
	ZXI	190	-42	178	-78	267	-36	265	-76	320	-08	280	101	215	-75	295	59	309	56	-18.10%
	VDI	312	80	276	98	278	11	255	-10	260	60	284	04	260	45	310	-15	331	-22	34.48%
	ZDI	303	-09	187	-89	245	-33	266	11	255	-05	285	01	251	-09	285	25	312	19	3060%
	ZXI AT	110	-193	90	-97	180	-65	125	-141	120	135	145	-140	227	-24	233	52	207	105	52.58%
ERTIGA	LXI	1787	00	1987	00	2045	00	2158	2033	1951	00	2241	00	2354	00	2545	00	2668	00	00.00%
	VXI	2234	447	2654	667	2589	544	2451	293	2354	-403	2514	273	2954	600	3145	-600	2870	-202	25.02%
	LDI	2456	222	2678	24	2908	319	2946	495	3245	-891	3456	942	3652	698	3825	680	3909	-1039	37.43%
	ZXI	2002	-454	2212	-466	2345	-563	2341	-605	1956	1289	2554	-902	2243	-1409	2425	-1400	2678	1231	12.04%
	VDI	2098	96	2132	-80	2432	87	2254	-87	2021	-65	2535	-19	2841	598	2721	-296	2543	135	17.40%
	ZDI	1532	-566	1832	-300	1765	-667	1845	-409	1556	465	1841	-694	1787	-1054	2023	698	2131	412	-14.26%
VITARA	MT	23	00	34	00	28	00	21	00	28	00	40	00	21	00	35	00	42	00	00.00%
	AT	12	-11	21	-13	27	-01	15	-06	23	-05	46	-06	12	-09	24	-11	38	-04	-47.82%

TABLE- (HYUNDAI SEGMENT'S- SALES FIGURES & PERCENTAGE)

Name of Car	Model	Record of Monthly Sales & Variation from Base Model (January - August) 2012																		Percentage Increase (Sales)
		January		February		March		April		May		June		July		August		September		
SANTRO XING	LX	1898	00	1876	00	1976	00	1913	00	1802	00	1945	00	1945	00	2059	00	2132	00	00.00%
	GL +	1676	-222	1743	-133	1767	-209	1845	-68	1896	94	1541	-404	2014	69	2118	59	2456	324	-11.70%
	GLS	1987	311	1912	169	2109	342	1842	-03	1841	-55	1945	404	1956	-58	2413	295	2343	-113	4.68%
	GLS LPG	1387	-600	1490	-422	1481	-628	1342	-500	1341	-500	1520	-425	1642	-314	1452	961	1387	-956	-26.92%
I 10	D LITE	1876	00	1765	00	2212	00	2045	00	2154	00	2245	00	2541	00	2254	00	1909	00	00.00%
	ERA	2067	191	1676	-89	1909	-303	1984	-61	1784	-370	2142	-103	2212	-329	2154	-100	2343	434	10.18%
	MAGNA	1954	-113	1976	300	1987	-78	1548	-436	1981	197	2045	-97	2145	-67	2015	-139	1960	-383	4.15%
	MAGNA+L	1732	-222	1876	-100	1909	502	1642	94	1745	-236	1984	-61	2145	0	1639	-376	2260	300	-7.68%
	ASTA	2765	1033	2654	778	2411	-1255	2580	938	2810	1065	2545	561	2514	369	2984	1345	2676	416	47.38%
	KAPPA	1532	-1233	1209	-1445	1156	-21	1054	-1526	954	-1856	1125	-1420	1345	-1169	1645	-1339	1777	-899	-18.34%
	SPORTZ	1456	-76	1565	356	1135	-147	1145	91	1254	300	1654	529	1684	339	1843	198	2130	353	-22.38%
	SPTZ AT	789	-667	676	-889	988	988	954	-191	854	854	1054	-600	954	-730	1121	-722	909	-1221	-57.95%
I 20	ERA	2343	00	2765	00	2567	00	2504	00	2451	00	2354	00	2154	00	2545	00	2666	00	00.00%
	MAGNA	2576	233	1765	-1000	1870	-697	1548	-956	1452	-999	1845	-509	1745	-409	1945	-600	1890	-776	9.95%
	ASTA	2634	58	2133	368	2455	585	1974	426	1874	422	1874	29	2546	801	2451	506	2030	140	12.41%
	SPORTZ	1989	-645	1902	-231	2221	-234	2254	280	2545	671	2354	480	2154	-392	2058	-393	2312	282	-15.10%
ACCENT	EXE.	190	00	202	00	228	00	214	00	325	00	210	00	145	00	205	00	210	00	00.00%
	EXE LPG	125	-65	110	-92	154	-74	124	-90	110	-215	134	-76	190	45	185	-20	188	-22	-35.90%
EON	DLITE	2987	00	2787	00	3030	00	3012	00	2842	00	2345	00	2845	00	2645	00	2909	00	00.00%
	DLITE +	3098	111	3121	334	3321	291	3045	33	3114	272	3214	869	3047	202	3254	609	3334	425	3.72%
	ERA +	3102	04	3118	-03	3225	-96	3212	167	3046	-68	3345	131	3168	121	3354	100	3424	90	3.85%
	MAGNA	2890	-212	2202	-916	2432	-793	3054	-158	1954	-1092	2345	-1000	2124	-1044	2512	-842	2765	-659	-3.25%
	SPORTZ	1321	-1569	1568	-634	1678	-754	1045	-2009	1654	1654	1554	-791	1654	-470	1298	-1214	1767	-998	-55.77%
VERNA	VTVT	1445	00	1565	00	1121	00	1245	00	1542	00	2541	00	1549	00	1654	00	1990	00	00.00%
	CRDI	1667	222	1876	311	1990	869	1842	597	1645	103	1451	-1090	1478	-71	1847	193	1656	-334	15.36%
	VTVT SX	1987	320	1765	-111	1880	-110	1658	-184	1784	139	1984	533	1845	367	1984	137	2121	465	37.50%
	CRDI AT	989	-998	888	-877	787	-1093	1054	-604	941	-843	1124	-860	1298	-547	841	-1143	1112	-1009	-31.55%
	CRDI SX	1010	21	1321	433	1123	336	954	-100	1045	104	984	-140	1045	-253	1142	301	1333	-1306	-30.10%
SONATA	GDI MT	35	00	31	00	18	00	20	00	41	00	23	-961	30	-1015	45	-1097	27	-09	00.00%
	GDI AT	11	-24	15	-16	21	03	12	-08	15	-26	21	-2	22	-8	32	-13	18	-09	-68.58%
ELANTRA	S	112	00	117	00	211	00	221	00	151	00	150	00	112	00	204	00	189	00	00.00%
	BASE	90	-22	98	-19	70	-141	106	-115	154	03	105	-45	186	74	151	-53	211	22	-19.65%
	SMT	181	91	178	80	176	-91	245	139	149	-05	142	37	178	-8	202	51	115	-96	61.60%
	SX MT	93	-88	87	-91	85	-64	095	-150	254	105	184	42	208	30	247	45	190	75	-65.18%
SANTA FE	2 WD	15	00	23	00	21	00	12	00	25	00	11	00	22	00	19	00	33	00	00.00%
	4 WD	11	-04	34	11	34	13	23	11	13	-12	05	-6	10	-12	17	02	21	-12	-26.66%
	4 WD AT	14	-01	11	-23	14	-20	25	02	19	06	13	8	08	-2	35	18	14	-07	-6.66%
	4 WD VT	23	09	10	-01	12	-02	22	03	32	13	26	13	21	13	31	04	20	06	53.33%

4.7 Identifying the cost of each module based on cost difference and judgmental/experience of professionals

In this last section, we are identifying the cost of each module from the all models and their cost.To evaluate the exact value of module two types of values will be used. One of them is judgmental value by some of experts and professionals and second one is by difference between costs of models of same companies. Some of small parts are gathered after that a final product is produced in manufacturing process. This practice will be done for all companies with similar way and than modules will be comparing in next process easily.

TABLE- (MARUTI SUZUKI SEGMENT'S-Value of each module)

Name of Car (A)	Options (B)	Value of cost difference (C) (D)		Judgmental values (E) (F)		%age Variation (G)	Arithmetic mean for exact value (H) = (D) + (F) / 2
		In Amount	In %age	In Amount	In %age		
ALTO	V1=(LXI – LX)	18665	6.22	25000	8.32	0.25	7.27%
	V3=(VXI – LXI)	16732	5.28	18000	5.67	0.06	5.46%
	V5=(VXI – LXI)	6308	5.28	15000	4.72	0.11	5.00%
	V4=(K10 – VXI)	6308	1.95	10000	3.09	0.36	2.52%
	F3=(CNG-K10)	25452	7.29	30000	8.60	0.15	7.94%
A - STAR	V5=(VXI – LXI)	31239	7.54	10000	2.42	2.11	4.98%
	V4=(ZXI – VXI)	26699	6.05	20000	4.54	0.33	5.29%
	V2=(ZXI – VX AT)	24898	5.35	15000	3.22	0.66	4.28%
	T2=(ZXI -VX AT)	24898	5.35	20000	4.72	0.13	5.04%
WAGON R	V1=(LXI -LX)	29549	7.62	20000	5.15	0.47	6.38%
	V3=(VXI -LXI)	30362	7.35	25000	6.05	0.21	6.70%
	T2=(AT- VXI)	51836	11.14	50000	10.75	0.03	10.95%
	F2=(AT- VXI)	51836	11.14	60000	13 .48	0.17	12.31%
	V2=(AT- VXI)	51836	11.14	20000	4.49	1.48	7.81%
	V4=(AT- VXI)	51836	11.14	40000	5.98	2.16	10.06%
	V5=(AT- VXI)	51836	11.14	15000	3.37	2.30	7.25%
	F3=(DUO-AT)	23613	4.83	20000	4.09	1.80	8.92%
RITZ	V5=(LXI -VXI)	5609	1.30	50000	1,16	1.20	2.46%
	V4=(VXI - ZXI)	37953	8.13	30000	6.43	0.26	7.28%
	V2= (VXI - ZXI)	37953	8.13	20000	4.68	0.73	6.40%
	E5=(ZXI- LDI)	48760	9.46	40000	7.76	0.21	8.61%
	F2= (ZXI- LDI)	48760	9.46	50000	9.70	0.02	9.58%
SWIFT	V3= (LXI –VXI)	41127	8.27	20000	4.02	1.35	6.74%
	V5= (LXI- VXI)	41127	8.27	25000	5.02	0.64	6.64%
	V4=(VXI- ZXI)	35112	6.60	25000	4.70	0.40	5.65%
	E5=(ZXI -LDI)	32597	5.78	30000	5.32	0.08	5.55%
	F2=(ZXI -LDI)	32597	5.78	40000	7.08	0.18	6.43%
	V2=(VDI -LDI)	45292	8.02	20000	3.52	1.26	5.78%
	V4=(VDI -LDI)	45292	8.02	40000	7.08	0.13	7.55%
	V5=(VDI- LDI)	45292	8.02	15000	2.65	2.02	5.33%
SWIFT DZIRE	V5=(LXI -VXI)	42311	7.80	35000	6.45	0.20	7.12%
	E5=(VXI - LDI)	68495	11.20	50000	8.18	0.36	9.70%
	F2=(VXI - LDI)	68495	11.20	35000	5.72	0.95	8.46%
	V4=(VXI - LDI)	68495	11.20	30000	4.90	1.28	8.05%
	V2=(LDI- ZXI)	33060	5.13	30000	4.66	0.10	4.90%
	E4=(LDI- ZXI)	33060	5.13	40000	6.20	0.17	5.66%
	T2=(ZXI- AT)	45835	6.65	40000	5.80	0.14	6.22%
	F1=(ZXI- AT)	45835	6.65	30000	4.43	0.50	5.54%
SX 4	V4=(VXI- ZXI)	49074	6.05	35000	4.32	0.40	5.18%
	V5=(VXI-ZXI)	49074	6.05	15000	1.84	2.28	3.94%
	E5=(ZXI-VDI)	46823	5.45	45000	5.25	0.03	5.35%
	F2=(ZXI-VDI)	46823	5.45	30000	3.57	0.52	4.51%
	V4=(VDI-ZDI)	35350	3.95	30000	3.35	0.17	3.65%
	T2=(ZXI AT- ZDI)	49,214	5.22	40000	4.25	2.22	4.73%
	E7=(ZXI AT- ZDI)	49214	5.22	50000	5.38	0.02	5.30%
	V2=(ZXI AT- ZDI)	49214	5.22	20000	2.15	1.42	3.68%
	V5=(LXI-VXI)	25589	3.48	20000	2.72	0.28	3.10%
	E5=(VXI- LDI)	22200	2.93	20000	2.65	0.10	2.79%
	F2=(VXI-LDI)	22200	2.93	35000	4.62	0.36	3.77%
	V2=(VXI-LDI)	22200	2.93	20000	2.64	0.10	2.78%

ERTIGA	V4=(LDI-ZXI)	30889	3.92	25000	3.18	2.23	3.55%
	E6=(LDI-ZXI)	30889	3.92	50000	6.35	0.38	5.13%
	F1=(LDI-ZXI)	30889	3.92	25000	3.17	0.23	3.54%
	F2=(ZXI- VDI)	38913	4.70	30000	3.62	0.29	4.16%
	E5=(ZXI- VDI)	38913	4.70	45000	5.13	0.08	4.91%
	V2=(VDI-ZDI)	30087	3.52	25000	2.92	0.20	3.22%
VITARA	T2=(AT-MT)	42219	4.85	40000	3.72	0.30	4.28%
	F2=(AT-MT)	42219	4.85	50000	4.64	0.04	4.74%

TABLE-(HYUNDAI SEGMENT'S -Value of each module)

Name of Car (A)	Options (B)	Value of cost difference (C) (D)		Judgmental values (E) (F)		%age Variation (G)	Arithmetic mean for exact value (H) = (D) + (F) / 2
		In Amount	In %age	In Amount	In %age		
SANTRO XING	V1= (LX - GL +)	69574	19.13	25000	6.87	1.78	13.00%
	V3= (LX - GL +)	69547	19.13	15000	4.12	3.64	11.63%
	F3= (LX - GL +)	69547	19.13	50000	13.75	0.39	16.44%
	V5= (GL+ - GLS)	22638	5.86	20000	5.17	0.13	5.52%
	V4=(GLS - GLS LPG)	1050	0.28	25000	6.46	0.95	3.37%
	F1 (GLS – GLS LPG)	1050	0.28	60000	15.50	0.98	7.90%
I 10	V3= (D LITE – ERA)	34616	8.54	20000	4.94	0.72	6.74%
	V5=(ERA – MAGNA)	14972	3.56	20000	4.76	0.25	4.16%
	V2=(MAGNA – M+ LPG)	28622	6.37	25000	5.57	0.14	5.97%
	V4=(MAGNA – M+ LPG)	28622	6.37	40000	8.91	0.28	7.64%
	F3=(M + LPG – ASTA)	96857	17.75	30000	5.50	2.23	11.62%
	E3=(M + LPG – ASTA)	96857	17.75	50000	9.16	0.94	13.45%
	V4=(M + LPG – ASTA)	96857	17.75	20000	3.66	3.85	10.70%
	F1=(ASTA – KAPPA)	72679	13.32	50000	9.10	0.45	11.24%
	T2= (SPORTZ - SPZ. AT)	26968	5.11	50000	9.48	0.46	7.30%
	V2= (SPORTZ - SPZ. AT)	26968	5.11	20000	3.79	0.35	4.45%
I 20	V3=(ERA – MAGNA)	24237	4.80	30000	5.94	0.19	5.37%
	V5=(MAGNA – ASTA)	125465	19.92	35000	5.55	2.59	12.73%
	E5=(MAGNA – ASTA)	125465	19.92	75000	11.90	0.67	15.91%
	V4=(ASTA – SPORTZ)	78179	11.04	40000	5.65	0.95	8.34%
ACCENT	F3=(EX. - EX.LPG)	39153	6.99	60000	10.71	0.34	8.85%
EON	V3=(DLITE – DLITE +)	29118	9.45	20000	6.49	0.45	7.97%
	V5=(DLITE + - ERA +)	14453	4.48	15000	4.65	0.03	4.56%
	V4 = (MAGNA- SPORTZ)	28907	7.56	25000	6.54	0.15	7.05%
VERNA	F2=(VTVT – CRDI)	123421	14.62	60000	7.11	1.06	10.86%
	E 7=(CRDI- VTVT SX)	15094	17.56	60000	6.98	1.52	12.27%
	T2=(VTVT SX – CRDI AT)	281880	24.69	150000	4.38	4.64	14.66%
	F2=(VTVT SX – CRDI AT)	281880	24.69	150000	4.38	3.00	10.97%
	T1=(CRDI AT – CRDI SX)	103986	8.35	40000	3.21	1.60	8.28%
	F1=(CRDI AT – CRDI SX)	103986	8.35	35000	2.81	1.97	5.58%
SONATA	T2=(GDI MT – GDI AT)	113857	6.35	80000	4.47	0.42	5.41%
ELANTRA	E7=(S – BASE)	12358	13.21	70000	7.48	077	10.34%
	F2 = (S- BASE)	12358	13.21	50000	5.34	1.47	9.27%
	E7=(SMT – SX MT)BASE	100090	9.28	75000	6.95	0.33	8.12%
	F1=(SMT – SX MT)	100090	9.28	80000	5.56	0.66	7.42%
SANTA FE	T2 =(4 WD – 4WD AT)	92000	7.14	60000	4.65	0.53	5.90%

There are three different kind of values are identified through this table, which makes an appropriate result for module option in car. After the last step of methodology to identifying cost of each module with the help of judgmental values and experiences valuation for finding the effect of modular product design on manufacturing process with proper evaluation, some of other results are generated for further exercises and studies. The information about a particular module of any car company for any model can be understood also. The last column is important because the ratio between cost figure in percentage and sales figure in percentage is calculated.

TABLE- (MARUTI SUZUKI SEGMENT'S-Overall valuation of modules)

Name of Car (A)	Module (B)	%age of Utilization (C)	%age Increase in Cost (D)	%age Increase in Sales (E)	Ratio of %age Increase in Sales & Cost (F)
ALTO	V1	7.27%	6.21%	26.52%	4.27%
	V3	5.46%	12.56%	35.21%	6.44%
	V5	5.00%	12.56%	35.21%	6.44%
	V4	2.52%	14.80%	-51.29%	-3.46%
	F3	7.94%	23.83%	-56.06%	-.2.36%
A-STAR	V5	4.98%	8.16%	85.64%	10.50%
	V4	5.29%	15.12%	11.86%	0.78%
	V2	4.28%	21.64%	-74.58%	-3.45%
	T2	5.04%	21.64%	-74.58%	-3.45%
WAGON-R	V1	6.38%	8.25%	21.98%	2.66%
	V3	6.70%	15.34%	10.88%	0.70%
	T2	10.95%	24.22%	-71.04%	-2.94%
	F2	12.31%	24.22%	-71.04%	-2.94%
	V2	7.81%	24.22%	-71.04%	-2.94%
	V4	10.06%	24.22%	-71.04%	-2.94%
	V5	7.25%	24.22%	-71.04%	-2.94%
	F3	8.92%	25.23%	-13.62%	-0.54%
RITZ	V5	2.46%	0.62%	5.58%	9.00%
	V4	7.28%	0.85%	-5.91%	-6.95%
	V2	6.40%	0.85%	-5.91%	-6.95%
	E5	8.61%	21.82%	65.86%	3.02%
	F2	9.58%	21.82%	65.86%	3.02%
SWIFT	V3	6.74%	09.01%	5.13%	0.56%
	V5	6.64%	09.01%	5.13%	0.56%
	V4	5.65%	27.68%	-31.53%	-1.14%
	E5	5.55%	23.86%	28.66%	1.20%
	F2	6.43%	23.86%	28.66%	1.20%
	V2	5.78%	33.79%	25.35%	0.70%
	V4	7.55%	33.79%	25.35%	0.70%
	V5	5.33%	33.79%	25.35%	0.70%
SWIFT DEZIRE	V5	7.12%	10.44%	6.58%	0.64%
	E5	9.70%	22.13%	10.67%	0.48%
	F2	8.46%	22.13%	10.67%	0.48%
	V4	8.05%	22.13%	10.67%	0.48%
	V2	4.90%	28.73%	-21.44%	-0.75%
	E4	5.66%	28.73%	-21.44%	-0.75%
	T2	6.22%	35.29%	-22.75%	-0.65%
	F1	5.54%	35.29%	-22.75%	-0.65%
SX 4	V4	5.18%	10.79%	-18.10%	-1.68%
	V5	3.94%	10.79%	-18.10%	-1.68%
	E5	5.35%	14.46%	34.48%	2.38%
	F2	4.51%	14.46%	34.48%	2.38%
	V4	3.65%	26.80%	30.60%	1.15%
	T2	4.73%	26.01%	52.58%	2.02%
	E7	5.30%	26.01%	52.58%	2.02%
	V2	3.68%	26.01%	52.58%	2.02%
ERTIGA	V5	3.10%	03.60%	25.02%	6.95%
	E5	2.79%	06.74%	37.43%	5.55%
	F2	3.77%	06.74%	37.43%	5.55%
	V2	2.78%	06.74%	37.43%	5.55%
	V4	3.55%	11.09%	12.04%	1.08%
	E6	5.13%	11.09%	12.04%	1.08%
	F1	3.54%	11.09%	12.04%	1.08%
	F2	4.16%	23.63%	17.40%	0.74%
	E5	4.91%	23.63%	17.40%	0.74%
	V2	3.22%	20.08%	-14.26%	-0.72%
VITARA	T2	4.28%	00.00%	00.00%	00.00%
	F2	4.74%	04.80%	-47.82%	-9.96%

TABLE- (HYUNDAI SEGMENT'S- Overall valuation of modules)

Name of Car (A)	Module (B)	%age of Utilization (C)	%age Increase in Cost (D)	%age Increase in Sales (E)	Ratio of %age Increase in Sales & Cost (F)
SANTRO XING	V1	13.00%	23.65%	-11.70%	-0.50%
	V3	11.63%	23.65%	-11.70%	-0.50%
	F3	16.44%	23.65%	-11.70%	-0.50%
	V5	5.52%	31.36%	4.68%	0.15%
	V4	3.37%	31.72%	-26.92%	-0.85%
	F1	7.90%	31.72%	-26.92%	-0.85%
I 10	V3	6.74%	9.45%	10.18%	1.08%
	V5	4.16%	13.38%	4.15%	0.32%
	V2	5.97%	21.10%	-7.68%	-28.78%
	V4	7.64%	21.10%	-7.68%	-28.78%
	F3	11.62%	47.25%	47.38%	1.02%
	E3	13.45%	47.25%	47.38%	1.02%
	F1	11.24%	27.64%	-18.34%	-0.67%
	V4	6.73%	35.04%	-22.38%	-0.64%
	T2	7.30%	42.32%	-57.95%	-1.34%
	V2	4.45%	42.32%	-57.95%	-1.34%
I 20	V3	5.37%	5.05%	9.95%	1.98%
	V5	12.73%	31.18%	12.41%	0.40%
	E5	15.91%	31.18%	12.41%	0.40%
	V4	8.34%	47.47%	-15.10%	-0.32%
ACCENT	F3	8.85%	7.52%	-35.90%	-4.78%
EON	V3	7.97%	10.45%	3.72%	0.36%
	V5	4.56%	15.62%	3.85%	0.25%
	V4	7.05%	37.10%	-55.77%	-1.50%
VERNA	F2	10.86%	17.12%	15.36%	0.90%
	E7	12.27%	19.21%	37.50%	1.96%
	T2	14.66%	58.32%	-31.55%	-0.55%
	F2	10.97%	58.32%	-31.55%	-0.55%
	T1	8.28%	72.75%	-30.10%	-0.42%
	F1	5.58%	72.75%	-30.10%	-0.42%
SONATA	T2	5.41%	16.82%	-68.58%	-4.08%
ELANTRA	E7	10.34%	1.33%	-19.65%	-14.77%
	F2	9.27%	1.33%	-19.65%	-14.77%
	E7	8.12%	16.86%	-65.18%	-3.86%
	F1	7.42%	16.86%	-65.18%	-3.86%
SANTA FE	T2	5.90%	8.21%	-6.66%	-0.81%

CAR COMPANIES & MODELS		BODY TYPE OPTIONS			ENGINE TYPE OPTIONS										TRANSM. OPTIONS		SUSPENSION OPTIONS					FUEL TYPE OPTIONS			VEHICLE FEATURES OPTIONS				
		B1	B2	B3	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	T1	T2	S1	S2	S3	S4	S5	F1	F2	F3	V1	V2	V3	V4	V5
MARUTI	ALTO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.94	7.27	NA	5.46	2.52	5.00
	A-STAR	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.28	NA	5.29	4.98
	WAGON-R	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	10.95	NA	NA	NA	NA	NA	NA	12.31	8.92	6.38	7.81	6.70	10.06	7.25
	RITZ	NA	NA	NA	NA	NA	NA	NA	8.61	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	9.58	NA	NA	6.40	NA	7.28	2.46
	SWIFT	NA	NA	NA	NA	NA	NA	NA	5.55	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.43	NA	NA	5.78	6.74	6.60	5.98
	SWIFT DZIRE	NA	NA	NA	NA	NA	NA	5.66	9.70	NA	NA	NA	NA	NA	NA	6.22	NA	NA	NA	NA	NA	5.54	8.46	NA	NA	4.90	NA	8.05	7.12
	SX 4	NA	NA	NA	NA	NA	NA	NA	5.35	NA	5.30	NA	NA	NA	NA	4.73	NA	NA	NA	NA	NA	NA	4.51	NA	NA	3.68	NA	4.41	3.94
	ERTIGA	NA	NA	NA	NA	NA	NA	NA	3.85	5.13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.54	3.96	NA	NA	3.00	3.55	NA	3.10
	VITARA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.28	NA	NA	NA	NA	NA	NA	4.74	NA	NA	NA	NA	NA	NA
HYUNDAI	SANTRO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.90	NA	16.44	13.00	NA	11.63	3.37	5.52
	I 10	NA	NA	NA	NA	NA	13.45	NA	NA	NA	NA	NA	NA	NA	NA	7.30	NA	NA	NA	NA	NA	11.24	NA	11.62	NA	5.21	6.74	7.19	4.16
	I 20	NA	NA	NA	NA	NA	NA	NA	15.91	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5.37	8.34	12.73
	ACCENT	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.85	NA	NA	NA	NA	NA
	EON	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.97	7.05	4.56
	VERNA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.87	NA	NA	NA	828	14.66	NA	NA	NA	NA	NA	5.58	10.91	NA	NA	NA	NA	NA	NA
	SONATA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5.41	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	ELANTRA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	10.34	NA	NA	NA	NA	NA	NA	NA	9.23	9.27	NA	NA	NA	NA	NA	NA
	SANTA FE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5.90	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE- FINAL SELECTED MODULES CAR COMPANIES

MODULES	No. of Module (Maruti)	No. of Module (Hyundai)
	08	07
POWER STEERING (V1)	√	√
MANUAL TRANSMISSION (T1)	√	√
POWER WINDOW(V3)	√	√
TORSION SUSPENSION(S4)	√	√
PETROL FUEL TYPE(F1)	√	√
CFENTRAL LOCK(V5)	√	√
HATCHBACK BODY (B1)	√	×
ANTI BRAKING SYSTEM(V4)	√	√
COIL SUSPENSION(S2)	×	×
DIESEL TYPE(F2)	×	×
ANTI ROLL SUSPENSION(S5)	×	×
AIR BAGS (V2)	×	×

Some of the pareto charts are discussed above, These pareto charts are draw for all discussed automobile Companies. In these five pareto charts all modules of utilization are includes. The modules according the table of utilization for each module are considered. There are three different axis are use n the diagram. The value in percentage of each module is also considered as value in table of utilization for each module.

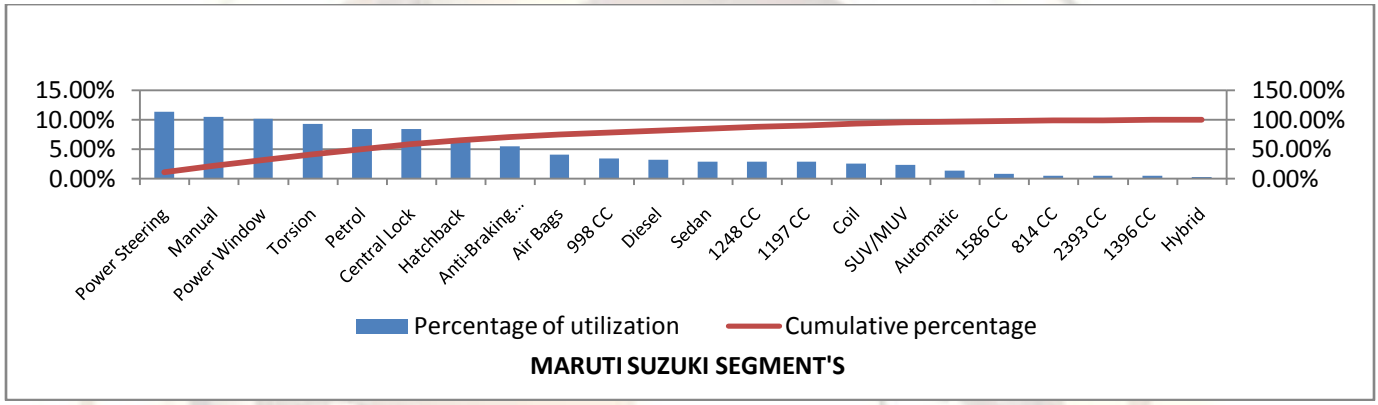


Figure (PARETO CHART- MARUTI SUZUKI SEGMENT'S)

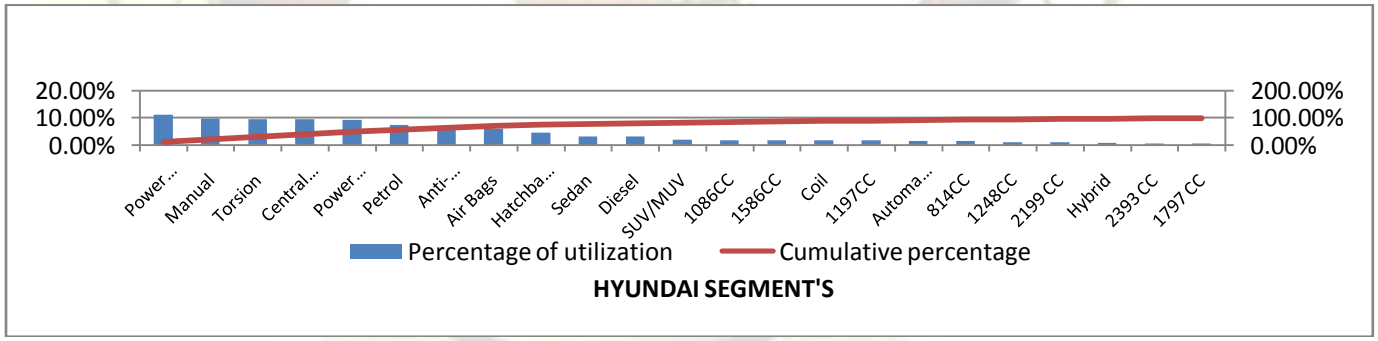


Figure (PARETO CHART- HYNDAI SEGMENT'S)

As we noticed in previous tables, some of the modules are common in different types of models. The all kind of modules like, body type, engine types, transmission types, suspension and others are available in all models. The compilation of all demanding modules according previous tables in important to recognize the final desirable modules of customers. This exercise will be affected for all car companies with all models. The overall results of previous five tables will be listed similarly in a table.

The non-demanding or non using modules are denoted by NA. The discussed table represents the demanding modules after draw a pareto chart for all five companies. The all modules of every car company with are discussed in pareto chart. This pareto chart developed with combination all frequencies and values of modules in percentages. This table provides final result after all methodological exercises and this is based on demanding ratio of modules. The selected modules of

all companies are based in variation of draw line pareto chart, which shows the decreasing values from a specific point. The module before those points are considered is this table of all companies and remaining is dropped. The modules are short listed due to finalize the demanding modules by customers in market. The non-demanding are left but their presence important also. The discussed modules are considered to shows that following modules are mainly discussed and accept by customers in selection of an automobile module. These modules can be change due to changes according car company's results are varies due to different strategies about modules of automobile companies for their different models.

FINDING AND RESULTS

These points can be considered as results for customers of market to sort out their problems and confusions easily. Some of other results and conclusions are also discovered after exercises of methodology. Then finally to fulfill the purpose of expression and discussion for the remaining other results of all exercise in methodology can be listed through following points.

(1) Due to the exercises in methodology of dissertation, a benefit generate automatically that the automobile modules (car) and their specifications at the time of assembling as well as modeling and in other process can be defined as a mathematical equation easily. (2) The selection at the time of production and assembling of different automobile products can be very easy and comfortable for automobile companies after expression of modules and options as mathematical equations. The expression of automobile modules in mathematical coding defined exact option.(3) Another result or finding of this methodology in respect of automobile modules is that the all types of modules can be calculated in form of percentage ratio due to their utilization by customer in market, which provides some appropriate results for changes in strategies and process for modularity and production by automobile companies(4)With the help of graphical representation, the graphical values of modules in figures of different modules for all discussed automobile companies provides us some details of their choice ratio and demands between customers so effectively. The choice and demand ratio for a particular module can be identified quickly between all modules(5)The modules of automobile of different car companies are having different values of costs.Thatsby these modules are increasing the overall cost of a car in market. The differences between costs of modules are calculated easily and effectively with the help of a step of methodology. (6) Another finding of the methodology is related to justification of module values with a special and new process of arithmetic mean of mathematical language, which provides us the almost similar values of a car modules for any car company if verifies from market (7) One of the results discovers that costs are increase not only due to increasing in number of modules but behavior and type of modules are also important parameters(8) These analysis generate a special result and hypothesis which says that the choice of customers in market about options for various modules of automobile are also change with changes in car company. The variations in choice by customers are also possible with reputation and reliability of automobile company in this industry due to effectiveness of modules (9) The accurate value of a module in any model of car can be calculated easily by comparing study from base model. This creates the comparison between all options and modules from base model of that specific selected car. The differences are major and minor can be decided in perfect satisfactory way

DISCUSSIONS & FUTURISTIC LOGICS

In the whole study to understand the effect and evaluation of modular product design on manufacturing processes some of the new logics and ideas are generated after many exercises. These all ideas and results can be useful for Indian automobile industry with market as well as customers. This part of dissertation is also provides enough good solution for consumer of products/modules respectively. This chapter of dissertation is involved some of the discussion after whole exercise on automobile module with some useful logics in respect of some additional points. The conceptual discussions and different futuristic logics are important to know for Indian automobile industry after this case study.

Some new ideas and results of this case study provide information about automobile modules and options differently in details. This case study totally based on data's of vehicles of all automobile companies. The several steps of methodology involved the different methods and ideas for finding the required solutions of discussed problems. The methodology proves the efforts about modularity concept with some useful solutions and outputs. They all cannot be useful for future logics but important to discuss for more up gradation of products/modules with various options for related field. The vast field and complicated issues of this industry can be summarized through the object of this chapter.

(I) Modular products are selected by customers according reviews of market (II) The demand and choice is vary according cost/value of product in market by customer (III) The sale factors and figures are directly related to modularization of products(IV)

The common popular modules/products are provide by all automobile companies (V) The values of some modules neither low nor high according automobile company (VI) Utilization of modules also depends on model of car in market (VII) A car and its combinations can be discuss as a mathematical equations (VIII) Conventional modules are still popular for all automobile companies in vehicles(IX) Vehicles costs/values can be customize by modularization/manipulation in module(X) Valuation of a specific module from combination of modules.

CONCLUSIONS

In the discussion part after complete exercise on related topic of dissertation, the final results and some conclusion are consider. The overall summary of this dissertation can be including in this chapter. The contents of this chapter are based on whole methodology for finding the results and solutions of discussed problems also. The objectives of this research generate some new ideas and solutions for automobile industry. These all points can be helpful for customer and customization for vehicles for automobile companies. First of all, the analysis of research says that demands of the modules are change according the need of customer. The several types of modules are available in market. Those all modules are selected by customer only. The conversion in their selection is focused by different companies. One of the conclusions after whole exercise says that the modularization in modules/products can change the choice of customer very easily. This conversion can be possible when another is providing additional features in nominal costs. So optimization for product customization in market for customers is very essential. Another conclusion is related to sort out the confusion in selection of any module, if it is a modular product also. The customer seems confused in choice of module and demand in features. The differences in demand and choice factor can be solved by previous record of sales and result of module as performance. The performance results are depends on high choice module in market. It proves that this particular module is demanded and satisfactory in performance. As we know that, the purpose of this dissertation indicated towards the direction of modularity acceptance and effectiveness in products for manufacturing in market. This can be understood easily by comparison between conventional and modular products. The results are says that modularity is only the choice of customer in market for all companies and with all segments of automobile industry. One of the important conclusions about modules noticed that they are changed in choice and demand according name of automobile company. Some of modules are best selling products for one company and some other is important for another company. It varies due to the different results in performance and efficiency of module/product. This is based on manufacturing concept and different companies having different strategies for modular design and assembling of product for customer and market.

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