

An Empirical Study of Product Design for New Product Development with Special Reference to Indian Mobile Industry

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Abstract: The form and function of a product is the subject of product design. The development of the form consists of deciding what the product looks like, that is, how the product is shaped and what is created. Functional layout discusses the function and execution of the material. One way for manufacturers to attract consumers and achieve a difference is by designing the configuration of elements that form a new product collectively. This study is an empirical study of product design which is important for a new product to be presented. In the current context, a manufacturer of mobile phones constantly considers the features that they should incorporate into mobile telephones that are completely different from those of other manufacturers. This research focuses entirely on mobile telephony, which in the last few years has changed dramatically. This study also analyzes the views of the participants who agree that the design of a product plays a very important role in the development of a new product.

Keywords: Product Design, New Product Development, Mobile Phone Industry, Form Design and Functional Design.

I. INTRODUCTION

Brand development is intended for developing a fresh product for its consumers to be marketed by a company. The cohort and creation of concepts via a process which pointers to fresh products is very large, coefficient and successful. It is therefore an important aspect of the development of new goods.

Because a con sensually accepted definition is lacking, which adequately represents a wide-ranging topic. There is a need for two distinct but interdependent interpretations. One should describes the product design explicitly with respect to the object and the other describes the product design process with regard to this item.

The product design consists of an object set of characteristics, consisting of its discreet properties (i.e., the aesthesis of the tangible good), its function (i.e. its function) and its integral form and function holistic properties.

The cycle of product design is the collection of strategic and tactical practices used to create a product design from idea generation to marketing. Product designers routinely conceptualize and analyze ideas and make them concrete inventions and goods. The task of the product designer is to combine art, science and technology to produce new goods for use by people. Digital tools have enabled their emerging function and empower designers to collaborate, visualise, evaluate, model 3D and actually develop concrete concepts which might have taken on countless exertion previously.

The design of the product is often mistaken with industrial design (and definitely overlaps with it) and is now a broad term for the design of goods, technology and physical objects. Industrial design is about putting creative shape and functionality together for mass producing goods which are usually associated with craftsmanship and ergonomics. Certain dimensions of engineering design covers product design and industrial design, in particular when usability and usefulness problems are at stake (e.g. problem resolution), although these constraints are not always apparent.

What is the nature of product design?

The responsibilities and activities of product design include various tactics, which are as follows:

Transcribing the needs of consumers into consumer requirements

Developing new products

Quality goals Formulation

Cost goals formulation

Prototype design and testing

Specifications of documentation

Factors influencing Product Design

There are lots of factors which influence the product design directly or indirectly. These factors are as follows:

Customers Desires: Designers need to find out exactly what the customers are looking for to ensure that the products are customer-friendly.

Function / form trade off: Development must mix efficiency and aesthetics with the right balance between both.

Product Quality: The quality of the product depends on design quality and compliance reliability.

Process Capability: The product design also depends on the process capability of the machines and equipment.

Influence on prevailing products: The use of common parts and components, current manufacture and delivery methods and the integration of new manufacturing technology with old one, must be taken on account of the new product designs in the replacement of existing product designs so that costs are held to minimum for implementation of the changes.

New Product Development

A new product is genuinely innovative and differs greatly from the other goods already in existence. Figure 1 demonstrates the following seven phases in new product development:

Need Identification

The recognition of needs must be followed by the production of ideas. The development of new products starts with a concept. Concept is created by clients, the top managers of the sales, manufacturing or technology departments.

Advance Product Planning

This phase comprised preliminary market analysis and the development of an alternative product definition that clarifies functional and logistical growth, transportation, distribution and handling requirements.

Advance Design

The next phase of the new product development involves the advance design which includes a detailed study of technical feasibility and the identification of trade off product design by basic and applied researchers. Enticing design approaches are tested by crucial criteria to see whether technical aid is needed to study, explore, model physically and test prototypes.

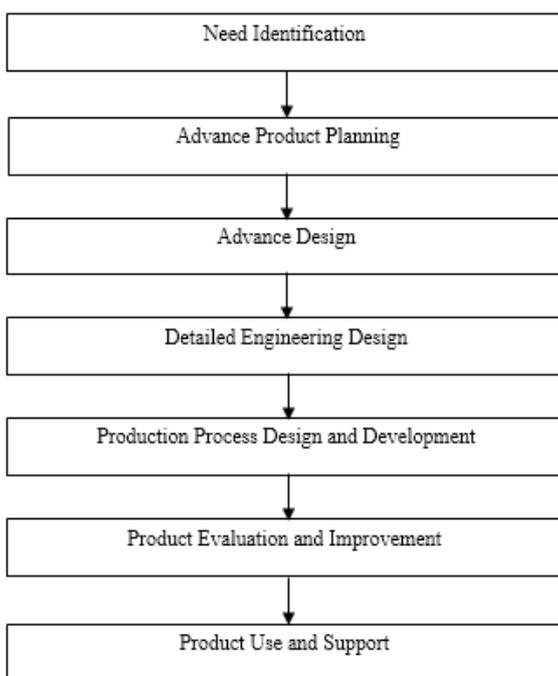


Figure 1 Stages of New Product Development

Comprehensive Engineering Design

In this point, a range of engineering activities are involved in the development of a comprehensive product description including its subsystem, components, content, size and so forth. In order to find solutions that fulfill many design objectives the development process usually includes study, testing and collection of data:

- ☆ Functioning Design
- ☆ Reliability Designing
- ☆ Maintenance Designing
- ☆ Safety Designing
- ☆ Producibility Designing

Design and Development of Production Process

Plans for materials procurement, production warehousing, transport and distribution are designed by comprehensive product design engineers and manufacturing specialists. This process involves the scheduling of other support systems, for example control of production, information sharing and human resources management.

Improvement and Evaluation of Product

The product needs continuous analysis and improvement once it has been released. The monitoring, evaluation and, if need be, redesign of the product is focused on field and failure data, technological advancement in materials and machinery, and structured research.

Support and Use of Product

Support for customers who use the service is an important stage in product development. The system of support could be:

- ☆ Train consumers on product specific applications
- ☆ Offer assurance and maintenance services
- ☆ Apportion replacement pieces

- ☆ Enhance the service with changes in development

Review of Literature

Silinevica (2017) described in his article that The major factor for economic advancement in developing market competitive advantages is new product creation. He showed that the product life cycle is very short and continues to be shorter every year. Technology will be the main driver of the economy. Innovation. The rate of creativity in Latvia is not enough. Business incubators in Latvia are among the most important players in the field of technology. The function of each step of innovation processes is underlined in this analysis. The researchers are presenting a new model for analyzing stage by stage development processes. This framework describes the main innovation-preventing issues. This model allows concrete proposals to be created for improving the country's creative environment.

Luchset *al.* (2014) In their report, it was mentioned that an increased attention to products design in business practice (I Samsung, Puma, Dyson, Apple, etc.) has been augmented, in a number of disciplines, by academic research on product design, both by the business media (I Business week, Fast Company and the New York Times best-seller list) and in education (i.e. Stanfords B. school) In this study, authors review work into product design conducted in the last 17 years over leading marketing-oriented journals. A similar study covering a span of 13 years from 1995-2008 was performed by researchers. Nonetheless, the emphasis was on creating a product design conceptual framework, presenting product design research on other relevant advertising themes and developments in publishing. Instead, this present project aims to explain, together with the research recommendations for marketers, what has been learned from these earlier research on product design in each of the subject categories that the researchers define.

Bhuiyan (2011) depicted that the goal of the study is to develop a system of critical success factors, indicators, and applying tools and techniques for the metrics at every point of the NPD process. This researcher's approach is to study decades of NPD performance experiments and how they can be accomplished. His findings are searched for common factors for businesses with market success. This outlines the success indicators

of NPD, recommends measures for these variables, and provides tools and techniques for using these metrics. This has been carried out at every level of the NPD process, in a setting in which the researchers recommend that complex NPD initiatives be implemented. He said several various research avenues could give companies with huge success factors (CSFs) and measurement successful product creation as well as academics doing work in these areas potential relevant information. Implementation and validation of the proposed system provides the main research opportunity.

Goulding (2007) described that the emergence of a formalized new product development can be attributed to the needs of companies in the capitalist system for maintaining a competitive advantage in their operating markets. He called the system "scientific, commercial and industrial measures leading to the promotion of new products." Notice the difficulty of the function: It's likely a gigantic underestimate to characterize new product design as difficult. The principles and traditions of this system are also to be illuminated. He states that the most critical criteria for successful implementation are indeed a pragmatic approach and an open dialogue.

MANUFACTURING OF MOBILE PHONES IN INDIA: To an Optimistic Forthcoming!

According to IBEF (2019) India is the second biggest manufacturer of mobile phones after China in the world. However with the present development rate, India isn't too far from being the next world's leading mobile phone market. The annual mobile phone manufacturing in the nation has risen from 3 million devices in 2013-14 to 14 million devices in 2017-18, according to the Indian Cellular Association (ICA). India records for near about 11-12 % of worldwide production of mobiles, which in the year 2014 was only about 3-4%. According to Randstad India, today's telecom sector is among the top five job opportunity generators in India, generating more than four million direct and indirect jobs over the next few years.

A further spike in India's pocket is that it became the fastest-growing mobile app market in the world during the first quarter of 2018. The Indian government announced the Phased Manufacturing Program (PMP) in May 2017 to encourage portable handset national manufacturing. The above initiative enabled to create a

solid mobile manufacturing environment for indigenous people in India and encourages large-scale production. In nudging businesses, the PMP has effectively helped shift manufacturing from straight imports. Under the PMP, the complete capital investment by computer and component players is anticipated to reach INR 57 billion by the end of 2018, according to the ICA. In reality, ICA President Pankaj Mohindroo states, "I am quite optimistic during the upcoming years or two, with these creative strategies, big upfront investments will be made in the mobile devices industry." For more than hundred competitors/players, India's mobile phone industry has risen exponentially over the previous decade, and growth has risen exponentially with the advent of smart phones.

BOOM OF SMARTPHONES

India surpassed the United States last year to become the second biggest smartphone market after China in the world. According to a research by Cisco Systems, statistics indicate that there will be 780 million linked smartphones in 2021, compared to 359 million in 2016. Smartphone manufacturers from Oppo to Xiaomi Corporation are developing industries in the fastest increasing industry in the world for the Indian government's product boosting push to encourage foreign buyers to "Make-in-India." According to International Data Corporation (IDC), India's smartphone industry rose 14 percent with complete shipments of 140 million units in 2018, the highest growth rate among the top 20 economies. In India, demand for new phones is on the rise, assisted in aspect by the Indian major, The Reliance-Group, offering feature-phones 4 G technology costing approx. 23 US \$, inexpensive information and free voice services plans. In addition, Xiaomi said it would set up three more factories in India very soon.

Every quarter, India buys 30 million smartphones, and the proportion is rising several times a year. Mobile subscriptions in India are anticipated to increase to 1.4 billion by 2021, as per the IDC and the Ericsson Mobility Report. That is why smartphone manufacturers like Samsung and Apple perceive Indian customer perceptions as they incorporate modifications and fresh characteristics into their phones. India being an enormous market, Indian customers wishes and needs have a major effect on sales.

The sub-10,000 smartphone segment has had greatest revenues since 2012, as a cost delicate market. With 10,000 submarines, every smartphone manufacturer will take advantage of demand for budget phones. Budget intelligent devices have flooded the market, ranging from local products like Micromax to Karbonn and international brands such as HTC, Samsung and Xiaomi.

Contemporary Advances

In an effort to win Indian Prime Minister Shri Narendra Modi's flagship program, Samsung Electronics Company is opening India's biggest mobile phone plant in the world. The Noida unit capacity of Samsung is doubled to about hundred and twenty million units per year for mobiles, from 68 million units. The firm has taken up the 'Make in India ' initiative by initiating the 'Make for the World ' project aiming at exporting portable devices to foreign products manufactured in India.

From low-end smart phone costs below 100 US\$ to the flagship models, the Samsung plant produces everything. "The new plant will help Samsung introduce some local characteristics to the R&D devices by cutting time to market," says Tarun Pathak, Counterpoint Research Associate Director.

An Exhilarating Forthcoming

It is anticipated that by 2020, the mobile phone sector will achieve US\$ 219 billion. In addition, increasing mobile penetration and decreasing information expenses in India will add 500 million fresh web users during the next 5 years. In 2019-20 it is estimated that near about 500 million mobile phones will be manufactured which will worth about 46 billion dollars as per the report of Indian Ministry of Electronics and IT the Fast Track Task Force (FTTF). The goal is also to produce a production element worth 8 billion dollars for manufacturing and 1.5 million dollars in jobs by 2019-20. The variables to keep the market upward, including low smartphone consumption, will ensure convenient FDI in our country and the rise of enduring progression.

Indian scenario of Mobile Phone Industry

In India the output of cell phones has risen from just 144 million in 2003-2004 to 512 million in 2018-19 at an annual growth rate of 28.3%. Cell phones are normally described as wireless devices used to create and receive

calls and to send text messages while moving across multiple fields of the region. Cell phones today, however, have shifted outside of their principal role of speech interaction and they are used for many other reasons, like Internet surfing, music listening, video viewing, and so on.

Outline of Market

- The cellular telephone sector is the world's fastest growing sector and with India adding more mobile connects monthly, the huge influx of mobile devices into the nation is obvious.
- The country's telecommunications boom offers many phone manufacturers possibilities. Telecoms have fiercely zoomed up the trading curve among the country's fastest increasing industries. During the first half of 2019 the number of devices launched in India amounted to 857. An estimate of over 2000 units are due to launch before year-end. This is a huge rise compared to past years, with 1137 phones in 2018 and near 950 phones in 2017 introduced.
- Mobile phones dominate the telecommunications industry in India. In 2019, there have been more than 1000 million mobile phone users in the nation, making it a dominant tool for voice as well as other value related services.
- In 2019, it is anticipated that the mobile sector will achieve 500 billion dollar with a CAGR of around 6.8 % as compared to year 2017.
- In India the number of mobile telephone companies has been more than 1200 million in 2018-19, compared with 250 million in 2008.
- But the amount of smartphone launches by the Indian brands was high in 2014, most of the products they launched are priced at around and under Rupees ten thousand. As for number of devices listed above Rs. 10000, it is only made by MicroMax to the top ten. In 2019, however, Xiaomi is India's leading player, followed by Samsung, Vivo, Oppo etc.

Market Perils

- The mobile sector in India is extremely competitive and calls for extensive growth studies.
- Manufacturers need to define threats to prepare or mitigate such a danger through advanced cyber adversaries and assaults on networks. To supervise these challenges, companies are using high-end mobile phone intrusion detection software.
- Mobile malware should be carefully avoided in order to enable readily sustainable future access to information and system resources.
- In these days, failure to embrace fresh innovation paths is the common risk facing producers. The early creation of innovation and the attraction and maintenance of a broad spectrum of clients became an important problem.

Prospects of Top Market

- In the government's plan to create 100 intelligent cities there are more possibilities for building a fiber optic network.
- From the beginning, the mobile sector in India was an appealing target for mobile telephone companies. For instance, the large number of clients drawn mobile telephone companies, such as Xiaomi, HTC and Apple to India.
- It turns out to be the world's biggest domestic market for selling devices for the mobile sector, with the rapidly increasing population in India.

Competitive Issues

- In addition, building key skills in mobile app safety also has a connection with the achievement of a manufacturer of mobile phones in this sector. Institutions must adopt protocols with multiple safety characteristics in mobile app safety.

- The mobile sector in India is overwhelmed with launches that provide more or less the same characteristics and interfaces. The companies should create new functions that deliver higher user service in order to gain benefits over other businesses.
- In the Indian telecommunications sector, fast growth is expected under the government's favorable regulations and the upcoming 5 G infrastructure.

Presence of different mobile phone industries in India

In India there are many mobile telephone firms which supply clients with mobile phones. Following are information of few organisations:

APPLE INC.

Apple Inc. is a US corporation based in Cupertino / California, United States, conniving, evolving and vending buyer computer, electronics and internet services. It's also fourthlargest technology firms with Amazon, Facebook and Google.

The company's products include smart phones, iPad laptops, mac Computers, iPod mobiles, Apple Watch smartwatch, electronic Apple TV media players, AirPods portable audiobudders, and the HomePod smartphone. The iTunes Store, iOS App Store, Mac App Store, Apple Music, Apple TV+, iMessage and iCloud servers are all included in our internet facilities.

Apart from Wayne selling the share in just 12 days, Apple was formed in April 1976 to build and sell Wozniak's Apple I personal computer from Steve Jobs, Steve Wozniak and Ronald Wayne. Apple Computer Inc., was formed in Jan. 1977 and in no time the Apple II expanded rapidly their computer sales. Within a couple of years, Jobs and Wozniak had recruited and had a factory floor from computer developers. In 1980 Apple was released to the public for immediate economic achievement. With innovative graphical user interfaces, Apple shipped its new computers in the next few years, such as the real Macintosh in 1984, and received widely critical publicity for its products. Furthermore, the higher price and restricted application library of its products created issues, as did the fight between managers over authority. Wozniak left Apple friendly and stayed an honorary staff member in 1985,

while Jobs and others stepped down from founding NeXT.

During the 1990's, the company vanished the share in market in the cheaper duo-poly of MS Windows on Intel PCclones as the personal computer industry grew and increased. The Board hired CEO Gil Amelio for a 500-day remediation fee— remade with resignation, executive restructuring, and consumer focus— to rehabilitate the financially troubled company. In 1997, he led Apple to purchase NeXT, solved the highly unsuccessful OS plan and brought jobs back. Jobs reclaimed leadership status thoughtfully and became CEO in 2000. Apple quickly returned to profit by revitalizing Its various campaigns when it revitalized its image by unveiling iMac in 1998, launched the flagship Apple Stores chain in 2001 and acquired a number of companies to expand the Apples portfolio. Jobs renamed Apple Inc. as a combined consumer electronics company in January 2007, launched the iPhone with a great financial achievement. In the month of August, Tim Cook became the new CEO and resigned as CEO for the health issues. Two months later the company died and a period came to an end.

The scale and sales of Apple are well-known. The total annual worldwide sales for 2018 amounted to \$265 billion. Apple is the biggest selling software company in the world and one of the most successful companies in the world. It is also after Samsung and Huawei, the world's third largest manufacturer. The first public U.S. corporation to be valued at more than \$1 trillion was Apple in August 2018. As of 2018, the company has 1,23,000 full-time employees and 504 retail outlets in 24 countries. It operates the iTunes Store, the largest music store in the world. More than 1.3 billion Apple products are being used worldwide as of January 2018. The company is also very loyal to the brand and ranks as the most valuable brand in the world. Apple is nevertheless criticized for its entrepreneurs ' work practices, nonethicaland environmental commercial observes, comprising anti-competitive conduct, and the roots of sources. iPhone X_R and iPhone X_Sare its latest smart phones.

SAMSUNG

Headquartered in Samsung Town, Seoul, Germany, Samsung is a multinational South Korean company. This features a number of affiliates, which are mostly m

arketed under Samsung and the biggest chaebol in South Korea.

Lee Byung-Chul founded Samsung in the year 1938 as a trading enterprise. Over the next three decades, the company diversified into fields like food, clothing, insurance, bonds and retail. In the late 60's and the shipbuilding and construction industry in the mid-1970s, Samsung joined the electronic industries. Since Lee's death in 1987, Samsung has been divided into four firms including the Samsung Group and the Shinsegae Group. Samsung and electronics, especially mobile phones and semiconductors, have become increasingly globalized since 1990. As of 2017, it has the sixth worldwide brand value.

The major industrial subsidiary of Samsung is the world's largest software engineering firm, Samsung's Heavy Industries Sales, Samsung's Engineering Samsung C&T and the 13th and 36th largest shipbuilder worldwide, including Samsung's Electronic, consumer electronic and chipmaker. The Samsung Life Insurance Company (Globally 14th largest life insurance company) is one of many major companies that included Samsung Life Insurance, Samsung Everland, South Korea's oldest theme park and Cheil Worldwide (2012's 15th largest business advertising agency).

Samsung is a powerful driving force behind "The Han Miracle" for the South Korean financial, political, media and cultural development. Nearly one-fifth of its affiliates are South Korean exports. In South Korea, Samsung's sales amounted to 17% of GDP \$1.082 billion. Galaxy Note 10/10+ and S10 are its latest smart phones.

XIAOMI

Xiaomi Corporation was established in 2010 and has its headquarters in Beijing. Chinese electronics business Xiaomi produces and invests in cell phones, mobile applications, tablets, luggage, trimmers, earphones, MI TV, footwear, fitness bands, etc. Xiaomi ranks 468th and is Fortune Global 500 List's youngest organization in 2019.

In August 2011 Xiaomi launched its first smartphone and quickly gained market share in China in the year 2014. Xiaomi became the fourth largest smartphone manufacturer in world at the end of the first quarter of 2019, leading in China and India, both of them. Xiaomi

created a broader range of electronics for customers, including an ecosystem for a smart home interface (IoT).

Xiaomi consists of over fifteen thousand staff and is spreading to various nations comprising of South Africa, the Philippines and Indonesia in China, India, Malaysia and Singapore. The founder and CEO, Mr. Lei Jun is reported to have a net value of 12,5 billion US dollars, according to Forbes magazine. It is the 11th wealthiest person in China and the 118th in the world. Xiaomi has raised \$1.1 billion in investment funds and is the 4th most successful software startup in the world, making Xiaomi more than \$46 billion worth of its valuation. Redmi K20/ K20 Pro, Note 7/ 7S/ 7Pro and Poco F1 are its latest smart phones.

VIVO

Vivo Engineering of Communication Co. Ltd. is a Chinese-based smartphony / smartphone, computer and online-based technology owned by BBK Electronics. For iManager included in their proprietary and Android-based Funtouch OS, the Company develops mobile applications through its Vivo App Store. Vivo hires 1600 research and development staff with its R and Development Cents in Shenzhen and Nanjing. Vivo S1, V15 and V15 Pro are its latest smart phones.

OPPO

The Chinese publicity agency, Guangdong OPPO Mobile Telecommunications Corp., Ltd is headquartered in Dongguan, Guangdong, in China and is known for its smart phones, Blu-ray players, and other electronic devices. OPPO was one of the top smartphone brands in India in 2018, one of the leading manufacturers of smartphones.

Its latest smart phones are OPPO Reno Series, K3 and F11/11 Pro.

Objectives of the Study

The objectives of this study are as follows:

- ❖ To study the concept of Product Design for New Product Development.
- ❖ To analyze the Indian Mobile Industry with respect to New Product Development.
- ❖ To identify the benefits and components of Product Design.
- ❖ To develop and proposed a frame work of Product Design.

Research Methodology

Research in common parlance refers to a search for knowledge. One can also define research as a scientific and systematic search for pertinent information on a specific topic. In fact, research is an art of scientific investigation. The present study has made an attempt to fulfill the rational requirements of a logically steered study to the extreme probable magnitude. Based on the identified research gaps as derived through an extensive review of literature, research objectives have been set up and the research hypothesis have been framed. Subsequently, decision points pertaining to specific research approach, specific research and sampling design have been adopted. The details of research methodology are shown in table 1.

Table 1 Research Methodology

S. No.	Particulars	Data
1	Data Type	Primary and Secondary Data
2	Sampling Unit	Mobile Phone Industry
3	Sampling Type	Random and Convenience Sampling
4	Sample Size	80
5	Research Tool	Questionnaire
6	Type of Research	Analytical and Descriptive Research
7	Data Collection Method	Survey
8	Survey Area	Western part of Uttar Pradesh

Formulation of Research Hypothesis

H₀: The impact of Product Design in New Product Development is significant.

Data Analysis Tool

For analyzing the data Mean, Standard Deviation and Z-Test tool was used.

Survey Findings and Testing of Hypotheses

This section of the research paper covers the testing of hypothesis of the data set. The findings of every question, which are asked by the respondents, are as follows:

❖ Rating on the Product Design practices adopted by the organizations for New Product Development

The following description shows the rating of the Product Design practices adopted by the organizations:

Table 2 Product Design Practices

	Different Product Design Practices for New Product Development							Total	
	Product Quality	Innovative Design	Value for Money	Functionality	Visual Appeal or Aesthetics	Impact on Existing Products	Introduce New Technology		
Strongly Agree	Count	32	40	26	20	42	20	36	216
	% within	40	50	32.5	25	52.5	25	45	
Agree	Count	32	26	20	14	22	16	24	154
	% within	40	32.5	25	17.5	27.5	20	30	
Neutral	Count	8	4	2	18	6	18	12	68
	% within	10	5	2.5	22.5	7.5	22.5	15	
Disagree	Count	6	4	32	16	6	14	6	84
	% within	7.5	5	40	20	7.5	17.5	7.5	
Strongly Disagree	Count	2	6	0	12	4	12	2	38
	% within	2.5	7.5	0	15	5	15	2.5	
Total	Count	80	80	80	80	80	80	80	560
	% within	100	100	100	100	100	100	100	100

The table 2 above represents about the product design practices adopted by the organizations for New Product Development:

1. Product Quality

The results of this statement are shown in the table below:

HYPOTHESIS AND TEST RESULTS						
Q. No.	Null Hypothesis	N	Mean	Standard Deviation	Df	Sig. (2-tailed)
1	There is no impact of product quality in developing a new product.	80	4.075	1.009	79	0.007

Result: The Null Hypothesis is rejected

Interpretation: From the frequency table 80 percent of participants agree with the aforementioned statement and the mean value (4.075) and the default deviation (1.009) further justify this view. The calculated value of Z-test for the testing of this hypothesis is 0.007, that is lower than tabulated p-value (0.05). Therefore, the null hypothesis is viewed as rejected. The performance of a service therefore has an important impact on the development of a new product.

2. Innovative Design

The results of this statement are shown in the table below:

HYPOTHESIS AND TEST RESULTS						
Q. No.	Null Hypothesis	N	Mean	Standard Deviation	Df	Sig. (2-tailed)
2	The innovative design is not necessary for developing a new product.	80	4.125	1.187	79	0.007

Result: The Null Hypothesis is rejected

Interpretation: From the frequency table it has been observed that 82.5% of participants agree to the declaration. The standard deviation is 1.187 and the mean value is 4.125. The estimated significance value of z-test is 0.007, less than p-value (0.05), for testing of this hypothesis. Therefore, the null hypothesis is viewed as being rejected. Thus the development of a new product involves innovative design.

3. Value for Money

The results of this statement are shown in the table below:

HYPOTHESIS AND TEST RESULTS						
Q. No.	Null Hypothesis	N	Mean	Standard Deviation	Df	Sig. (2-tailed)
3	There is no criterion for value for money during a manufacturing of a new product.	80	3.5	1.304	79	0.077

Result: The Null Hypothesis is accepted

Interpretation: The statement was not accepted by 40 percent participants, and the mean value was 3.5 and standard deviation was 1.304. In order for this hypothesis to be checked, Z-tests showed that the measured significance value (0.077) is greater than the p-value (0.05). Therefore, the null hypothesis is viewed as being accepted. Correspondingly, in the development of a new product, there is no requirement of value for money. More money is spent by consumers for a better product.

4. Functionality

The results of this statement are shown in the table below:

HYPOTHESIS AND TEST RESULTS						
Q. No.	Null Hypothesis	N	Mean	Standard Deviation	Df	Sig. (2-tailed)
4	There is no significant impact of functions while designing a new product.	80	3.175	1.394	79	0

Result: The Null Hypothesis is rejected

Interpretation: From the Frequency table it is clear that 42.5% of participants agree with the above assertion and 22.5% of respondents are neutral. The mean value is 3.175 and the average is 1.394. The Z-test has been carried out in order to test the hypothesis and the measured meaning value (0.000) is lower than the p-value (0.05). Therefore, the null hypothesis is viewed as rejected. The influence of functions during the development of a new product therefore is important.

5. Visual Appeal or Aesthetics

The results of this statement are shown in the table below:

HYPOTHESIS AND TEST RESULTS						
Q. No.	Null Hypothesis	N	Mean	Standard Deviation	Df	Sig. (2-tailed)
5	Visual Appeal or Aesthetics have no impact during a manufacturing of a new product.	80	4.15	1.152	79	0.003

Result: The Null Hypothesis is rejected

Interpretation: The frequency table revealed that 80 percent of the participants agreed with the above assertion and the mean value (4.15) and standard deviation (1.152) further justify this. The estimated significance value of Z-test is 0.003 for evaluating this hypothesis which is lower than p-value (0.05). Thus the null hypothesis is viewed as rejected. So, during the development of a new product, visual appeal and aesthetics have a significant impact.

6. Impact on Existing Products

The results of this statement are shown in the table below:

HYPOTHESIS AND TEST RESULTS						
Q. No.	Null Hypothesis	N	Mean	Standard Deviation	Df	Sig. (2-tailed)
6	During a manufacturing of a new product, there is no impact on existing products.	80	3.225	1.387	79	0.001

Result: The Null Hypothesis is rejected

Interpretation: The frequency table shows that 45% of participants agree with the above assertion, while 22.5% agree that it is neutral. The standard deviation is 1.387 and the mean value is 3.225. The Z-Test has been performed and the determined value (0.001) is greater than p-value (0.05) in order to test the hypothesis. Thus the null hypothesis is viewed as rejected.

Correspondingly, there is a substantial effect on existing products in the development of a new product.

7. Introduce New Technology

The results of this statement are shown in the table below:

HYPOTHESIS AND TEST RESULTS						
Q. No.	Null Hypothesis	N	Mean	Standard Deviation	Df	Sig. (2-tailed)
7	There is no need to introduce new technology for manufacturing a new product.	80	4.075	1.058	79	0.009

Result: The Null Hypothesis is rejected

Interpretation: From the frequency table, the mean (4.075) and standard deviation (1.058) values have shown that 75% of the participants agree with the aforementioned assertion. The estimated value of Z-test is 0.009 for the analysis of this hypothesis, which is lower than the p-value (0.05). It is therefore viewed as rejecting the null hypothesis. Therefore it is important to introduce a new technology to produce a new product.

Implications of the Research

One of the objectives of any research is to produce some impact on the areas research being done in terms of practical implications. This study is helpful in causing some impact on the respective research dimensions. This part of the study addressed about the role of Product Design for New Product Development. Therefore, the researchers design a framework of Product Design.

Framework of Product Design

Product design determines which products are to be used, measures and densities, describes the features of the product and set performance standards. The performance of the service can be influenced greatly by product design. Bad models cannot or may be so difficult to satisfy the needs of the consumer. Expensive designs can lead to an unsustainable cost that loses market share. When the design process is too long, a rival company is the first to introduce a new product to grab the market. The design of goods may be an art, but it must be effectively managed. Figure 2 shows the framework of Product Design which consists of several stages. These stages are as follows:

❖ Idea Generation

The process of design starts with the customer's understanding and client requirements. Ideas for new or up-to-date products can be produced

from a variety of sources, including a company's own research and development department, customer complaints or proposals, marketing research departments, suppliers, field sales people, factory personnel and new technological developments. Nevertheless, competitors are also an inspiration for the new product.

❖ Feasibility Study

A feasibility study involving several types of analysis is conducted on the promising concepts. A feasible study consists of a market analysis, an economic analysis and a technical analysis.

❖ Form Design

The layout of the type refers to the shape, colour, size and style of an item. This may also apply to the quality of the material. The form design is also made up of aesthetics like photo, the appeal of the consumer and personal identification.

❖ Functional Design

Functional development focuses on how the service is carried out or how the project is carried out. This aims to fulfill the customer's fitness performance requirements. Reliability and maintainability are the performance characteristics taken into account during this design phase.

❖ Production Design

The manufacturing model is about how material is made. Designs which are often difficult to make contribute to poor production performance. The lack of awareness about production capacity could lead to designs that do not currently provide the required skills and resources. Design changes are expensive and disturbing and adaptation in one part in other parts may be necessary. During the preliminary design process, production design is considered.

Simplification, standardization and modularity were preferred solutions to production design.

Outcomes of the Study

The outcome of the study is explained in the following points:

- ❖ This study explained several features of Product Design.
- ❖ This research also emphasizes on risks and concerns of Indian Mobile Phone Industry.
- ❖ This article depicts about the Smart Phone Industry and its' recent developments.
- ❖ This study also describes relevant information regarding smartphone companies which sell their products in India.
- ❖ This study also explains the framework of Product Design.

Contributions of Product Design to the Society

There are several results in the current research which have a direct and indirect connection with society. Such results are applied to our society and some contributions from the investigators are explained in the following points:

- The researchers provide a product design framework to the society. This is helpful for the manufacturers for designing their new products.
- This research is helpful in framing the pricing of products.
- This study also contributes to finalize the appropriate products to the customers.

The aforementioned points are the reasons why the product design theory would make a significant contribution to our society. This work therefore helps organizations to take this principle into account in their daily activities.

Suggestions

In the light of foregoing analysis, findings and observations, some broad suggestions have been

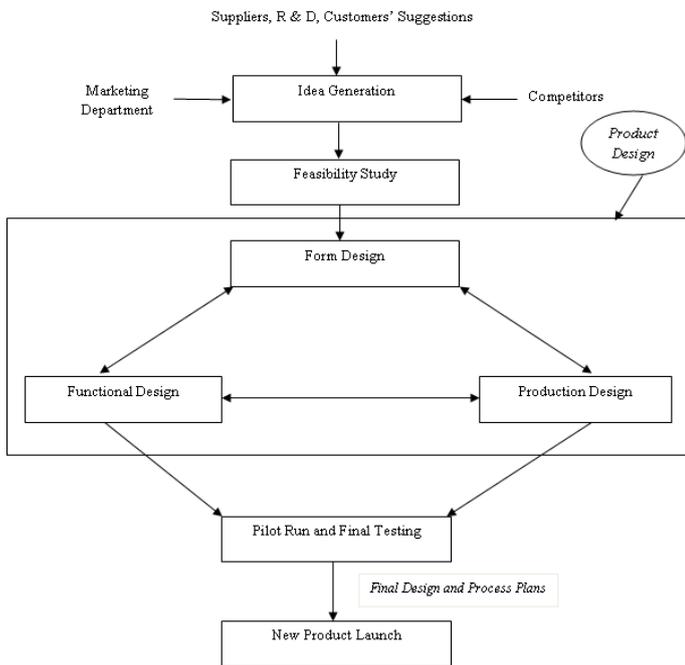


Figure 2 Framework of Product Design

❖ Pilot Run and Final Testing

For pilot run and final testing the designs that meet the preliminary design requirements are used.

❖ Final Design and Process Plans

Final design involves a comprehensive drawing documentation and material process plans specification that include workable production instructions such as required machinery and equipment, a guideline on procurement, a job description and procedure for staff, automated computer programming, etc.

❖ New Product Launch

It involves improving efficiency, managing the supply chain and sustainable development of marketing plans in launching new goods.

recommended. The present research has indicated some of the facts about product design. So based on these observations, some specific suggestions are as follows:

- The researchers suggest that the product should be design in keeping of the mind of few facts i.e. product quality, innovative design, value for money, etc.
- The researchers also suggest to the manufacturers that customers spend more money on a good handset but the worth of the product should be there.
- The researchers also suggests to the consumers/ customers that the selection of the product after consideration few important particulars viz. introduction of new technology, visual appeal, etc.

Limitations

During the current research, the following limitations were recognized:

- The area of study for the research is the western part of Uttar Pradesh but it is very difficult to cover each and every city of the western part of the state.
- The research topic is very wide and the researchers have limitation of time to cover each and every aspect related to Product Design. Thus time factor can be considered as one of the limitations.
- This research is completely based on the information provided by the respondents. Therefore, the accuracy of findings and results of this research are not foolproof.

Conclusion

This paper explains about the role of product design for new product development. This study provides the

information that which concepts we have to consider before and during the development of a new product. This study describes the facts related to the mobile manufacturing in India and the boom of smartphone. This study also covers the Indian mobile phone industry: market overview, risks, opportunities and competitive factors. In this study, researchers describe the profile of various mobile phone manufacturers like Apple, Samsung, Xiomi, etc. During the survey, researchers ask several questions about the product quality, innovative design, value for money, visual appeal, etc. from the customers. The respondents provide their response positively and the analysis reflects that they have final basis to select an appropriate product. At last, researchers design a framework of the product design, which is very helpful in different product manufacturing industry.

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