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Global Journal of

ENTERPRISE INFORMATION SYSTEM

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कर्म:Society

Kedar Amar Research and Academic Management Society

Kedar Amar Research and Academic Management Society known for it's acronym KARAM Society has been established in the year 2009 keeping in dream the empowerment and comprehensive expansion needs of society. The society has been established as a "Not for Profit" Company under the societies registration act, 1860 with a Registration no. S/65067/2009. In the present state -of-affairs, the KARAM Society engaged in the advancement of medical knowledge and provision of assistance to medical students and professionals.

The mandate behind KARAMS is to make certain transparency, accountability and adherence to corporate governance norms. Recently KARAM Society had put it's ware bouts in an online publishing and collaborated with Open Journal Inc. and Publishes two hard core empirical research journal on information systems (www.gjeis.org) and in medical science (www.agems.in). Both the Research journals are now available in a Brick-&-Mortar mode also with an ISSN and eISSN Numbers respectively. The rationale of the KARAM Society is to promote empowerment and inclusive development with an emphasis on social, digital and financial inclusion; strengthening of delivery systems and participatory democracy for bringing about a systemic change to help meet development objectives better. During the past two decades founder members of KARAM Society have travelled transversely the country to learn critique and encourage social, digital, medical and financial inclusion. In the process, knowledge repositories have been created on what works—the most excellent practices—actively engaging all stakeholders from policy makers and civil society to ordinary citizens. The KARAM will allocate this knowledge for progression and nation-building all the way through e-learning modules and virtual platform for practitioners and publishing video documentaries on our portals. Recently it had started new portal http://open-journal.com which is backed by the gamut of great academician from different part of the world.

In the last few years KARAM Society conducted numerous health camps in a charitable mode in a various districts of Haryan, Rajasthan, Uttarpradesh, New Delhi, etc. which are organized with support from corporate, civic bodies, the government, NGOs and individual volunteers. KARAMS has conducted over 75 general health camps till date and has benefitted more than 25, 000 people directly. In line with the policy to provide healthcare services to the community around our facilities, KARAM Society has started a Mobile Medical launched Mobile Medicare Unit (MMU hereafter) to address the health concerns of older persons living in urban slums. Technical aids are provided to the poor elderly that could improve their quality of life and make them independent. Eye camps are organized every year now and then to screen beneficiaries for cataract. Awareness about diseases and healthy living is an important component and constant effort by KARAM Society is being made in this direction. The team of KARAM SOCIETY India consists of a medical doctor, a community health mobilizer, a pharmacist and a social protection officer. The team will not only provide curative medical services but will also raise public awareness on preventive and promotive aspects through awareness generation and multi-disciplinary medical camps, etc.

KARAM Society best practices have been documented as information cards, video case studies, policy and white papers that are consistently shared with group of people at great, so that it can become a wider learning process. Having done all the above driven by individual enthusiasm and excitement, the members now felt the need to create an institutional framework that not only takes this work forward and emerges as a key expansion institution but also helps in facilitating implementation mechanisms such that the benefits of wide-ranging development are actually received by society.

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Message from Editor Desk

Free and Open Source Creating Miracle with EIS

Dear GJEISians,

Open-source software (OSS) is computer software with its source code made accessible with a license in which the copyright holder provides the rights to cram, revolutionize, and assign the software to everyone and for any insistence. Open-source software may be time-honored in a collaborative community form. The Group who had initiated open-source software is an obvious example of open collaboration. Open-source software at present is expansively used both as self-governing applications and as components in non-open-source applications. Many independent software vendors (ISVs), value-added resellers (VARs), and hardware vendors (OEMs or ODMs) make use of open-source frameworks, modules, and libraries within their brand-named, for-profit products and services.

While the expression "open source" applied initially only to the source code of software, it is nowadays being functional to numerous other areas such as Open source ecology, a progress to disperse technologies so that any human can make use of them. On the other hand, it is normally misapplied to other areas which have diverse and competing principles, which be related only moderately. The Internet has changed the production of, and access to, academic journals like GJEIS powered by Public Knowledge Project (PKP), with their contents obtainable online via services subscribed to by academic libraries. Individual articles are subject-indexed in databases such as Google Scholar. GJEIS considered to a specialized journals in an area of EIS which prepared in-house, by an academic department (KARAM Society) , and published both in print and online. At present, there is a pressure group in higher education encouraging open access, either via self-archiving, whereby the author deposits a paper in a institutional archive where it can be searched for and read, or via publishing it in a free open access journal, which does not charge for subscriptions, being either subsidized or financed by a publication fee. Given the goal of sharing scientific research to pace advances, open access has exaggerated computer journals more than humanities journals.

The GJEIS as a scholastic Journal facilitates well-groomed business leaders with its research initiatives and rigours blind and peer review process The journal is exactly now listed in almost fifty directories in the world, equipped with Digital Object Identifier (DOI) from Cross-ref USA http://www.crossref.org . It also had an average impact factor of 1.68 from the various impact factors rating agencies. The journal with its eight volumes focused on this part and emphasize how changes brings a paradigm shift on the plus side and create tremendous market opportunities in products and services. Mandate of a GJEIS is to popularize the impression of Enterprise, Information and System in business and outside business. It is designed to enlighten people that synchronization of three words is not just a pecuniary objective, but is more ubiquitous, that is why we have to get crossways what the academics and the peers are doing and saying about technological pitch in creating a niche. We have fabricated a comprehensive troop to make GJEIS authenticity.

We had moved to a new portal from mid of 2016 to http://www.informaticsjournals.com/index.php/gjeis/index   with an intention to strengthen GJEIS more academically and research oriented. We had also now made the open access just to enhance citation as well as reaching to unreached. Apart from it, the dedicated page in Face book created in order to touch with the GJEIS Fraternity https://www.facebook.com/GJEiS . The GJEIS Website has been moving to a new contemporary Google-hosted JavaScript service which follow community-curate online directory, helps in indexing and facilitate in providing s access to peer-reviewed articles. It is also equipped with search engine optimization and web analytics for statistical analysis.

Dr. Subodh Kesharwani

Founder, Editor-in- Chief

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A Comparative Study of Indian Smartphone Manufacturing Ecosystem with Global Best Practices for Strategic Insights

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Abstract

In this study we provide an overview of ecosystem indices of successfully smartphone manufacturing countries like China, USA, Taiwan, and South Korea by comparing some key parameters with that of peer average. The main purpose of this research is to compare various key manufacturing statistical parameters of other countries with that of India. It also brings out the current state of manufacturing in India, the market potential and the institutional frameworks developed to create an ecosystem conducive for manufacturing to grow. A SWOT (strengths, weaknesses, opportunities and threats) analysis is performed across all countries and analyzed for working out the SWOT matrix in Indian context to help formulating the strategy.

Keywords: Ecosystem, Smartphone Manufacturing, SWOT

1. Introduction

Mobile handset in today's world has become one such device which we cannot live without having and it has evolved from being just a phone to a million other things. It is one device that serves as our email device, camera, games console, multimedia device, Twitter dashboard and our social network controller all fitted into single equipment. The situation is going to get even more difficult as the manufacturers to up their game continue to put more and more functions in to the device

As more and more players are moving into the mobile market mobile handsets are going to get cheaper and inexpensive. This will intern open opportunities for marketing and commerce in emerging markets as many consumers will have access to basic smartphone service like the internet. Meanwhile in established markets smartphones will mature more and will quickly shift the pattern for consumer media usage forcing the market to become more mobile centric. The number of smartphone users in the world today has exceeded the two billion mark in the year 2016 (emarketer, 2016) and India is also not far behind in this race. It is currently the third top most on the list of countries ranked by total number of smartphones users and it is believed that it will even leave United States behind by the end of year 2016 with over more than 200 million smartphone users. Since it is the one of the fastest growing smartphone market it holds a great future and has many ongoing opportunities in this domain.

It has recorded a total shipment of over 103.6 million smartphones in the year 2015 which is an increase of 28.8 percent as compared to the previous year 2014, thus outperforming even China. (IDC, 2014). Also the narrowing of difference of price between feature phones and smartphone has increased the consistent growth in the demand. As more and more individuals are subscribing to wireless services, the demand for phones, especially smartphones has increased compared to even larger devices such as a laptop.

In this paper we demonstrate the current state of smartphone manufacturing in India, the market potential and the institutional frameworks developed to create an ecosystem helpful for the manufacturing to grow.

2. Global Manufacturing Scenario

The following parameters are indicative of high potential market conditions for successful smartphone manufacturing:

- **Low Smartphone penetration:** The smartphone penetration in India which is 10% leaves a vast potential for growth, makes India a great market for Smartphone production.

- **Presence of Multi-National Corporations (MNCs) and Original Equipment Manufacturers (OEMs):** India has about a hundred VLSI design companies with semiconductor design capabilities, which makes it a great centre for research and development.
- **Presence of Indian IT Companies:** The smartphones are mostly software driven and the cost of hardware is shrinking while that of software is increasing. Applications developed around the smartphones are pure software driven and is a rapidly growing ecosystem in India. The IT companies are rightly poised for investment in this process for enabling cost effective smartphone production.
- **Low-cost skilled labor force:** The Labor costs are among the lowest in the world till date in India. A large pool of talented scientists and researchers offer cost-efficient research and development. There is an abundant availability of engineers and English-speaking workforce in the services as well as manufacturing industry.

Table 1 shows the Smartphone manufacturing data statistics for the countries like China, USA, Taiwan, and South Korea which are explained in detail as shown below.

Table 1. Manufacturing Data Statistics (Source: Deloitte, 2013)

Statistics	China	USA	Taiwan	South Korea	Peer Average
Manufacturing GDP CAGR (2005-2010)	11.9%	0.5%	7.9%	6%	2.9%
Manufacturing GDP as %age of total GDP	32.4%	12.9%	27.1%	30.5%	18.3%
Labor Costs (US$/hour) (2011)	2.8	35.4	9.2	17.6	21.9
Manufacturing exp %age of total exports	93.2%	64.3%	88.2%	85.3%	59.9%
Manufacturing Jobs created/100 persons	3.1	-3.1	N.A	-4.5	-0.8
Highest Corporate tax rate	25%	40%	17%	24.2%	26.2%
Researchers/million population (2009-2013)	963	4,663	N.A	6286	2,980
Per capita income (US$) (2012)	6,070	51,163	22,002	23,053	15,886

2.1 SWOT Analysis for China

China has emerged as the manufacturing backbone of the world in almost every sector. As of 2012, China produced a staggering 1.18 billion mobile phones, which accounts for more than 50% of all the handsets sold worldwide and this number is increasing every year. As per reports of Ministry of Industry and Information Technology (MIIT), more than $1.13 trillion pooled into the domestic electronics manufacturing sector of China.

OEM's established at different parts of the world, depend on China for electronic components. Approximately, 75-80 % of global handsets are sourced from China. If China has grown to this size and scale, it is primarily due to the efforts of the government which supported the industry through a series of both fiscal and non-fiscal incentives and initiatives. Under the country's 12th Five-Year Plan favorable policy actions also helped China for future competiveness to maintain its top ranking. This plan includes the establishment of policies in technology innovation, infrastructure, work force development, health, safety and substantiality (Deloitte, 2013). Hence, despite the recent slowdown, many favorable policy initiatives that were supported with investments in key strategic industries have helped China to maintain its strength in the manufacturing industry.

The SWOT matrix of is given in Figure 1

Strengths
- Low cost labour
- Robust raw material supplies
- Low finance cost and government support
- Increase in global consumer base due growth in middle income class
- Availability of advanced infrastructure as compared to other Asian countries
- Increase in R&D spend (2011-15 target is 2.2% which is higher compared to 1.75% in 2005-10)
- Rapid increase of S&T output and patent rights.
- Rapid increase in China's %GDP investments in IT

Weaknesses
- Enforcement of laws and policies
- Weak financial system
  - *Capital flows into loss-making state-owned enterprises*
- Poor conditions of the laborers
  - *Housing, health care, access to education, social security (entitled but not available)*
- Low level overall education and skill attainment
- Lack of effective assessment, accreditation, and qualification systems
- Weak indigenous innovation capacity remain as an imitator
- Low productivity of R&D spending

Opportunities
- Strengthen IPR protection
- Improve labour market flexibility
- Further encourage private sector development
- *Strengthen compulsory education*
- Boost innovation capacity
- Strengthen technology diffusion
- Expand access for rural and local communities

Threats
- Increasingly competitive and complicated global environment
- Risk of increasing regional and rural-urban development gaps
- Imbalance between growth and the environment
- Increasing energy constraint
- India's fast growing IT sector
- Sliding cost of Hardware vis-à-vis higher cost of software

Figure 1. Strengths and Weaknesses of Smartphone manufacturing in China.

2.2 SWOT Analysis for United States

The United States is the thrid most competitive manufacturing nation as per the Global Manufacturing Competitive Index Report by Deloitte 2013. While there are several advantages for manufacturing in the US, a few weaknesses that may become threats in the near future can hinder with the growth of the country's economy. Some of the factors that improved US appeal as a manufacturing destination include physical infrastructure, talent driven innovation, strong legal, and established supplier network. Apart from this, laws of intellectual property protection and technological transfer, integration and adoption have undoubtedly been a valuable asset in attracting MNC's to enhance the growth of the country as a manufacturing hub (Deloitte, 2013).

Despite all these attractive incentives an increasing sense of uncertainty has started to plague much of the U.S regulatory system. CEOs and senior executives participating in 2013 GMCI survey almost concerted expressed concern over the consequences of uncertainty. In a nutshell, factors like regulatory disadvantages and policy along with corporate tax, high labor, sluggish GDP growth rate and unemployment rates have projected a fifth place for U.S in the list of competitive manufacturing nations (Deloitte, 2013).

The SWOT matrix of is given in Figure 2
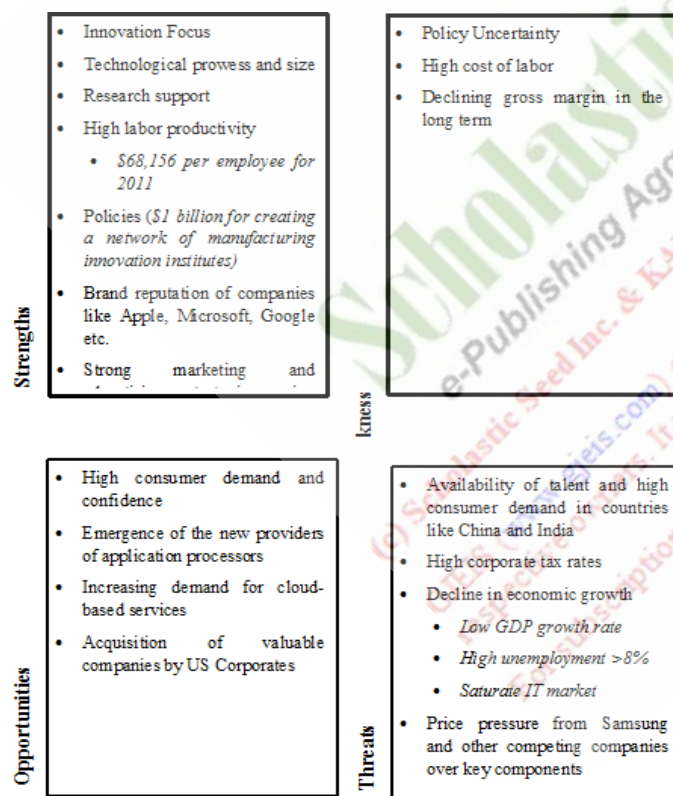
2.3 SWOT Analysis for Taiwan

Handset manufacturers in Taiwan started with contract manufacturing and finally established themselves as OEM (original equipment manufacturer). Many firms from Taiwan are going into brand manufacturing such as HTC, ACER and ASUS. This has led to a considerable increase in the R&D facilities of Taiwan mobile industry. In 2012, the performances of Taiwan's own handset manufacturers decreased due to patent litigation and shortage of key components while the manufacturers were affected by the poor sales performance.

Taiwan is proliferating as a handset manufacturer mainly due to the government incentives and schemes such as tax rebates. "Statue for upgrading industries" was one of the major steps taken to promote handset manufacturing. Certain companies were categorized as upgrade industries and they were awarded with a sales tax rebate of 20% of invested amount over the next 5 years (Deloitte, 2013). High economic freedom, emphasis on Infrastructure development and some government initiatives such as Taiwan's free trade zone are some of the important factors contributing to handset manufacturing in Taiwan. The corporate tax in Taiwan is 17 percent and the investment in education by the government is 18 percent, which is greater than other Asian countries. ITRI (Industrial technology research institute) is the largest applied technology R&D institute in Taiwan. With all such strategies and policies, Taiwan is playing an important role in handset manufacturing ecosystem and as a supply chain partner for many other countries (Deloitte, 2013).

The SWOT matrix of is given in Figure 3

Figure 2. Strengths and Weaknesses of Smartphone manufacturing in USA.
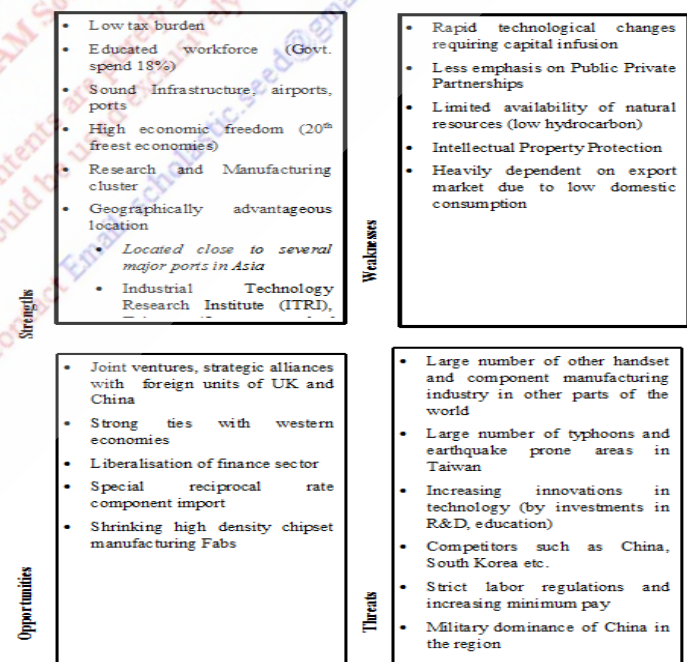
Figure 3. Strengths and Weaknesses of Smartphone manufacturing in Taiwan.

2.4 SWOT Analysis for South Korea

South Korea in terms of current manufacturing was ranked as the fifth most competitive nation by the 2013 GMCI survey. Competitive costs and better quality were the major factors that have contributed to the emergence of handset manufacturing in South Korea. In US, the average manufacturing wages per hour is $33.4, which is almost double of that in the South Korea. The country has a good number of free trade agreements in force. Samsung is a leading South Korean manufacturer and now ranks among the top manufacturers of Smartphone. It is considered as one of the best in terms of design features and technology.

South Korea has invested a lot in research and development and for innovation in ICT sector it is currently top ranked country. Japanese favors South Korean components over Chinese components. Well-educated workforce and favorable industrial policies are some of its major strengths. However, bureaucratic complexities of licensing, approval requirements and registration are major disadvantages to South Korean handset manufacturing. During last economic declines and slowing global economy, there were difficulties in conducting business in South Korea (Deloitte, 2013).

The SWOT matrix of is given in Figure 4
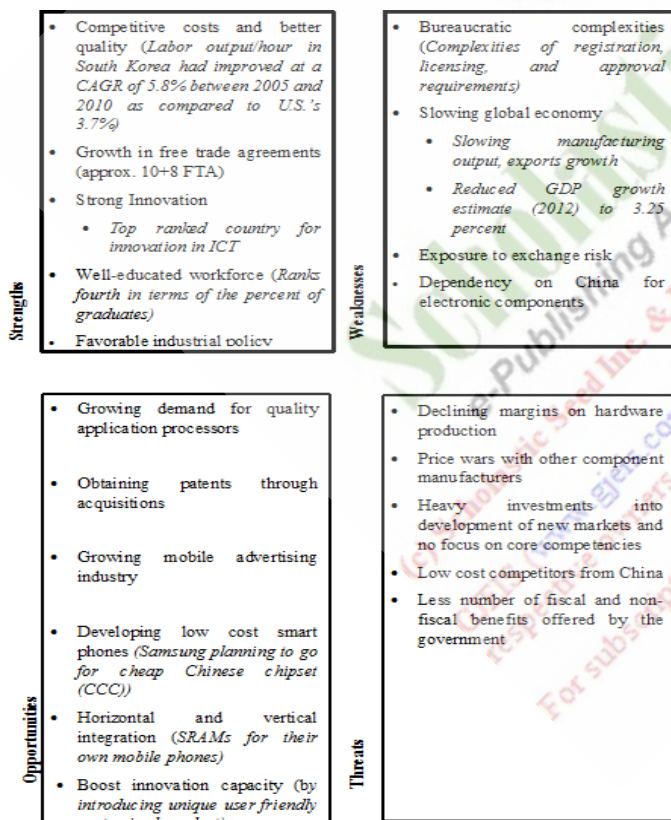
Figure 4. SWOT of Smartphone manufacturing in South Korea.

2.5 Synthetic Learning

Among all the countries analyzed, China has emerged as world's most competitive manufacturing nation. Manufacturing GDP growth rate of China is 11.9% which is much higher than the world average of 2.9% during 2005-2010. It has been consistently observed that China's labour and material cost advantage, high expert oriented manufacturing, strong government investment and innovative approach to manufacturing are its key strengths and this makes China favorable market for smartphone manufacturing. But, researchers per million populations are lowest as compared to world's average and even lowest among all the countries analyzed. This shows that the country has weak indigenous innovation capacity and remains as an imitator or adaptor of technologies. United States is the third most competitive manufacturing nation due to its core competency for talent-driven innovation. While the Apple products, including their components mostly, are manufactured in China, The US economy gets the primary benefits as Apple keeps software development, product management, marketing functions, product designs in U.S. Thus, China's economy gets only 15% of the revenue share whereas U.S. gets 85% of the revenue share of Apple product due to its consistent focus on innovation. If China boost innovation capacity and strengthen its IPR protection, strengthens its financial support for innovation, it can become major competitor to USA.

Taiwan has large semiconductor and electronics industry and has evolved as one of the largest chip fabrication country in the world.. But, intellectual property protection in Taiwan remains a challenge despite being removed from the watch list of the United States Trade Representative. If IPR policies are made favorable most of the countries can outsource chip manufacturing to Taiwan where maximum fabrication can be done. Establishment of ITRI (Industrial Technology Research Institute) was a step towards industrial transformation and innovation to create economic growth in Taiwan. Similarly, South Korea spending on education is highest amongst OECD countries. Higher the spending in education, more prosperous will be the nation in terms of manufacturing and this in turn will enhance the economic growth.

2.6 Current Scenario of Indian Smartphone Market

Smartphone sales in India increased by 166.8% making it the world's fastest growing Smartphone market in the last quarter of 2013, according to Gartner. It also revealed that worldwide, Smartphone sales in 2013 account for 53.6% of overall mobile phone sales, exceeding annual sales of feature phones for the first time. The top five foreign countries smartphone shipments and market share, 2013 and 2017 (units in million) vis-à-vis India are brought out in Table 2.

Table 2. Comparative Analysis of Smartphone Shipments and Market Share (Source: IDC,2012)

Country*	2013 Unit Shipments	2013 Market Share	2017 Unit Shipments	2017 Market Share	2017/2013 Growth
China	301.2	32.8%	457.9	30.2%	52.0%
USA	137.5	15.0%	183.0	12.1%	33.1%
UK	35.5	3.9%	47.5	3.1%	33.8%
Japan	35.2	3.8%	37.7	2.5%	7.1%
Brazil	28.9	3.1%	66.3	4.4%	129.4%
India	27.8	3.0%	155.6	10.3%	459.7%
Others	352.5	38.4	568.1	37.5%	61.2%
Total	**918.6**	**100.00%**	**1516.1**	**100.00%**	**65.0%**

In the competitive Indian market, Samsung, featured with its android operating system, has captured 27% of market share by the end of Q4, 2015. Local manufacturers like Micromax and Lenovo group are runner-ups with occupancy of 14% and 12% of market share, respectively. The smartphone market share of the companies, manufacturing in India, with disregard to their local value addition, is brought out in Figure 5.

2.7 Comparative Study of Smartphone Manufacturing Practices

In this section a comparative study is carried out on Smartphone manufacturing market in India with that of China, US, South Korea and Taiwan. Further, analysis is done with the help of SWOT analysis to identify the strategies India need to develop.

India as a global manufacturing destination has not been solidified yet. The country has dropped two spots from second to fourth in 2013 GMCI ranking. In order to regain its former position, India has to focus on education and product-oriented research to appeal itself as a global manufacturing destination. India's economic development is relied on a low cost and limited pool of skilled labor rather than an abundant supply of semi-skilled and semiliterate labor. This means that India is specialized in ICT services rather than in manufacturing model whereas other economies such as China, Taiwan, South Korea, relied on manufacturing which is providing more jobs to the poor population of country. Taxation is always in the upper range of 30-31 % for Telecomm products in India, which is generally higher than other countries like China, USA, Taiwan, and South Korea. Also, import duties on components are high and for same feature, components are much cheaper in other countries. Present taxation structure in telecom sector needs to be made simpler by rationalizing taxation so as to make industry investor or customer friendly.

Table 3. Manufacturing Data Statistics (Source: Deloitte, 2013)

Data Analysis: Key Statistics	China	United States	Taiwan	South Korea	India
Manufacturing GDP CAGR (2005-10)	11.9%	0.5%	7.9%	6%	8.5%
Foreign Direct Investment (FDI) (USD Million)	40300	68145	N.A.	3802.25	2908
Labour Costs (US$/hour) (2011)	2.8	35.4	9.2	17.7	0.9
Primary Energy Production (Quadrillion Btu)	97.83	79.13	0.48	1.58	16.05
Corporate tax rate	27%	40%	20%	25%	33.61%
Researchers/million population	1071	4,663	N.A.	6286	136
Expenditure on R&D per capita (US$ PPP)	217.69	1275.64	812.69	1111.12	29.07
Expenditure on R&D as % of GDP (PPP)	1.97	2.7	2.3	3.74	0.9
VAT	17%	11.7%	5%	10%	13.5%
Other Taxes			Trade Promotion Fee: 0.04%	*MFN Duty Rate: 8% *MFN-Most Favored Nation	Landing Charges: 1% Countervailing Duty: 12%+4% = 16% Cess:3%

3. Comparative Analysis

3.1 India and China

The comparison of key statistical parameters of China and India is tabulated in Table 3.

3.1.1 Analysis

The analysis of this statistical data between China and India can be summarized as follows:

- China has high capital which is 93.2% of total exports in manufacturing exports whereas in India it is just 50.3%. China plans to invest U.S. $600 billion in smart grids.
- Income tax incentives are provided by the Chinese Government for venture capital firms that invest in unlisted new and high technology enterprises, whereas India has set a target of $1 trillion investment in infrastructure over the next 5 years (2012-17).
- Compulsory licensing for local manufacturing in China but no such policy in India.
- In China locally manufactured phones has VAT of 6% and 17% VAT on the imported phones, whereas in India the latter has a VAT of 13.5%.
- Expenditure on R&D per capita and percentage of GDP are very low in India as compared to China. The dependence of these factors can be taken vice versa also.
- Low primary energy production in India results in high utility cost required for the setup of the manufacturing units.
- However, India has ambitious manufacturing policy which offers, faster permits lower taxes and easier labor laws. It is expected to boost the manufacturing to 25% and add 100 million jobs in manufacturing by 2022(Deloitte, 2013). The government policies off late has been very supportive for electronic manufacturing and system design.

3.2 India and the United States

The comparison of key statistical parameters of USA and India is tabulated in Table 3.

3.2.1 Analysis

The interpretation of the statistical comparison is as follows:

- In technology innovation United States stand among the top countries in terms of patents awarded and 20% of research in universities is funded through the National Science Foundation, whereas in India, expenditure on R&D per capita i.e. 29.07 US$ PPP and as percentage of GDP that is 0.9 PPP, investment in research is very less. Therefore, the scope for innovation in India is very less as compared to United States.
- Corporate Tax Rate in India is less than US, whereas US has one of the highest taxes across the globe. But again the increased VAT in India and other taxes levied by the Indian government counterbalances the effect.
- One more advantage India has over US is the low labour cost that is 0.9 US$/hour whereas in US it is 35.4 US$/hour. But India lacks infrastructure required for the setup of the manufacturing units.

3.3 India and Taiwan

The comparison of key statistical parameters of Taiwan and India is tabulated in table 3.

3.3.1 Analysis

The analysis of the comparison of statistical parameters are as follows:

- In Taiwan, 88.2% of the total exports account for manufacturing exports whereas in India, it is 50.3% (Deloitte 2013). The production is export oriented
- Taiwan has a low corporate tax of 20% as compared, whereas in India it is 33.61%. Advantage of low corporate tax encourages companies to take risk and try out new production processes and techniques.
- As India has various other taxes imposed on goods and services such as Landing Charges, Countervailing Duty, Cess Tax, etc. it discourages local producers to import materials essential for production, several taxes imposed on local manufacturers (varies with state) and has forced them to import raw materials. This in turn causes rise in the price of product, due to increased bill of material (BOM). Taiwan, on the other hand does not have these high local taxes.
- India has a benefit of low labour cost where the rate is as low as $0.9/hr. as compared to Taiwan that is $9.2/hr. Not only this in India a large number of skilled engineers we contribute greatly to research and development.
- In Taiwan, per capita expenditure on R&D is $812.69 PPP whereas India on the other hand has a per capita expenditure as low as $29.07 PPP. Although India invests more in R&D as compared to Taiwan but due to high population of 1.27 billion (compared to Taiwan which is 23.4 million) per

capita expenditure is reduced in India. As a result of this, innovation is hardly achieved due to sub-critical funding and distribution of funds amongst various research groups.

- India has high value added tax (VAT) of 13.5% as compared to Taiwan that is 5%. This tax is levied on the value added to the material, during the process of manufacturing, and the mobile vendors, along with the consumers bear this cost. The mobile manufacturers obtain various materials for the process of assembling and hence have to pay VAT for such items. This causes a rise in the bill of material (BOM) of the Smartphone. Also, the end consumers have to pay VAT for Smartphone, which increases the cost of a Smartphone, resulting into a decline in demand.

3.4 India and South Korea

The comparison of key statistical parameters of Korea and India is tabulated in table 3.

3.4.1 Analysis

The comparison of the statistical data between Korea and India throws up the following conclusions:

- 85.3% of South Koreas total exports are from manufacturing sectors whereas in India it is 50.3% (Deloitte 2013). This means that South Korea has a well-developed and sound manufacturing sector, compared to its other sectors. As a result of this, its key player Samsung is world leader in the Smartphone market (Deloitte 2013).
- South Korea gets Foreign Direct Investment as high as $3.8 billion whereas India has a FDI of $2.9 billion. So it is observed that South Korea has FDI which is 1.3 times that of India. This mean a greater emphasis is given to foreign players to invest in the countries that have manufacturing and service industries.
- South Korea has a corporate tax of 25% against India's 33.61%.
- India has lower labour rates compared to South Korea. As a result, India hold great opportunities in labour intensive manufacturing processes, as compared to that of South Korea.
- South Korea spends more in R&D.
- It has a per capita expenditure of US $1111.12 PPP as compared to India's US $20.07 PPP.
- South Korea has more researchers per million of its population, with the figure standing at 6286 versus India's 136. South Korea has well established research and development centers, fostering innovation & technology as well as a good number of higher-education technological institutes and large network of research laboratories.
- VAT is low in South Korea whereas in. India taxes like Cess Tax, Countervailing Duty etc. leads to a rise in the cost of

Smartphone that causes poor demands. Hence, it is essential to have a favorable institutional & policy environment to support Smartphone manufacturing.

4. SWOT Analysis for India

Based on the analysis undertaken with different global smart phone manufacturing countries, the SWOT matrix has been developed with special regards to the ecosystem and analysis of each elements of the matrix is undertaken thereafter.

Figure 5. SWOT Matrix for Indian Smartphone Manufacturing Ecosystem.

4.1 Strengths

India's younger population is also adaptive to try out new technology that comes bundled with every generation smart phones.

1. Presence of Skilled Labour: India scores high after Singapore and USA in the category of skilled labour (KPMG, 2011). Labour is one of the essential factors required for Smartphone manufacturing as well as it also attracts other Smartphone manufacturers to India. Although many processes are automated, the large volume of product requires skilled labour for final assembly and testing of each price for its performance parameters.

2. Presence of Qualified Engineers: Engineers are needed on design of higher-end production process in any Smartphone manufacturing as they have the innovative capabilities of generating newer application which can point to niche areas that are extremely necessary for Smartphone manufacturing companies. Hence presence of qualified engineers is the greatest strength for India.

3. Large Consumer Base: In India the large customer base attracts various Smartphone manufacturing companies. The local customer base is a source of high profit as well as establishment of production houses also reduce costs and lead to greater profit margins.

4. Presence of IT companies: India has a large number of contract R&D providers who provide services such as chip design, software, signal processing and operating systems. Also, the presence of Indian IT companies is of great advantage for companies currently manufacturing in India which is able to provide cheap IT solutions to the manufacturers. Infosys, an India-based IT company has greatly influenced the manufacturing process in India. Tata Consultancy Services (TCS) is another such Indian firm.

4.2 Weakness

1. Poor infrastructure: The key impediment to handset manufacturing in India is the high cost of infrastructure services. The world has far better physical infrastructure than India. So, comparatively India lags behind other countries, which is clearly a weakness. This needs to be tackled through Public private partnership and encouraging FDI.

2. Government Policies: Government Policies which levy heavy taxes on import in India, for example, importing a US $5 battery from Hong Kong the cost increases by US $1.51(duty costs), whereas if the same is to be imported to the US there would be no change in price due to absence of duty costs. Manufacturer friendly policies need to be developed that boosts local value addiction right from design to dispatch.

3. High freight cost: China invests 2.5% of its GDP on roads as compared to 0.3% in India (KPMG, 2011). This results in higher freight costs in India. For example the freight as a per cent of CIF import cost in India is 11%, as compared to world average of 6% (KPMG, 2011). Procedural bottlenecks in imports are also significant obstacles. While processing of imported goods in China takes 2-3 days, while the average time taken in India is about 10 days.

4. High Utility cost: It is also an obstacle to the manufacturing process in India. Peak electricity shortfall in India was 12.1% in 2003 *(Deloitte, 2013)* and Cost of power to industrial consumers is at least twice as expensive in India as in China. Due to frequent outages, most units in India choose to install captive units in addition to grid supply resulting in higher cost of power.

5. Labour Laws: It is widely cited bottleneck in the Indian manufacturing business case. Flexibility in labour laws, such as hiring contract labour, is critical in electronics components manufacturing, which are cyclical industries. It is thus not surprising that the World Economic Forum *(WEF)* ranked in India is 98th among 102 countries in terms of labour reforms while China ranked 26th (KPMG, 2011). This acts as a different to the genuine manufacturers to set up manufacturing facility and needs to be amended.

6. Absence of local component base: Though today most of the Smartphone companies are able to import the raw material used in its manufacturing the absence of local component base can still be considered as one of the weakness in India. Having a local component base will create an environment of innovation and spin up support industries and start-ups required for technology companies.

4.3 Opportunities

1. Low tariff rates: By increasing competition amongst the telecommunication service providers the tariff rates are one of the lowest in the world which has increased the telecom penetration in urban and rural areas. Therefore the consumer has the appetite for adopting smartphone and higher data consumption. This will lead to increased sell of smartphones and hence will attract smartphone manufacturing companies to India.

2. Less penetration of Data services: The Smartphone mainly fits in when it is required to have streamlined internet connectivity, apps to attract customers, apps to address niche consumer needs so that customer can utilize Smartphone to a full extent. Hence India needs to focus more on technologies and APP development.

3. Less penetration in rural areas: There is negligible usage of Smartphone in rural India as it does not fulfil the needs of rural persons and therefore has an untapped potential. India needs to conduct surveys and hence forth identify what rural Indian needs. This needs to overcome with the help of more research and development so that it can be a positive source to attract Smartphone manufacturing companies to India.

4. Low usage among various groups: In India the age group where most of the Smartphone penetration exists is less. India need to look at the problems faced by other age groups in order to promote Smartphone sells in the country. This will depend on development of applications focused to various age profiles and their needs i.e., the need of child is different to adolescent and for that of old age.

5. Advantages to Manufacturers

- **High economic growth**: A vast domestic market for Smartphone manufacturers is provided by India. To grab this opportunity, plants in India have been set up by global Smartphone manufacturers, by introducing and using the latest technology thus competing with the local Smartphone manufacturers.

- **Ambitious national manufacturing policy:** This policy was approved in 2011, and plays a vital role in building industrial enclaves that offer lower taxes, easier labour laws and immediate permits. The market share of manufacturing is anticipated to improve from 16 % of GDP in 2009 to 25 %

by 2022. (Deloitte, 2013). The present government is very aggressive for manufacturing with focused Make-in-India mission.

- **Planning for huge investments in infrastructure: A** target of $1 trillion investment in infrastructure over the next 5 years (2012-17) has been envisaged, which is a huge investment in infrastructure (Deloitte, 2013).

4.4 Threats

1. Global Competition: The main threat to Smartphone manufacturing industry development in India is from the external world. As pointed out earlier every country that has Smartphone manufacturing base has huge investments in research and development, freight etc. They have a good supplier chain network. Their geographical locations are suitable from trade prospective and are much developed in terms of infrastructure. Hence this is a serious threat to Indian economy in terms of Smartphone manufacturing.

2. Less developed technology: The technology such as 3G and 4G are not very much in use in India while many developed countries are aggressively working on 5G technology. Not much effort or resource is channelized in India for R&D in emerging economy. This leads to a least usage to Smartphone's in India because most of the applications operate on internet facility. The tariff of 3G and 4G are not affordable to Indian population which is also a real problem.

3. Difference in specs and price rates: The Indian local manufactures are selling their Smartphone at half price as compared to the foreign companies with same specs. This builds a problem for Smartphone making OEMs to find a suitable market in India.

4. E-waste management: India is currently importing about 1 Billion of Smart phones/year. The average life of a Smartphone is expected to be 21 months (Media, 2014). Hence discarded Smartphone waste will be huge in the country. So it is necessary for India to find a suitable disposable method in coming time.

5. Conclusion

In this study, strengths, weaknesses, opportunities and threats for various smartphone manufacturing ecosystems across globe have been identified. SWOT analysis has also been conducted. Comparative study of the five countries i.e. China, USA, Taiwan, and South Korea will help India to analyze and determine different strategic areas. These countries have strong manufacturing-base and are key markets for smartphone manufacturing. Major strengths of five countries are increase in R&D expenditures, increase in number of middle class consumers whereas major weaknesses are low productivity of R&D spending, rapid technological changes, slowing economic growth, etc. Strong ties with western economies, joint ventures, and boost in innovation

capacity are some of the major opportunities that each country is facing. International competition in terms of innovation, price wars with component manufacturers are acting as threats in introduction of a new handset in these five countries.

India can focus on weaknesses of these countries being potential competitors and transform them into India's opportunities. This will boost country's competitive advantage and help maintain its position as a strong contender on the global manufacturing front. The weaknesses should be eliminated, opportunities should be grabbed in time and threats should be handled with technical and economic resources and conviction. There is a need to look into variables for inhibitors and critical success factors to improve our Smartphone manufacturing ecosystem.

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Effect of Angle of Abduction and Illumination Level on Performance in a Human-Machine Interaction Environment

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Abstract

An experimental investigation was conducted to evaluate the human performance in the context of human-machine interaction environment. It was observed that both the illumination level and an angle of abduction have significant effect on human performance when workers work in human-machine interaction environment.

Keywords: Anthropometry, Angle of Abduction, Ergonomics, Illumination Level

1. Introduction

In this era of automation both management and workers are concerned with the quality of work lives, ergonomics and occupational safety and health. Since the 1960's, the rapid growth of information systems has led to the wide development of research on human-machine interaction (HMI) that aims at the designing of human machine interfaces presenting ergonomics properties such as usability, transparency, compatibility etc. Stenzel and Sommer[1] measured output from 12 people working at a leather goods factory over a 4 year period in the middle of which illumination was varied. It was found that the performance improved with increased illumination. Benneti et al.[2] studied the effect of illumination levels on catching behavior in professional cricketers. It was noted that the illumination level should be optimized to get superior performance from the cricketers. Juslen and Tenner[3] suggested that changing the lighting increases the workers performance.

Body movements occur around moveable joints. Each type of joint allows certain type of movements. Abduction is a movement of a body segment towards the midline as when moving the arm from the outward horizontal position downwards to the vertical position. Cormick and Sanders[4] found truck drivers to be taller and heavier than general civilian population. Body measurements vary as a function of age, sex and for different ethnic population. Okunribido[5] conducted an anthropometric survey of female workers in Nigeria and it was observed that Nigerian female hand is wider and thicker but shorter than females from UK, Hongkong and America. Akmal[6] studied the effect of angle of abduction pertaining to the optimum design of human-machine interaction system and concluded that angle of abduction has no statistically significant effect on the data entry task. Khan and Asghar[7] performed a study of an angle of abduction in a computer numerically controlled electro dischar e achine - t as nd that the pti i ed an e a d cti n as r s peri r performance. The main purpose of ergonomists is to design workplaces which are comfortable to fit both the body and mind of the worker. Nowadays, there has been a rapid growth in the use of computers at variety of workplaces and a new field of study is emerged which is termed as human machine interaction environment. In the present research work, two studies have been carried out. Firstly, the effect of illumination level when the workers work on computer numeric control milling machine have been studied. Secondly, the effect of angle of abduction was evaluated experimentally.

2. Brief Description of Experimental Set Up

For the experimental investigations an experimental set up was fabricated within the CNC room in the National small scale industries corporation limited (NSIC), Aligarh, and (India). The fluorescent tubes were arranged to obtain different illumination levels (100 lux to 900 lux).

A digital lux meter was used to measure the illumination level. The arrangements have been depicted in Figs. 1, 2, 3 and 4.

Figure 1.   photograph showing a subject fixing a job.

Figure 2.   photograph showing a subject fitting a tool.

Figure 3.   photograph showing operator entering the computer program for machining.

Figure 4.   photograph showing CNC milling room.

The set-up is comprised of following subsystems: CNC mill trainer *MT200,* a digital lux meter (*Model 101, Range 1 to 50,000 lux*), an electronic switchboard having arrangements of a fluorescent tube lights, an electronic timer (*LCO stopwatch quartz-016*), provision of fluorescent light sources, VDU with the keyboard and a program in machine control language for feeding the program in the computer of CNC milling machine.

3. Subjects Selection

The subject's selection has been one of the most important factors which determine the reliability of results of any ergonomics experiment. When illumination level was varied eight subjects from same sex (males) were selected to participate in the study. When angle of abduction was varied twenty-one subjects were selected to participate in the study. All the subjects chosen were skilled and have knowledge of CNC milling m/c.

4. Experimental Design

One of the primary purposes of experiments in which the same subject was observed under each of the treatment was to provide a control on differences between subjects. In this type of experiment, treatment effects r subjects 'i' was measured relative to the average response made by subjects on all treatments. So, each subject serves as his own control and responses of individual objects to the treatment was measured in terms of deviation about a point. The average responsiveness of the subjects was measured. The experiments in which the same elements were sed a the 'k' treatments required observations on each element. Hence, the term repeated measure was used to describe this kind of design. The present work was based on single factor repeated measure type of statistically design. Here two dependent studies are undertaken as detailed below.

Study 1: The independent variable is level of illumination. The various illumination levels used were (100 lux, 200 lux, 530 lux, 860 lux). At these illumination levels the task structure was to enter the computer program for machining. Four levels of illumination were used to evaluate the effect of illumination on human performance.

Based on the calculations the optimum illumination level was determined. **Study 2:** The independent variable is angle of abduction. The two types of tasks were performed by the subjects, one was to fix the job and another one was to change the tool. Twenty one subjects performed this experiment. Seven subjects of height 5, seven subjects of height 6, seen s jects height 9 were chosen for the experiment. The time taken to complete the task was noted as an index of performance.

5. Methodology used During Experiment

In the NSIC in the machine room where CNC milling machine was kept the illumination level was kept (i) 100 lux (ii) 200 lux (iii) 530 lux (iv) 860 lux and then the 8 skilled subjects perform the experiment. The time to feed the program was noted. In the second study where the effects of angle of abduction was considered the 21 subjects were asked to perform the tasks. The time to fix the job and the time to fit the tool was noted down.

6. Results

For the study on the effects of illumination level in a human machine interaction environment the data was collected and the results were obtained for the eight subjects belonging to male population. The time taken to feed the program was taken as an index of human performance. Over the data collected the analysis of variance pertaining to the single factor repeated measure type of statistical design was performed. The results of the analysis have been shown in Table 1.

At α = 0.10, F ratio was used in testing hypothesis about the effect of level of illumination on human performance while working on CNC milling machine. At 0.10 level of significance the null hypothesis (with the critical value of F ratio as {$F_{0.90}$ (3, 21) =2.36} was contradicted by the experimental data.

With this result it was concluded that statistically, the level of illumination considered in this study showed a significant effect on human performance.

Table 1. Summary of analysis of variance for the study pertaining to the effect of illumination (Study 1)

Sources of variation	S.S	Df	MS	F
Between people	3.75	7		
Within people	6.75	24		
illumination	1.99	3	0.6633	1.67
Residual	8.34	21	0.3971	

The analysis of variance based on the single factor repeated measures type of design revealed that the variable, illumination has been a significant factor in human machine interaction environment. To establish which one out of the four considered illumination levels could be more compatible the data was further analyzed by method of comparison of means proposed by Winer[8]. This indicated that illumination level 860 lux offered an optimum performance. The analysis of variance is employed where the F- ratio (F= $MS_{illumination\ level}$/ $MS_{residual}$= 1.67) is used in testing hypothesis about time in minutes to enter the program as a function of the effects of the illumination level.

For a 0.10 level test on the hypothesis that $T_1=T_2=T_3=T_4$, the critical values from ANOVA table for the F-ratio is $F_{0.90}=2.36$. The experimental data contradicts this hypothesis. The data indicates that illumination at 860 lux is different in its effects on the performance of an operator, from the effects of the other three illumination level.

To test the hypothesis $T_1=T_2=T_4$ the sum of squares for these three illumination level is given by

$$SS_{illumination\ 1,2,4} = [T_1^2 + T_2^2 + T_4^2] / n - [T_1 + T_2 + T_4] /3n \qquad (1)$$
$$= 0.61375$$
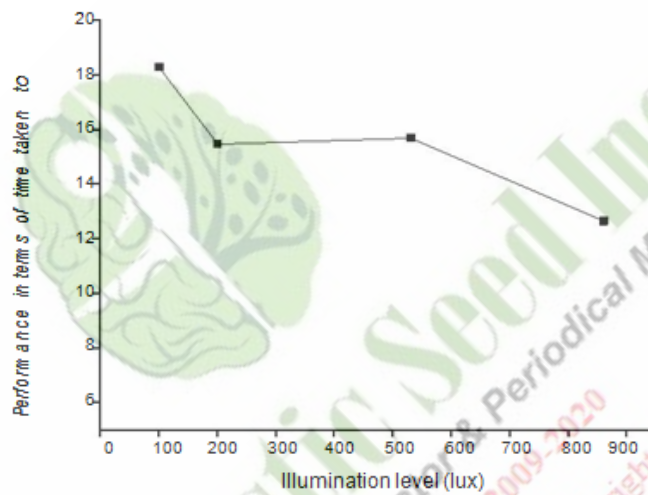
Figure 5. Graphical representation of the performance in terms of time taken to enter the program in minutes when illumination level is varied.

Observed F statistic

$$F = MS_{illumination\ 1,2,4} / MS_{res} = 0.7866 \qquad (2)$$

And by the comparison of means for a 0.10 level test the critical value of this statistics is

$$F_{0.90}(2, 21) = 2.57 \qquad (3)$$

Since the observed F statistic does not exceed the critical value , the data do not contradict the hypothesis that

$T_1= T_2 =T_4$ which shows that the performance at 860 lux is optimum illumination level as far as human performance in human machine interaction environment is concerned.

An attempt was made to develop a mathematical model for representing human performance measured in terms of (time taken by skilled operator to enter the computer program) under

Table 2. mean value of time taken to enter the program in minutes at respective level of illumination

Level of illumination (lux) i	Mean value of time taken to enter the program in minutes (P)
100	18.3
200	15.49
530	15.71
860	12.66

varying levels of illumination (See Fig. 5). A curvilinear model was filled in the data. It had the following form

$$P = A + Bi + C i^2 \qquad (4)$$

Where P is the performance of skilled operator (expressed in terms of time in minutes taken to enter the program)

i is the illumination (lux) and A, B and C are the c e icient's of 2nd order quadratic. This data was used to develop the model as shown in following Table 2.

Using the data of Table 2, the mathematical model which was developed is as follows:

$$P = 14.25 + 4(10)^{-5} i + 1.59(10)^{-11} i^2 \qquad (5)$$

The error sum of squares of this model has been noted to be 15.93.

Study 2: For the study of effect of angle of abduction the data was collected and the results were obtained from 21 subjects (male population)(See Table 4). The subjects were asked to perform the tasks. While doing the experiment the illumination level was maintained at 860 lux. Table 3 shows effect of angle of abduction. The analysis of variance pertaining to the single factor repeated measure type of statistical design was carried out. Table 5 shows the summary of variance analysis for the study of the effect of angle of abduction.

Fratio was used in testing hypothesis about the effects of angle of abduction. At 0.10 level of significance the null hypothesis (with the critical value of F ratio ie. $F_{0.90}$ (2,12) = 2.81 was contradicted by the experimental data. With this result it was concluded that statistically, angle of abduction considered in the study has a significant effect on human performance. To establish which one out of three angle of abduction could be more

Table 3. Observation table showing effect of illumination level

Subjects	Time (min) required to enter the program at different levels of illumination			
	100 lux	**200 lux**	**530 lux**	**860 lux**
1	3.40	1.51	1.29	1.43
2	2.03	2.16	2.02	1.36
3	1.46	1.14	1.15	1.16
4	2.08	2.25	2.32	1.51
5	2.29	1.58	2.12	1.28
6	2.12	1.36	2.00	2.13
7	2.39	3.09	2.39	1.26
8	2.53	2.40	2.42	2.53

Table 4. Observation table showing effect of angle of abduction

Subjects	Time (mins) to perform the tool task (fixing of work piece and fitting of the tool) at different angle of abduction		
	34°	**36°**	**3°**
1	1.38	0.59	0.93
2	0.97	0.67	1.53
3	0.84	0.60	0.81
4	0.89	0.83	0.74
5	1.42	0.78	0.61
6	0.94	0.70	0.44
7	0.92	0.69	0.65

compatible, the data was further analyzed by method of comparison by means. This indicated that 36˚ angle of abduction offered an optimum performance. Suppose it has been anticipated that angle of abduction 36˚ has different effect than others

$$F_{statistic} = SS_c / MS_{res} = 0.344 \qquad (6)$$

By the comparison of means, the critical value for 0.10 level test of this hypothesis is

Table 5. Summary of variance analysis for the study of the effect of angle of abduction.

Sources of variation	S.S	Df	MS	F
Between people	0.31	6		
Within people	1.19	14		
illumination	0.49	2	0.23	2.66
Residual	1.04	12	0.08	
Total	**1.50**			

$$F_{0.90}(1,12) = 3.81 \qquad (7)$$

The observed data does not contradict the hypothesis that $T_1 = T_3$, which shows the performance is optimum at 36˚ angle of abduction.

An attempt was made to develop a mathematical model for representing the human performance measured in terms of time taken to complete the task under varying angle of abduction. It had the following form:

$$P = D + Ex + F x^2 \qquad (8)$$

P = per r ance i in achine perat r
x = level of angle of abduction
and D, E and F are coefficients of 2nd order quadratic.

The data used for developing the model has been shown in Table 6. Using the given data the mathematical model obtained has been given as

$$P = 9 + 0 \ x + -0.014) x^2 \qquad (9)$$

7. Conclusions

The experiments which have been conducted succeeded in highlighting the relative importance of selected system (CNC milling machine) and display variables (illumination level and angle of abduction, and provided some indication of the sensitivity of those variables. On the basis of study following conclusions were made

Table 6. Mean values of time taken to complete the tasks under different angle of abduction

X	P
3 ˚	7.36
36°	4.86
3°	5.71

1. The illumination level has a significant effect on the performance of CNC milling machine operators as far as program entry task is considered. The results of the study indicated an optimum performance when the illumination level was 860 lux.

2. The angle of abduction has also a significant effect on human performance

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Forecasting the Implementation Success of AMT in SMEs using an Integrated AHP-TOPSIS Approach

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Abstract

The adoption of Advance Manufacturing Technology (AMT) requires careful planning at each level of organization due to large capital investments involved in newer technology. It has been seen in many cases that the AMTs have improved the firm's peformances, however according to recognized practitioners there is still a possibility of project failure due to adoption of this new technology. Hence it is always practiced to identify the major success factors that influence the adoption of AMTs. This study proposes a hybrid model for AMT justification which takes account thirteen factors and their relative importance in the justification phase. The justification phase comprises of three sub-phases: identification of critical factors; calculation of priority weights and ranking of critical factors and determination of possibility of successful adoption of the technology. The results showed that in order to have fruitful result from AMT investment, the strategic issues, technology transfer and continuous support of management should be properly organized to avoid the barriers in successful adoption of advance technologies.

Keywords: Advance Manufacturing Technologies (AMT), Analytical Hierarchical Process (AHP), Implementation, Small and Medium Enterprises (SMEs), Technique for order preference by Similarity to Ideal Solution (TOPSIS)

1. Introduction

The manufacturing sector plays a vital role in development of economy. In developing countries like India, Small and Medium Enterprises (SMEs) are the strength of manufacturing sector. In the past years, these enterprises have been excessively promoted due to its immense contribution to generate opportunity of employment. An important advantage of this sector is their high labor-capital ratio. Apart from providing the services to larger enterprises, SMEs also promotes the industrialization of rural and backward areas. Since it is well entrenched that SMEs significantly contributes to nation economy, hence survival of these enterprises in a global business environment is one of the most pressing matter for a nation. In the global business environment, complexity, uncertainty and dynamism are the dominant characteristics that ensued in a diversification of the today's market. To remain competitive, manufacturing organizations must update their technologies used for manufacturing processes. The decision for up gradation of technologies must justify the cost of implementation as well as the quality and responsiveness expectations of customers.

It is unquestioned that the adoption of Advance Manufacturing Technologies (AMTs) in manufacturing propels the globalization and innovation. When a production system uses computers not only for manufacturing operations but for planning and control, for procurement and inventory tasks and also for shipment and service of finished products, then such automation in technology is called Advanced manufacturing technology. The espousal of AMTs in SMEs would enhance quality, financial and organizational performances, operational capability, leads greater control of operations, effective coordination between different departments and shorter lead time. However, the high initial capital investment in AMTs seeks the wise decision from the top management about the enactment of this technology in low budged SMEs. The need of AMTs in SMEs arises due to increased competition in global market, rapid changes in the market, dynamism in product variety and shorter life span of products in market [Rosnah (2003)][25].

AMTs have widely accepted as valuable weapons to face challenges imposed by dynamic market, its high initial investment should justify an organizational survival in highly competitive market. Some previous studies on AMTs adoption in SMEs show

that these computerized innovations are not always lucrative for an enterprise and it can only be successfully implemented if evaluation of technology would be done on the basis of critical analysis of tangible and intangible factors[Mechling et.al. (1996)[19], [Koc &Bozdag(2009)],Chung(2000)[7], Sohal(2000)][32].

In this paper an attempt is made to adopt an integrated approach that involves AHP-TOPSIS methods to critically evaluate thirteen factors that play a crucial role in decision making process of implementation of AMTs in SMEs.

AHP involves formulation of structure hierarchy, starting from the goal of decision and then through the intermediate levels that define the objectives to the lowest level that usually represents the set of alternatives. In AHP a pairwise comparison matrix is formed that compares the elements in intermediate level. The result of the comparison matrix depicts the weights assigned to these objectives. By continuing the procedure, final priorities of alternatives can be obtained. Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) developed by Yoon and Hang (1980) determines the euclidean distance from positive and negative ideal solution and thus provides the scoring of alternatives. The main aim is to provide ranking of alternatives. Over the past few decades, TOPSIS has found its applications in decision making process. It is particularly useful in scenarios in which hundreds of objectives or alternatives are considered. In AHP the use of pairwise comparison matrix restricts the number of objectives and alternatives to twenty. However, TOPSIS still requires weighting of criteria's. Thus it is usually combined with AHP.

The present paper is organized as follows: the second section provides research background of critical factors. The third section discusses the methodology. The paper is finally concluded with a discussion of limitations and future directions.

2. Research background supporting Critical Factors

A limited budget of SMEs enforces enterprises to use a systematic selection model for making decisions on AMTs selection. A large number of selection models have employed for AMTs selection over the past years. Several models and approaches have proposed in the literature for evaluation and justification of advance technologies. Few of these are analytical hierarchal process [Yusuff et.al. (2001)[37], Tansel & Yurdakul(2013)][34]. Cone ratio data envelopment analysis (Talluri and Yoon (2000)), Financial evaluation techniques [Orr (2002)][23]. The justification of AMTs is the new field of study and till date several researches have been performed. Singh and Kumar (2011)[29] employed a two phase approach using AHP and VIKOR for effective utilization of AMTs. They considered seven factors which were weighed by

AHP method and VIKOR technique was utilized to rank the final results. Kluczek and Gladysz(2015)[12] employed AHP and TOPSIS in an industrial case study where the goal was to determine the most suitable improvement option that prevents hazardous solvents and solid waste in painting process.

Chang and Wang (2009)[6] presented a comparison between AHP and Consistent fuzzy preference relations (CFPR) methods used for justification of AMTs. Authors compared seven attributes using these two methods and outcome was more chances in successful implementation of AMTs. Lee et.al. (2012)[16] implemented AHP and correlation analysis in their study on technology transfer adoption and how the factors influences the decision making process. Singh and Kumar (2013)[31] published a research paper on a hybrid method that uses AHP-TOPSIS-AHP in three phases. The authors carried out their research by selecting seven factors that assist in effective utilization of AMT. It was also reported by Zhou et. al.(2009)[38] that investments in AMTs were justified with firm performance in Swedon but not in Singapore and according to Koc & Bozdag(2009),failures in AMT results more often than their success especially in small and medium enterprises.

Most recently Kumar and Raj (2016)[15] have employed integrated AHP and modified gray rational analysis to take into account the vagueness in decision regarding selection of mobile robots for material handling in FMS environment.

The present study is based on Singh and Kumar (2013) method but we have considered thirteen factors that almost cover all the attributes that play a major role in making decision on AMTs justification in SMEs.

Following are the factors that may assist in justification of AMTs in SMEs of India.

2.1 Strategic Issues (ST)

Strategic issues address a series of decisions that provide the necessary support to achieve defined objectives of an organization. These issues deal decisions in structural and infrastructural areas in a time and market specific pattern. These strategies should take into account the manufacturing capabilities, competitive priorities and decision criteria. An effective strategy of an organization includes decisions involving capacity, inventory, plant size and location, quality control, work force management policies, organizational structure and financial and information system. [Efstathiades,et.al. (2002)][8,9],[Kreng et.al. (2011)].[14]

2.2 Technology selection and Transfer (TT)

These issues deal with how AMTs can improve productivity of a manufacturing system. The dynamic characteristics of market seek flexible manufacturing which integrates hardware with software technologies. The selection of hardware is carefully done on the basis of flexibility of machine tools, material handling and

storage units. The hardware should be selected on the basis of maintenance requirement, skilled worker's requirement, capital requirement etc. (Sambasivarao and Deshmukh(1995))[27]. The software should be selected on the basis of capability to process huge amount of data and flexibility to incorporate further modifications. The software should be capable to integrate all the concerned department of organization such as engineering design, manufacturing, business, shop floor etc[Lee et.al. 2012].

2.3 Organizational changes & external consultants (OR)

To adapt a new technology, one needs to revise the organizational structure. A new technology calls integration of production planning and execution activities which were earlier considered as sequential and separate. Flexibility in structure enhances variety rather than volume and judgment rather than standard procedure. A flexible structure brings different disciplines under one umbrella that does not appreciate differentiation in task and authority. An advance manufacturing technology demands flexible, adaptive and multi skilled oriented organizational structure. [Nyori et.al. (2015)][22]

2.4 Continuous management & manufacturing support(CM)

Support of top management is of crucial importance to successful implementation of AMTs. Their support is desirable throughout the justification, transfer and implementation of technology. A continuous support of management has a positive influence on operation managers and technology operators [singh et.al. (2007)][30].

2.5 Human Factors (HF)

A new adaption of technology should be carefully done so that individuals and groups would be productive, efficient, flexible and motivated. Human factors refer to employee reactions on technological change. It is natural for psychological unprepared employees to resist technological change due to uncertainty, technological stress, job security and fear of losing identity. So it is the responsibility of management to make their people comfortable with the ongoing change by organizing workshops, expert's lectures that can motivate as well as enhance knowledge and skills of workers.Special emphasis should be given in involvement of workers in technology transfer and selection. [Bidanda & Cleland(1995)][1],[Bayo-Moriones & Cerio(2004)][2].

2.6 Vendor Selection(VS)

Vendor selection is another important factor in adoption of advance technology. A manufacturer planning to invest in AMTs should have prior information about vendors and the products. He should avoid group buying and technological packages offered by vendors. The selection of vendor should be done by the panel of experts on the basis of technical and business requirements of the organization. (Un and Asakawa, 2015)[35]

2.7 Implementation Practice (IP)

The implementation practices have substantial influence on results of AMTs implementation. Implementation practices involves working procedures, planning and control activities, quality methods, skill development etc. These practices largely influence total cycle time for a manufacturing process. Better implementation practices helps in reducing the bottlenecks of shop floor [Pintado et.al.(2015)][24].

2.8 Planning to Infrastructural Preparation (PTI)

Since advance technologies are solely depended on software, the basic infrastructure such as internet, power, and telephone lines should be 24/7 available at the facility location. The excessive use of information technologies in manufacturing unit demands this basic infrastructure to be in place. A proper plan can handle these infrastructural issues [Millen, & Sohal, 1998][20]

2.9 Social Issues (SI)

It deals with how the implementation of automation techniques affects those who are associated with the organization. The decision of adoption of new technology depends also on how the decision will proved to be beneficial for its people. The social issues include customer satisfaction, community development, ecological issues and working environment. The customer satisfaction can be calculated by keeping an eye on market fluctuations and the depletion of product demand. AMT implementation guarantees high quality products at reasonable prices that somehow help in raising standard of living of customers. Another important factor is working environment which if safe, fatigue proof, hygienic, properly illuminated and ventilated will improve worker's productivity. Also, organization must take care that adoption of these technology should not deplete or harm natural resources like water, air etc. [Elghany, 2015][10].

2.10 Hands on Training (HT)

Advance manufacturing technology supersedes the traditional manufacturing and it has increased the demand of skills requirement in manufacturing sector. Instead of searching skilled workers, advance manufactures should provide the necessary education and training that can anticipates and satisfies the training needed for manufacturing sector.

An adequate hand on training prepares the workers for shop floors and management's efforts in this direction help in gaining the trust and cooperation of workers. [Mital et.al.(1999)][21].

2.11 Setting of Interim Target (SOI)

To evaluate the process of implementation of flexible technologies, a number of intervening targets need to define. This would help the organization to achieve a speedy growth in market. [Efstathiades et.al. 2002].

2.12 Performance Measurement (PER)

This issue deals with how the adoption of AMTs technologies have supported the objectives and goals discussed in strategic planning process. Performance of AMTs can be evaluated on the basis of cost and efficiency. The criteria of performance should be well defined for excellent benefits to the company. There should be a clear vision on performance goals during pre-implementation and optimization stage [Lin& Nagalingam (1999)][17], [Boyer & Pagell (2000)][4].

2.13 Integrity of AMT (INT)

The greatest advantage of AMT is its ability to control all the activities starting with arrival of raw material to the transport of finished goods. The complete integration of activities can be achieved through excessive use of computers in marketing, engineering, production and maintenance. The available literature truly supports integration of technology over individual automation of the processes. [Cescon, 2012][5]

After reviewing the available literature, we have come down to thirteen factors for AMT selection. Also while searching for most suitable method for our problem; we agreed to use an integrated approach that employed both AHP and TOPSIS. Most of the multi attributes problems use AHP for decision making because of its ease of use and its ability to eliminate deadlock as it is centered on collaboration. However this method alone is not efficient enough when sub-objectives and alternatives are involved are large. In such situations, the multiple comparison matrices formed that increase the complexity in computation. Also a general drawback observed in AHP is that it form hierarchical structure first and then determines the priorities. So we need to validate the prioritization with some other model. Thus to assist in decision making we use TOPSIS method due to its ability to consider a non-limited number of alternatives and criteria in decision making process. The prioritization of AHP needs to validate by TOPSIS.

3. Research Methodology

A group of experts from industry and academia were consulted to identify the factors and their relationships that need to considered while making the decision. All the factors that the experts have determined is shown in Figure 1. The AMT justification model proposed in this paper is an extension of Saaty's AHP. The extended model is comprised of AHP-TOPSIS approaches. In the first phase, a panel of experts has formed the decision factors whose weights influenced the utilization of AMT. The pair wise comparisons matrix formed using AHP technique determines the priority weights of sub-objectives. The results of AHP were verified by performing consistency ratio analysis. In the next phase, the procedure of TOPSIS approach has carried out that results in ranking the sub-objectives involved in problem. The significance of this step is to ensure that all the sub-objectives have been valued depending on their weights. The flow chart that describes the methodology opted in the paper is shown in Figure 2.
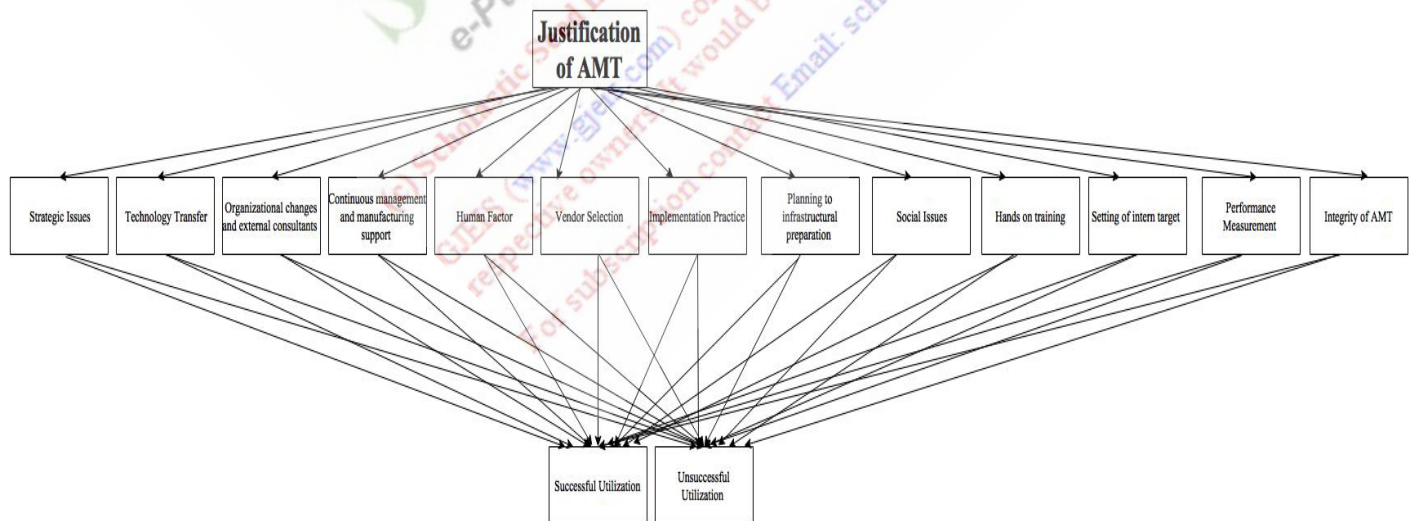
Figure 1.   Hierarchy of AMT justification.
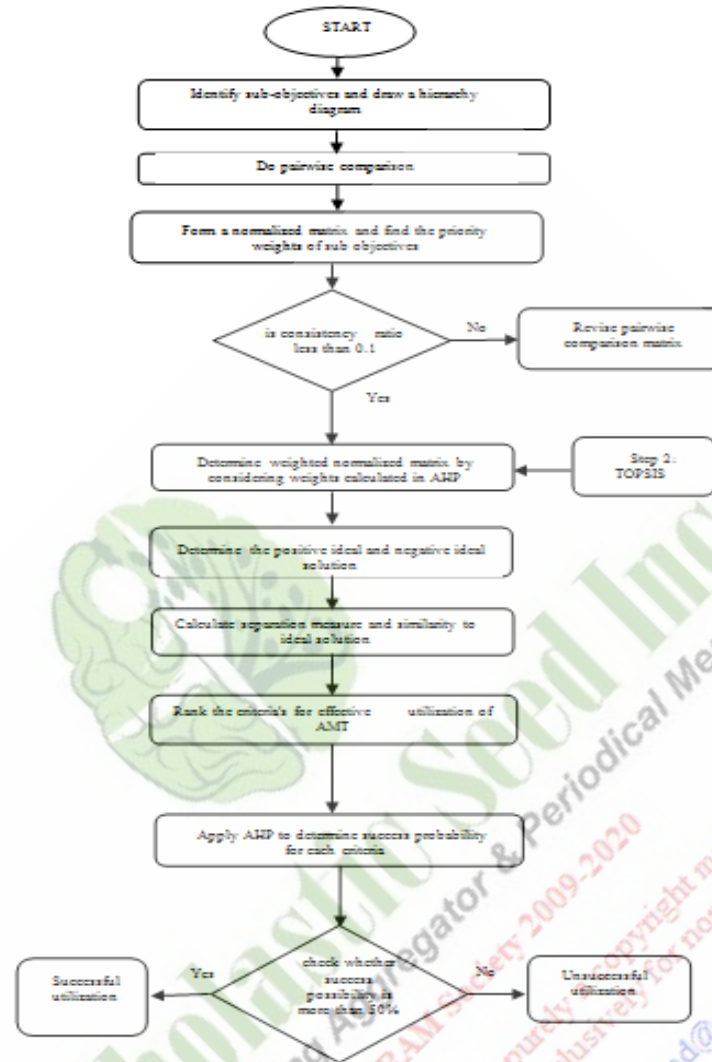
Figure 2. Flow chart of integrated approach.

3.1 Phase 1: AHP

The analytical hierarchal process also known as Satty method (1980) is a systematic approach of summarizing information about alternatives using multi-criteria. It is used for weighing qualitative and quantitative data.

In the first step, a complex multi-attribute decision making problem is breakdown into hierarchy of interrelated data that comprises of attributes and alternatives. Once the hierarchy is formed, the next step is prioritization of attributes which is carried out by forming comparison matrices. The attributes are compared pairwise depending on their influence and importance in decision making process. These comparisons are based on Satty's nine point scale of rating a criteria as shown in Table 1.

Table 1. Gradation scale for comparison of attributes as per Satty

Option	Numeric Value
Equal	1
Marginally Strong	3
Strong	5
Very Strong	7
Extremely Strong	9
Intermediate Values	2,4,6,8

The pairwise comparison matrix has been formed under the supervision of experts from academics and industries. The available literature on SMEs also justifies the importance of strategic issues over technology transfer. With all these attributes a total of seventy eight comparisons have performed by the AHP software. The final comparison matrix is shown in Table 2 .

The next step is to obtain a normalized matrix by dividing each cell of a column to sum of all cells of that column. Once the final normalized pairwise comparison matrix is formed the further step is to check the consistency of the matrix. the comparison ratio is obtained by using following formula :

$$CR = \frac{CI}{RI}$$

where $Consistency\ Index (CI) = \frac{(\lambda_{max} - n)}{(n-1)}$

Random index is taken from Satty's random index table based on matrix size.

If the consistency ratio (CR) is found out to be less than or equal to 0.1 , the result is acceptable else there is need to revise the pairwise comparison of attributes.

The average of each row of a normalized matrix gives the weights assigned to each criterion. The consistency ratio of comparison is found out to be 0.062 which is less than 0.1. Hence consistency is within the acceptable limit. The principal Eigen value is 14.160. The result of Phase 1 i.e. weighing of criteria is shown in Table 3.

3.2 Phase 2: TOPSIS

Technique For Order Preference By Similarity To Ideal Solution (TOPSIS) is a simple ranking method which was developed by Hwang and Yoon in 1981 and is used for conception and application. The idea for its development was to choose the alternatives such that they have shortest distance from positive ideal solution which would maximize the benefit criteria and longest distance from negative ideal solution that would minimize the benefit criteria. However the limitation of this method is it requires numeric data for attributes (Hwang and Yoon (1995))[36]. Like AHP, it also requires expert's perception in forming initial decision matrix. Once the decision matrix is obtained, the next step is to form a weighted normalized matrix (as shown in Figure 3) by multiplying the priority weights to normalized matrix.

Table 2. Pairwise comparison matrix of sub-objectives

Factors	ST	TT	OR	CM	HF	VS	IP	PTI	SI	HT	SOI	PER	INT
ST	1	2.00	7.00	3.00	8.00	5.00	9.00	6.00	4.00	8.00	6.00	9.00	6.00
TT	0.50	1	6.00	2.00	7.00	4.00	8.00	5.00	3.00	7.00	5.00	8.00	5.00
OR	0.14	0.17	1	0.20	2.00	0.33	3.00	0.50	0.25	2.00	0.50	3.00	0.50
CM	0.33	0.50	5.00	1	6.00	3.00	7.00	4.00	2.00	6.00	4.00	7.00	4.00
HF	0.12	0.14	0.50	0.17	1	0.25	2.00	0.33	0.20	1.00	0.33	2.00	0.33
VS	0.20	0.25	3.00	0.33	4.00	1	5.00	2.00	0.50	4.00	2.00	5.00	2.00
IP	0.11	0.12	0.33	0.14	0.50	0.20	1	0.25	0.17	0.50	0.25	1.00	0.25
PTI	0.17	0.20	2.00	0.25	3.00	0.50	4.00	1	0.33	3.00	1.00	4.00	1.00
SI	0.25	0.33	4.00	0.50	5.00	2.00	6.00	3.00	1	5.00	3.00	6.00	3.00
HT	0.12	0.14	0.50	0.17	1.00	0.25	2.00	0.33	0.20	1	0.33	2.00	0.33
SOI	0.17	0.20	2.00	0.25	3.00	0.50	4.00	1.00	0.33	3.00	1	0.25	1.00
PER	0.11	0.12	0.33	0.14	0.50	0.20	1.00	0.25	0.17	0.50	4.00	1	0.25
INT	0.17	0.20	2.00	0.25	3.00	0.50	4.00	1.00	0.33	3.00	1.00	4.00	1

Table 3. weights of criteria influencing justification of AMT

Factors	ST	TT	OR	CM	HF	VS	IP
Weights	0.25	0.188	0.032	0.139	0.021	0.071	0.015
Factors	PTI	SI	HT	SOI	PER	INT	
Weights	0.047	0.101	0.021	0.041	0.025	0.047	

The next step in TOPSIS is to determine positive ideal and negative ideal solution according to formulas given below:

$$A^+ = \left\{ \left(\sum_i^{max} A_{ij} \quad j\epsilon J \right) \cdot \left(\sum_i^{min} A_{ij} \quad j\epsilon J' \right) \right\}$$

$$A^- = \left\{ \left(\sum_i^{min} A_{ij} \quad j\epsilon J \right), \left(\sum_i^{max} A_{ij} \quad j\epsilon J' \right) \right\}$$

where J is associated with beneficial attributes and J' is associated with non-beneficial attributes. The positive (PIS) and negative ideal solution (NIS) are shown in Table 3.

After finding the best and worst ideal solution, the separation measure is calculated and is shown in Table 4.

$$E^+ = \left\{ \sum_{J-1}^{M} \left(A_{ij} - A_j^+ \right)^2 \right\}^{\frac{1}{2}}$$

$$E^- = \left\{ \sum_{J-1}^{M} \left(A_{ij} - A_j^- \right)^2 \right\}^{\frac{1}{2}}$$

After the ideal solution, calculate relative closeness which is the measure of ranking the criteria. The similarity to ideal solu-

FACTORS	ST	TT	OR	CM	HF	VS	IP	PTI	SI	HT	SOI	PER	INT
ST	0.1964	0.1583	0.0184	0.1088	0.0112	0.0474	0.0075	0.0291	0.0728	0.0112	0.0235	0.0129	0.0291
TT	0.0982	0.0792	0.0157	0.0725	0.0098	0.0379	0.0067	0.0243	0.0546	0.0098	0.0196	0.0114	0.0243
OR	0.0275	0.0135	0.0026	0.0073	0.0028	0.0031	0.0025	0.0024	0.0046	0.0028	0.0020	0.0043	0.0024
CM	0.0648	0.0396	0.0131	0.0363	0.0084	0.0284	0.0059	0.0194	0.0364	0.0084	0.0157	0.0100	0.0194
HF	0.0236	0.0111	0.0013	0.0062	0.0014	0.0024	0.0017	0.0016	0.0036	0.0014	0.0013	0.0029	0.0016
VS	0.0393	0.0198	0.0079	0.0120	0.0056	0.0095	0.0042	0.0097	0.0091	0.0056	0.0078	0.0071	0.0097
IP	0.0216	0.0095	0.0009	0.0051	0.0007	0.0019	0.0008	0.0012	0.0031	0.0007	0.0010	0.0014	0.0012
PTI	0.0334	0.0158	0.0052	0.0091	0.0042	0.0047	0.0033	0.0049	0.0060	0.0042	0.0039	0.0057	0.0049
SI	0.0491	0.0261	0.0105	0.0181	0.0070	0.0190	0.0050	0.0146	0.0182	0.0070	0.0118	0.0086	0.0146
HT	0.0236	0.0111	0.0013	0.0062	0.0014	0.0024	0.0017	0.0016	0.0036	0.0014	0.0013	0.0029	0.0016
SOI	0.0334	0.0158	0.0052	0.0091	0.0042	0.0047	0.0033	0.0049	0.0060	0.0042	0.0039	0.0004	0.0049
PER	0.0216	0.0095	0.0009	0.0051	0.0007	0.0019	0.0008	0.0012	0.0031	0.0007	0.0157	0.0014	0.0012
INT	0.0334	0.0158	0.0052	0.0091	0.0042	0.0047	0.0033	0.0049	0.0060	0.0042	0.0039	0.0057	0.0049

Figure 3. Weighted normalized matrix.

Table 4. Ideal Solutions

Ideal solution	ST	TT	OR	CM	HF	VS	IP
PIS(A⁺)	0.1964	0.1583	0.0184	0.1088	0.0112	0.0474	0.0075
NIS(A⁻)	0.0216	0.0095	0.0009	0.0051	0.0007	0.0019	0.0008
	PTI	SI	HT	SOI	PER	INT	
PIS(A⁺)	0.0291	0.0728	0.0112	0.0235	0.0129	0.0291	
NIS(A⁻)	0.0012	0.0031	0.0007	0.0010	0.0004	0.0012	

Table 5. Separation measure of sub-objectives

Separation Measure	ST	TT	OR	CM	HF	VS	IP
E⁺	0	0.1331	0.2624	0.1966	0.2675	0.2449	0.2705
E⁻	0.2705	0.1455	0.0096	0.0826	0.0041	0.0301	0.0011
Separation Measure	PTI	SI	HT	SOI	PER	INT	
E⁺	0.2550	0.2778	0.2675	0.2552	0.2697	0.2550	
E⁻	0.0180	0.0495	0.0041	0.2552	0.0147	0.0180	

tion and rank are shown in Table 5 & Table 6 respectively. For better visualization of ranking of criteria's the bar chart is shown in Figure 4.

3.3 Prediction of success possibility of AMTs

To calculate the chances of successful utilization of AMTs, again AHP is applied for finding out the chances of success and fail-

Table 6. Similarity To Ideal Solution

ST	TT	OR	CM	HF	VS	IP	PTI	SI
1	0.5233	0.0354	0.2959	0.0150	0.0039	0.0661	0.1786	0.0150
HT	**SOI**	**PER**	**INT**					
0.0632	0.0518	0.0661						

Table 7. Ranking Of Sub-Objectives

|	Criteria	Ranking As per TOPSIS	Ranking As per AHP
1	Strategic Issues(ST)	1	1
2	Technology selection and Transfer(TT)	2	2
3	Organizational changes & external consultants(OR)	9	9
4	Continuous management & manufacturing support(CM)	3	3
5	Human Factors(HF)	10	11
6	Vendor Selection(VS)	5	5
7	Implementation Practice(IP)	11	13
8	Planning to infrastructural preparation(PTI)	6	6
9	Social issues(SI)	4	4
10	Hands on training (HT)	10	11
11	Setting of intern target(SOI)	7	8
12	Performance measurement(PER)	8	10
13	Integrity of AMT(INT)	6	6
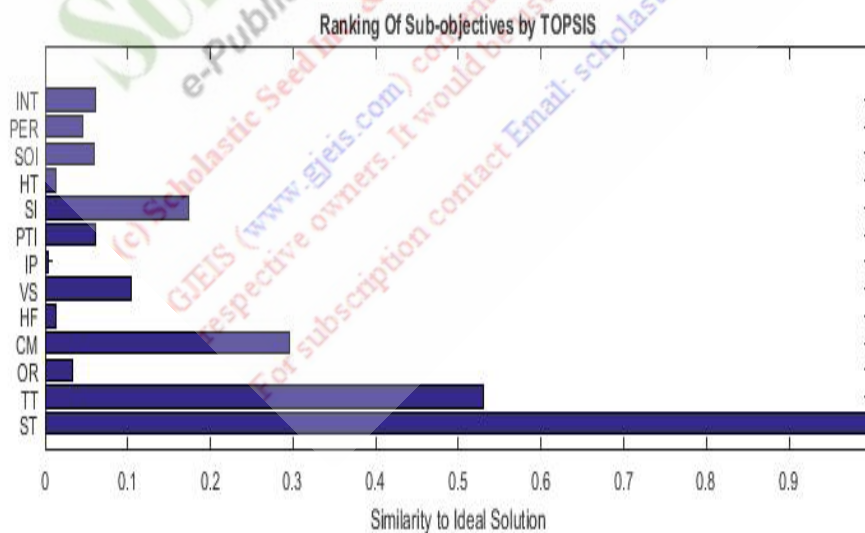
Figure 4. Bar chart of ranking.

ure of each attribute. The pair wise comparison matrix for each attribute is prepared that determines the priority weight of success and failure of each sub-objective. The predication of success is based on the user's perspective for each attribute in the organization which is as follows:

ST=5(Extremely Good); TT=3(Very Good);OR=5(Extremely Good); CM=5(Extremely Good); HF=3(Very Good); VS=3(Very Good); IP=3(Very Good); PTI=3(Very Good); SI=2(Very Good); HT=3(Very Good); SOI=1(Fair);PER=1(Fair);INT=2(Between Fair and Very Good).

the prediction of success or failure has been determined by multiplying the priority weights of success or failure by the priority weights of alternatives from step 1.

Probability of successful utilization is found to be:

0.833*0.25+0.75*0.188+0.833*0.032+0.833*0.139+0.75*0.021+0.75*0.071+0.75*0.015+0.75*0.047+0.667*0.101+0.75*0.021+0.5*0.041+0.5*0.025+0.667*0.047=0.708011

Probability of unsuccessful utilization is found to be

0.167*0.25+0.25*0.188+0.167*0.032+0.167*0.139+0.25*0.021+0.25*0.071+0.25*0.015+0.25*0.047+0.333*0.101+0.25*0.021+0.5*0.041+0.5*0.025+0.333*0.047=0.243341

The above calculation shows that the chances of successful utilization of AMTs is about 2.9 times more than that of unsuccessful utilization if the above thirteen factors are prioritized according to the author's prediction.

Table 8. Prediction of possible outcome for each criteria

Alternatives	Success	Failure	Priority weight
Strategic Issues(ST)			
Success	1	5	0.833
Failure	1/5	1	0.167
Technology selection and Transfer(TT)			
Success	1	3	0.75
Failure	1/3	11	0.25
Organizational changes & external consultants(OR)			
Success	1	5	0.833
Failure	1/5	1	0.167
Continuous management & manufacturing support(CM)			
Success	1	5	0.833
Failure	1/5	1	0.167
Human Factors(HF)			
Success	1	3	0.75
Failure	1/3	1	0.25
Vendor Selection(VS)			
Success	1	3	0.75
Failure	1/3	1	0.25
Implementation Practice(IP)			
Success	1	3	0.75
Failure	1/3	1	0.25
Planning to infrastructural preparation(PTI)			
Success	1	3	0.75
Failure	1/3	1	0.25
Social issues(SI)			
Success	1	2	0.667
Failure	1/2	1	0.333
Hands on training (HT)			
Success	1	3	0.75
Failure	1/3	1	0.25
Setting of intern target(SOI)			
Success	1	1	0.5
Failure	1	1	0.5
Performance measurement(PER)			
Success	1	1	0.5
Failure	1	1	0.5
Integrity of AMT(INT)			
Success	1	2	0.667
Failure	1/2	1	0.333

4. Conclusion

In this research study, after critically reviewing the available literature the authors have identified thirteen factors that play significant role in adoption procedure of Advance technologies in manufacturing firms especially in small and medium enterprises of India. The decision making becomes critical when an enterprise has a limited budget. A relationship between these 13 critical factors has established by AHP -TOPSIS integrated approach. Through this approach the most driving factor has identified. It can be concluded from the research that an effective implementation of available advance technology in SMEs could be observed if the management considers strategic issues and technology selection and transfer as major driving factors in the planning phase of AMTs implementation. Since decision on implementation practices is taken afterwards the installation of new technology hence it has least importance in planning phase. This research also suggests that management should not ignore the ranking of these factors. If priorities of critical factors are taken in same order as evaluated by authors then the enterprise shows successful results 71 percent of the times.

The limitation of the model is the subjective nature of priorities weights and rank. The vagueness of the results can be eliminated if Fuzzy perception will be incorporated. The authors are hopeful that these findings will help the industrial professionals in developing strategies for effective adoption of AMTs.

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Block-Chain: An Evolving Technology

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Abstract

Now a days, the people are attracting towards the digital currency due to demonetization, rapidly changing world, and global payment options etc. The industries are looking for such a technology which works in digital currency environments with the account of all the transactions. In this paper, we have discussed Blockchain technology, an evolving technology, which provides an assistance to the industries in digital currency environment with the record of each transaction. We have discuss the various types of blockchain with the core concept of hashing algorithm. We have discussed the application of blockchain in different industries and how it can make the significant impact on the business. The paper also focuses on the challenges of blockchain which are required to address before implementation. Therefore, this paper provides an insight on the blockchain technology with the fear and smile of beginning of new era of transparency.

Keywords: Blockchain, Digital Ledger, Hashing Algorithm, Smart Contracts

1. Introduction

Now a days, the world is going through the new revolution which is known as digital revolution and it starts with the use of internet. With the usage of the internet, a new era of decentralization, no central authority, has been started, which will be supported by cryptography. Especially in the area of cryptography or digital cash, a lot of advances have been done by applying the scientific research. Earlier, the digital cash had been conceptualized with the implementation of central server which can prevent the double spending, privacy and having controlling power[1-3]. By implementing the advances of cryptography and decentralized network of computers, a new profound technology, which is known as Blockchain, has been introduced. This emerging technology has the potential to change the life of society with new rules of spending and it will be the complete paradigm shift. The decentralized system, blockchain, started a new era of global payments, corporate governance, democratic participation and functions of capital markets. The blockchain, a novel technique, can ensure the security with privacy and consensus of all the players. In the present days, the block chain has to be understood by its definition, technique and usage along with the limitations.

The blockchain can be defined as a database which is distributed, shared, encrypted and it assists to develop as an irreversible and incorruptible public repository of information[4-7]. This technology permits, for the first time, unrelated people to reach consensus on the occurrence of a particular transaction or event without the need for a controlling authority. In this technology, the security is ensured if no adversary wields a large fraction of the computational (or other forms of) resource.

The proposed technology, Blockchain technology, has the potential to reduce the role of middleman who is one of the most important economic and regulatory actors in our society. It allows the people to transfer an exclusive piece of digital property or data to others, in a safe, secure, and incontrovertible manner. Blockchain technology can create digital currencies that are not backed by any governmental body in case of demonetization. It can develop digital contracts or smart contracts, whose execution does not require any human intervention. It provides a marketplaces in decentralized manner which can be operated free from the reach of regulation[8]. It is also assisted by the decentralized platforms for communications and to monitor or spy those platforms will become more difficult in future days. It also generates the assets which are Internet-enabled assets that can be controlled just like digital property. Blockchain is a world-shattering technology, and this technology will shift the balance of power from centralized authorities in various fields like business, finance, supply chain, voting, and intellectual property and

in politics also[9]. Therefore, it can be said that blockchain is a beginning of new era of digital property, smart contracts, decentralized governance and global capital market.

In the present paper, we have tried to understand and describe the blockchain technology. We have reviewed the literature for its definitions. We have also described the various types of the blockchain. There are three types of blockchain are in the fashion: Public, Private and Hybrid. We will elaborate all the types of blockchain. The paper also focuses on the various essential features of blockchain implementation like permissioned network, assets, transactions and consensus, a very important and unique feature. We have also done the work on its core technology, which make it safer and securer than other emerging technologies. To make it safer, the hashing algorithms have been deployed which is very difficult to wiretap. We also throw the light on the various applications of blockchain technology. Every technology has come with some limitations, therefore, we also focus on its limitations as it can eliminate many of our fundamental freedoms. Therefore, it can be said that the presented paper provides a complete overview about blockchain, which can be helpful for the future transaction in the internet based globe.

The remainder of the paper is as follows: Section 2 will describe the definitions, types and technology of blockchain while section 3 will focus on business applications of blockchain. The challenges of the evolving technology will be discussed in section 4. The paper will be concluded in section 5 with the recommendation for future work.

2. Blockchain Technology

Blockchain is the primary technology behind bitcoin and the core part of this technology is the distributed data store. All the participants in blockchain have their own data stores. The data stores store all of the transactions which has ever happened in the network. Therefore, the concept of blockchain is a distributed public ledger which is having the records of all transactions that have been performed in blockchain network and it has been shared among all the participant nodes. Each transaction in the public ledger is verified by consensus i.e. majority of the participants are agreed about the transactions. The main security feature of blockchain is that if any transaction has been entered in the public ledger, it can never be erased. Thus, the blockchain contains a certain and verifiable record of every single transaction ever made in the network. Therefore, it can be said that this technology provides a transparent network which was developed by open source, collaborative approach, and a good degree of decentralized contributed work. Firstly, we will review the various definitions of blockchain. To understand the blockchain and its information, a blockchain with two blocks is shown in Fig 1.
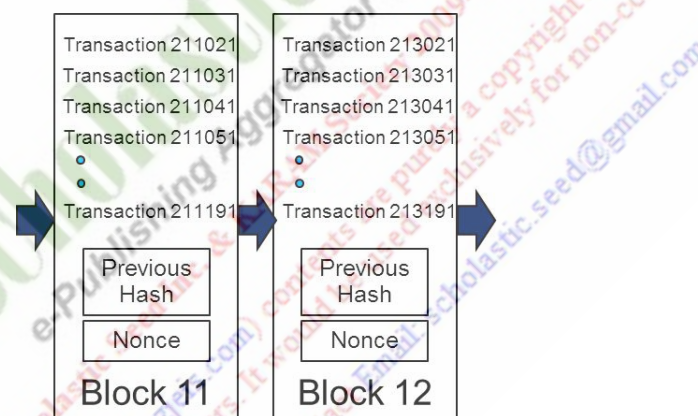
Figure 1.   Schematic Diagram of Blocks.

3. Definitions

We have previously explained the blockchain in general manner and its core concepts. In the literature, we found few definitions for blockchain. According to different practitioners, the definition of blockchain is "a magic computer that anyone can upload programs to and leave the programs to self-execute, where the current and all previous states of every program are always publicly visible, and which carries a very strong crypto-economically secured guarantee that programs running on the chain will continue to execute in exactly the way that the blockchain protocol specifies."[11] This definition is given in artistic manner (magic computer) and it losses the scientific precision due to the lacking of the words like ledger, money or transactions etc. At the conceptual level, the blockchain is more informational and procedural and it cannot be said that it is limited to only financial services.

Another definition with the focus on financial services has been given[12], "If we modify our database schema so that each row can represent multiple assets, rather than the blockchain's native currency, then we can rid ourselves of that currency entirely. This leaves us with a blockchain as a way to achieve consensus and security in a peer-to-peer financial application for any class of asset." As cryptography is the essential part of the blockchain, the crypto experts said that the coin should be an integral part of the network to maintain the security.

There is myth among the practitioners that the concept of blockchain is interesting but the currency or the store of value is not very interesting. It is not possible that we cannot consider both the things separately. There should be a primary value of the token or coin (bitcoin) that's used to move value, and there is a requirement of an incentive system to create the token or coin and the created token or coin will be used for the transactions of digital property[13].

4. Types of Blockchain

After the understanding of blockchain in the definitions, we will discuss the various types of blockchains. There are three types of blockchains: Private, Public and Hybrid blockchains. We will discuss the nature of each type of blockchain which will help us to understand the core concept of each blockchain.

In the Public blockchain, the digital ledger is completely decentralized and it can be accessible to any Internet user. The public blockchain is having the nature of free and unconditional participation of everyone in the process. The participants will decide about the current state of blockchain and what kind of blocks will be added to the chain. For validation of transactions, the public blockchain relies on consensus mechanism of proof-of-work. Especially

in the case of Bitcoin, the longest chain – the chain with the most proof-of-work – is considered to be the valid ledger.

As intended in the name, the entries in a fully private blockchain are monitored by a central authority of decision-making for writing permission. For read-permissions, it may be restricted to the participants or open to all the users. In a private blockchain, an organization can listed down the users based on the process of Know-Your-Business (KYB) and Know-Your-Customer (KYC). The difference between public and private blockchains is the extent to which they are decentralized, or ensure anonymity.

Between the two extremes, there exists a continuum of "partially decentralized" blockchains, rather than a strict public/private dichotomy. Partially decentralized, also called "consortium blockchains", constitute a hybrid between the low-trust (i.e. public blockchains) and the single highly-trusted entity model (i.e. private blockchains)[14]

5. Features

A distributed database of records of all the transactions, which are happened and shared among all the participant nodes, called the blockchain. The transactions are happened due to the available digital assets like one will send the digital assets to someone. The information of transactions will be shared as per the nature of network. For each transaction, the consensus is important i.e. if majority of all the parties verified the transaction, it will be validated. We can understand the logic by an analogy like stealing a chocolate from fridge in kitchen is easier than stealing the chocolate from fridge which is kept in the observation of thousand people. Therefore, there are some essential features of blockchain which we will discuss in detail (figure 2):
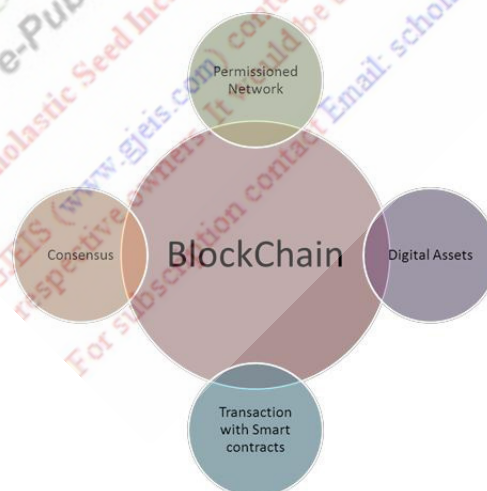

Figure 2.   Features of Blockchain.

1) Permissioned Network: Firstly, a network is created and genuine members or participants are invited in the network. The write or read permission will be provided according to the role of participants. In this network, all the transactions are shared with each participants in the network, but permissions can control who has the right to view or modify those transactions.

2) Assets: Assets can be created on a network using smart contracts and can be tangible or intangible such as intellectual property, art, financial assets, car leases or shipping containers full of goods.

3) Transactions: A transaction is created in blockchain, when any digital asset is transferred. A block has been formed with multiple transactions and it is secured by hash. The transaction entry is made ineradicable by hashing the transactions with the previous blocks, thus chaining them together.

4) Consensus: We need a way to tell if the transactions are authentic or not and if the members agree to those transactions. Consensus is the way to achieve that, where members vote on the validity of a transaction.

These key features now enable us to settle a transaction in seconds compared to days. As we have discussed the essential features of the blockchain. We will discuss the technology which make the blockchain safer and secured.

6. Block Hash Algorithm

There are many techniques in cryptography for e.g. public key cryptography where each coin is associated with it current owner's Elliptic Curve Digital Signature Algorithm key.

When a party send a bitcoin to another party, it is basically creating a transaction and new owner's public key is attached to the amount of coins being transferred and sign it with the private key and this transaction shows up on the bitcoin network which inform everyone about the new owner. There are signature on every message which is an evidence of its authenticity and the history will be kept by everyone for future references[2].

A transaction is basically a sequence of records called Blocks and the record of each and every transaction is like a chain which makes it a block chain. Everyone in the network is have a copy of Block Chain which can be updated by passing the new blocks on it. Each Block in the chain occurs after the previous one which proves that the previous one was authenticated.

To make sure the security of bitcoins, there is function called HashCash is used. Hashcash is the first secure efficiently verifiable cost-function or proof-of-work function. The beauty of hashcash is that it is non-interactive and has no secret keys that have to be managed by a central server or relying party; hashcash is as a result fully distributed and infinitely scalable. (Hashcash uses symmetric key cryptography, namely a one-way hashcash function - typically either SHA1 or SHA-256)[3].

Hash function is flexible enough to take any kind and size of a data as an input, transforms it in an effectively-impossible to reverse or to predict way, into a relatively compact string. Making a little change to an input data changes its hash by which no one can create a different block of data that gives exactly the same hash. The blocks, which do not have a serial number and can be identified by their hash, serves the dual purpose of identification as well as integrity verification. An identification string that also provides its own integrity is called a self-certifying identifier. The hashcash cost-function iterates by altering data in the block by a nonce value, until the data in the block hashes to produce an integer below the threshold - which takes a lot of processing power. This low hash value for the block serves as an easily-verifiable proof of work - every node on the network can instantly verify that the block meets the required criteria (Fig 3).
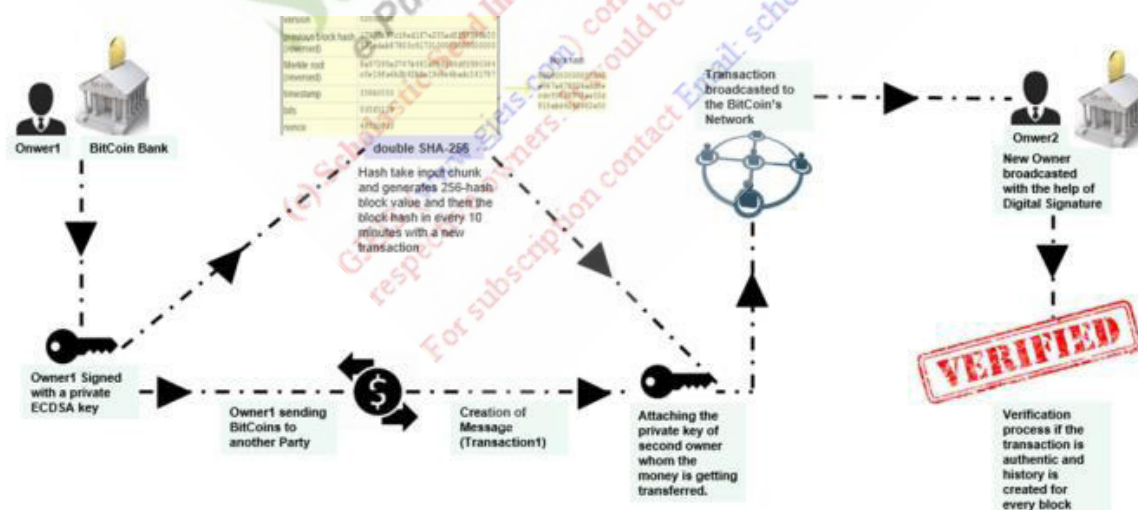

Figure 3.   End to End process of Bitcoin.

After discussing the blockchain technology with its features and core technology of hashing, we will explore the different areas of application.

7. Business Applications of Blockchain

In this section, we will review the opportunities of blockchain implementation in various business applications. Still the blockchain is not widely used in the business applications but due to its inherent transparency and consensus based validation, it can be applied in various fields like finance, supply chain, healthcare, government services, social services, money laundering etc. The applications are shown in figure 4.

The potential application areas of the blockchain are very widespread. We have classified the areas of application on the basis of the services provided by blockchain. According to figure 4, we can understand that one of the most important service is the transactions in digital currencies. With the service of digital currencies, the blockchain can change the future of e-commerce business. In e-commerce business, one participant can sell the assets and other party will pay in digital currency and it will be verified by all the participants[8]. This is another step towards cashless transactions. It is also useful for global payments due to the different currencies in different countries and buyer and seller can be from different countries and they can pay using digital currency. For peer-to-peer lending, it is the best way to lend the money and track the transactions.

The applications of digitized ledger is very high in all the areas and industries. It is highly applicable in healthcare industry for record keeping of health reports and issues. It is equally applicable for ownership of property and keep all the records for personal use and for government processes. It is like the digital wallet of all the ownership as well as personal identification documents. The blockchain is highly recommended for supply chain as there are so many materials, peoples and places are involved. To manage the supply chain efficiently, each and every transaction should be recorded from each people and location. In each process of supply chain, a lot of peoples are involved, therefore, consensus should be given by all the participants to validate the transaction of goods or payments. The blockchain can be applicable in government services like aadhar card, passport service etc[6].

It provides a secured network which is essentially required in the business of equity and derivatives as there are lot of opportunities of fraud or double spending. The secured network with hashing algorithm can prevent any alteration in the transaction. Therefore, it is very safe and secured network and highly applicable in financial transactions. With the feature of smart contracts, blockchain can be applicable in digital rights, betting and to decide the terms and conditions for loaning between two participant parties.

From the above, it can be said that blockchain technology is applicable in various industries and different business lines. It can also be said that blockchain technology is equally applicable in financial as well as non-financial industries. It can be applied in other social work like donations, marriage etc. With the widespread applications of the blockchain, we have to have an eye on the limitations of the blockchain.
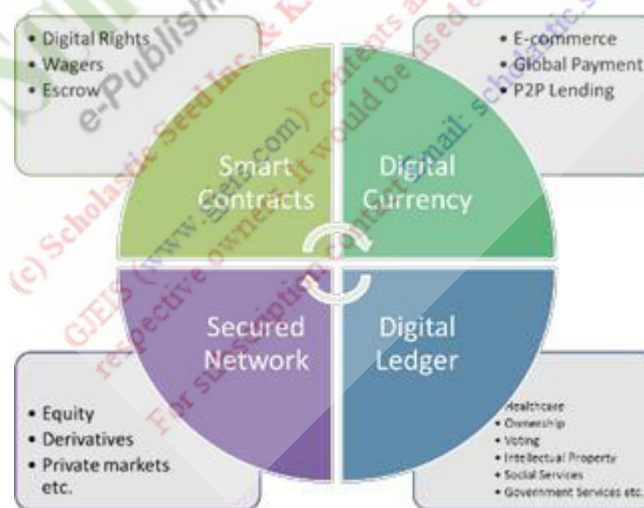

Figure 4. Applications of Blockchain.

8. Challenges

There are a lot of challenges imposed as blockchain is an evolving technology and still in developing stage. Those challenges are related to technical issues, business models, regulatory of government and adoption of the new technology. We will discuss the various challenges of blockchain technology in the light of various facts.

In the blockchain technology, there are several technological issues related to implementation and development or coding. There is another challenge related to the scaling up of the block generation speed from 6 per hour to 12 per hour. Now a days, the block has the maximum limit of 7 transactions per second but in financial services, it is sometimes 2000 transactions per second. So, the people are facing the challenge of scaling up. There is a security feature in blockchain that no one can erase any transaction but at the same time it becomes a limitation to modify the previous transactions. Some other technical issues have to do with the infrastructure. One issue is the explosion of blockchains, as there are so many different blockchains in existence. Another issue is that when chains are split for administrative or versioning purposes, there is no easy way to merge or cross-transact on forked chains[3,6]. The other issues are related to the infrastructure like data storage, cloud infrastructure, network administration, name and space management etc. Along with the technical challenges, blockchain is also facing some business challenges.

In business modelling, the reconfiguration of the entire business models with smart contracts and new rules is very difficult to implement. The main challenge is to make it completely decentralized without any transaction fee. The adoption of the Bitcoin for the transactions is another challenge for the business. As it is decentralized, there is another threat related to illegal activities like money laundering, smuggling, drug dealing etc. Another challenge is related to the implementation of government regulations like taxation, calculations for GDP etc. For the adoption it widely, peoples are having the threat like privacy. Those are the issues or perception which will be the biggest obstacles for widespread implementation.

However, with all of those probable challenges with blockchain, it can be said that blockchain is good for various business especially in education and healthcare and its impact will be significant. There are some solutions provided to overcome the technical challenges and the blockchain industry is working on it but on the other hand, we have to spread the awareness about its impact and advantages.

9. Conclusion

In this paper, we have discussed the concepts of blockchain technology with definitions as well as some of the significant features of blockchain. We have shown that this technology is emerging and make a new revolution in the financial services along with other applications in other business. We have also discussed the challenges of the blockchain. It works in un-trust environment only with consensus and people required the trust business but in the contrary the trust is not always a good thing because it increases the bond among gang members. Therefore, the blockchain technology can work excellently in major business where number of transactions are very high like financial services, supply chain, government services etc. The blockchain will increase the effectiveness and efficiency of the system by the inherency of transparency. We believe that the blockchain is still in infancy stage and in the near future, it will be more matured and applicable in other areas like sports, games, tourism etc.

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Knowledge and Choice based Decision Trees for Manufactures

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Abstract

With recent advances in data-driven analytics, and the resultant improved capabilities in working with huge datasets, strategic planning has become more complex for business units, and subsequently for the retail domain. The purpose of this study is to understand and define the hierarchy of decisions that leads to the purchase of consumer packaged goods. Consumers are driven by a much complex decision making process inside a store that finally leads to the purchase of a product. In this paper we are trying to emphasize on the consumer decision process and how it could be utilized by the retailers as well as the manufacturer to meet the needs of the customers. In a way it will help to make more successful sales conversion which in turn helps the manufactures of different products. The focus here is to capture the decision pyramid by using core statistical techniques.

Keywords: Agglomerative Clustering, Decision Trees, K-Means Clustering, Switching Matrix

1. Introduction

In today's world before we make any purchase, search is an activity which most of us engage regularly to extract up-to-date information which enable us to make the right purchase. However uncertainty is the driving force for consumer search. It should be mentioned that when an individual enter a store in his/her sub conscious mind they will already have an idea what they want to purchase and also a grief idea of the attributes they want in their product. If consumers had a perfect knowledge about their preferences and the market offerings are in line then life for the consumers will be much easier. This is an optimum condition which is very difficult to achieve. Generally our preference starts flickering moment we are given multiple choice.

If the decision trees created are clear and simple then depictions of product sets considered in a hierarchical order will help towards understanding products which can substitute each other. This representation of category attributes is extremely helpful in making assortment recommendations and in evaluating product development or brand positioning opportunities.

The decision trees based on consumer data should not be confused with the planograms[1]. However it can influence the shelf space in the context which items to include or exclude. So it helps in understanding groups of products which are forming the clusters. This cluster directly or indirectly influence the buyers while they are shopping.

These kind of product clustering has benefits the consumers in more than one ways like you get what you require more easily which in turn saves an individual time and also itrequires less effort. All these add to customer satisfaction and a happier customer tend to spend more money in his/her stipulated time. This will help in the revenue generation for the manufacturer.

The manufacturer historically spend a lot time to understand the market requirement and the requirement of their potential customers. These knowledge and choice based decision trees provides a great boon to the manufacturer. They always be a leg up in our competitive world. These models help in building customer loyalty within the brand and retailer.

A decision tree primarily focuses on how an individually within a store behaves and finally ends up purchasing the product[2].

There is very few researches have been cited for particular analysis, algorithm, or software program that can be used for generating the perfect CDT (consumer decision tree (CDT)). Therefore, we have elaborated the idea to create a CDT which will provide insights on planogram arrangement. The manufacturer can make the decisions for future manufacturing schedule on the basis of provided planogram arrangement.
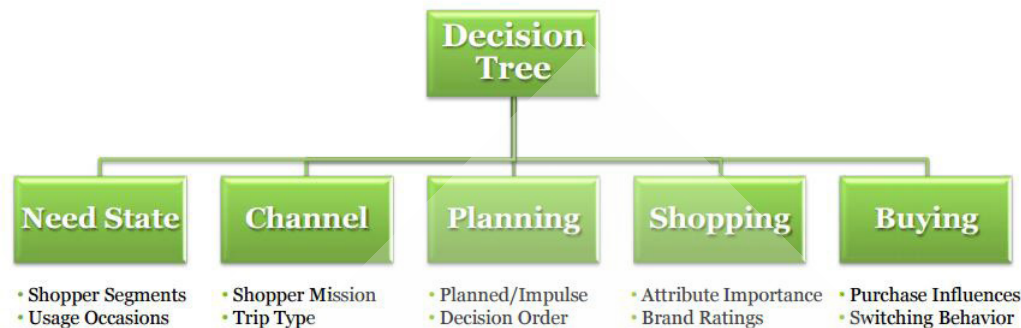
Figure 1.   In store Path to Purchase[2].

In this paper, we have proposed an approach that will help the manufacturer with insight into which product and attributes are more important to the customers. Hence this will lead to the revenue realization for the manufacturer. Here we concentrate on a particular category of our choice mostly in the retail consumer packaged goods sector. Within that category we intend to identify the key players (brands) and the hierarchy of the choices that people are making. In order to achieve that we will primarily use a combination of supervised and unsupervised clustering techniques. Also highlighting how to resolve some of the challenges that we will face during the analysis phase.

The paper is structured in the following manner we first look into some of the existing methods and the challenges we face, following which we will discuss a solution framework and methodology. Finally we conclude by mentioning the advantages of the solution and the future scope of improvement.

2. Challenges with Current Solutions

The decision making process is a very complex process which an individual takes before finally purchasing the product. Some of the advanced statistical techniques used to create decision trees are as follows[2]:
- Logistic regression
- Statistical classification trees
- Hierarchical cluster analysis

However the decision trees which are widely used has its own pitfalls:
- Stability Issue
- Complexity
- Cost
- Biased Nature
- Too much information

3. Stability Issue

Decision trees are affected by addition or deletion of observation. The tree structure will change to a great extent. Also if we add or delete any variables from our models this will impact our analysis.

4. Complexity

This is one of the major problem of decision tree making. Though decisions trees are easy to comprehend than other modeling techniques. However is the size of the decision tree increases it tends to become much more complex and a time consuming affair.

Computing probabilities of all possible branches, determining the best split of each node, and selecting optimal combining weights to prune algorithms contained in the decision tree are complicated tasks that require much expertise and experience[3].

5. Costs

The cost component of decision trees are an indirect effect of the complexity of the decision tree. We can very well understand that from the fact that well trained analyst would be required in order to build decision trees which are big. The time involved to train individual the concepts of different statistical methods to take care of the decision trees. Also one need to have in-depth business knowledge to make correct inferences. This makes decision trees an unlikely choice to many analysts as it tends to become more expensive[3].

6. Biased Nature

In our dataset if we have too many categorical variables then in that case the decision becomes more biased towards those categorical variables which has many levels.

7. Too Much Information

Another major detractor for decision trees is that it is resource intensive. In this case we get bombarded with information which at some point causes "paralysis of analysis ". The time taken to process this magnitude of data is long which in turn results delay in decision making process. In today's cut throat competition every minute lost may result in our revenue loss[3].

When we compare decision trees primarily classification trees with logistic regression has its own merits and demerits.

Logistic regression results are easier to interpret compared to decision trees especially in cases when we have too many attributes or features to be incorporated. Logistic regression is also better than decision trees in the context of over fitting. Also it is observed that the computational time required by logistic regression is faster. Logistic regression much more reliable and provides much flexibility when we are modeling. In logistic regression we have different methods for variable selection like subset selection, forward, backward, stepwise etc. We can also apply LASSO with logistic regression. The result interpretation for logistic regression is also easier[4,5].

However both Logistic and decision trees are plagued with the problem of instability. Though logistic regression provides a probabilistic framework but it gets impacted badly by any change in the variable list. In the following section we share how we can tackle these issues.

8. Analytic Solution Approach

8.1 Data Requirement

The data used to feed the tree is a critical part of the analysis. The data can be from panel data based on a statistically valid sample and that includes the offline population, cell phone-only households, and key ethnic groups. The data should have details of the each item transaction and key attributes information over the last couple of years.

8.2 Methodology

We assume that we have a heterogeneous set of population of consumers choosing among various brands.

It is well known that in consecutive purchases, many customers will re-purchase the same brand they bought last time, while many others will try out different brands. Marketers are interested in both the aspects of this phenomena. Repurchasing is measured as a behavioral loyalty metric, while brand switching is one among the number of methods used to identify competitive market structure. Examination of competitive market structure provides an understanding of the intensity of competition between particular brands or product variants which also gives fair amount information about the different attributes of the competitive products[6].

For example, the marketing manager for company A is interested to know to which Brands Company A loses sales to when a current company buyer buys a competitor brand on their next purchase. Likewise, which brands does Company A take sales from. If there is a particular brand that company A competes against very intensely, then company A can try to determine the cause of this, because the other brand represents a threat[6].

A measure of substitutability between competing brands in market research is to build a brand switching matrix. A brand switching matrix can be constructed either by cross elasticity or by brand switching probabilities. Brand switching probabilities are estimated from panel or survey data as cross classification probability (proportion of times Brand i and j are purchased on two adjacent occasions).

Table 1. Sample Brand Switching Matrix[6]

Second purchase									
First purchase	1	2	3	4	5	6	7	8	9
1 Heinz Tom	391	158	90	22	25	9	13	1	0
2 Heinz Chick	148	136	60	5	15	1	1	1	0
3 Heinz Veg	105	64	122	2	5	5	1	2	2
4 Campbell Tom	29	10	8	103	85	19	2	2	0
5 Campbell Chick	27	13	9	92	128	17	4	3	1
6 Campbell Veg	5	2	4	31	24	27	0	1	0
7 WW Tom	7	0	0	1	5	0	42	18	15
8 WW Chick	4	0	2	2	3	0	17	15	3
9 WW Veg	2	0	1	0	0	0	10	6	8

In the switching matrix between brand i and j, a higher number will indicate that these products are substitutable and similarly a lower number indicates that there is hardly any switching. This forms the basis of our distance matrix that we will use for clustering.

Once we have the distance matrix we will provide that as an input to k-means clustering. The k-means cluster will provide us the initial set of clusters. The optimal number of cluster is selected through an iterative process where we basically plot the between cluster variance against the number of cluster and find the point where percent difference from the previous cluster converges. Also we will be using Hubert Index and other statistical measure to justify the optimal number of cluster selected based on majority rule[7,8].

In k-means clustering it is observed that some of the cluster will have observation whose profile might not match with the dominant features of the cluster. In those kind of scenario we have correlation analysis to find the best match for that particular observation and reallocate them. Also we will calculate the gini index or any other heterogeneity index. To validate that the reallocation is working properly. Based on the latest k-means cluster result with the reclassified observation we will perform the Agglomerative Hierarchical Cluster which will provide us the tree structure[9].

From the optimal set of cluster we need to profile each segment. Agglomerative Hierarchical Cluster on the data will provide us the tree structure. A closer inspection of the tree will provide us the levels to identify the customer priorities.

Figure 2. Modeling Framework.

Figure 3. Illustrative Output.

9. Managerial Discussion

In this paper we are basically using an indirect approach to track customer preference. Traditionally we generally use propensity to buy models based on various attributes of the data along with customer information. However here we are looking at the purchase pattern of customers over a period of time to understand that within a category the competitive landscape placement.

In the above example we are looking at the analgesics industry layout in US. This industry is broadly classified into private label, internal and external analgesics. When we did a deep dive into internal analgesics we see that it is further broken down as prescriptive and non-prescriptive. Then within prescriptive if we continue we will see the first level is different brands followed by usage pattern, form and finally the lowest level is pack size.

This gives the manufacturer the idea about how the customers are behaving when they have to buy analgesics from any retail outlet. So the first priority in this case is brand then the customer looks for the usage form and pack size respectively before making the final purchase. The manufacturer will get the idea where they are facing tough competition and also provide them knowledge of areas they have no presence. So our analysis will help the manufacturer with the insight on future product development.

10. Conclusion

The final outcome will give for a category/market the high level breaks and as we move down the hierarchy we will have finer details of the products segments. To arrive at the structure we will use unsupervised Clustering technique along with other clustering techniques. The solution will capture the major segments in the data and will also provide actionable insights to both retailer/manufacturer.

Decision tree models will be helpful to develop a deeper understanding of consumers' hierarchical purchase pattern. Decision trees will further reflect on which of the product attributes trump one another and how, for instance, these dynamics relate to the shelf organization in store environment, puts a fine point on consumer insight. Decision tree models can be manipulated to focus on either brand or product perspectives. Decision tree models can often capitalize on visual representation of the products considered in order to facilitate decision making.

Manufacturer armed with such detailed information about their product and attributes helps them to plan for future products. It provides them information about the competitive landscape and the scope or opportunity given the current market structure.

The future of decision tree is immense only if we can mine the data correctly and at the right time [10]. The next step in this direction would to use artificial intelligence to train our models based on the historic data. Manufactures getting real time feedback to evaluate each customer even before they visit any outlet. The trees will provide us best possible future state and build action plan to drive real change[11].

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Brand Valuation: Accounting Perspective

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Abstract

Brands are one the most valuable assets for any business firm without any doubt. But this value is subjective in nature and it is very difficult to arrive at an absolute, quantified value for the treatment in financial statements. Last 3 decades witnessed the lots of debate in this area of discipline. This paper explores the evolution in the accounting for the brands in recent past and trouble with the valuation of brands. It also discusses briefly different approaches of brand valuation.

Keywords: Myntra, Brand, Wallet, Acquisition, Value

1. Introduction

Flipkart has bought a major stake in Myntra in a cash and stock deal that could value the company between $300-330 million (Firstpost.com, 21 May 2014).

Snapdeal buys Freecharge for $400m (Times of India, 9Apr 2015)

What makes above news interesting? By looking at these deals, one can wonder what makes these companies that much of worth? The net tangible assets possessed by these firms cannot justify these valuations. So, there must me something more than the tangible assets which enhanced the value of these companies. These can be termed as intangible assets which may include goodwill, customer base, patents, copyrights, staff capabilities, and above all the power of brands. As John Stuart, President Quaker Oats in 1922 said "If this business were to be split up, I would be glad to take the brands, trademarks and goodwill, and you could have all the bricks and mortar -and I would fare better than you." (Marquette, 1967). This paper will explore the Brand value aspect of this intangible asset. Before going into the details in the realm of brand value, it is imperative to understand the meaning of the brand.

2. Definition of Brand

Word brand has its root in German origin which means 'Burning'. Initially, this word was used for the identity marks made by burn-ing iron on livestock or criminals for their easy identification. From there it is adopted in marketing.

Kotler defined brand from the marketing perspective which says "name, term, sign symbol (or a combination of these) that identifies the maker or seller of the product".

Seetharaman et al. in his article titled "A conceptual study on Brand Valuation" defined brand from the accounting perspective. They said "A brand can be defined as an asset that does not have physical existence and the value of which cannot be determined exactly unless it becomes the subject of a specific business transaction of a sale and acquisition." (Seetharaman, Nadzir, & Gunalan, 2001)

In simple words, brand can be defined as the name or symbol that is intended to identify goods or services of one seller from the other sellers.

3. Brand Value

Often a company's brand value exceeds its net tangible assets. There are many examples of such valuation in business history. Such as acquired acquisition of Kraft Foods by Philip Morris Co. at whopping $12.9 billion which included an estimated $ 11.6 billion for intangibles. The

Following table represents the value of some top brands:

Source : World Intellectual Property Report, Brands – Reputation and Image in the Global

Marketplace, WIPO Economics & Statistics Series, 2013

Table 1. Brands account for a considerable share of companies' market capitalization(World Intellectual Property Organisation, 2013)

Interbrand			BrandZ		
Company	Brand Value 2103(In billion USD)	Brand value as a percentage of market capitalization	Company	Brand Value 2103(In billion USD)	Brand value as a percentage of market capitalization
Apple	98.3	58.0%	Apple	185.1	41%
Google	93.3	20.7%	Google	113.7	39%
Coca-cola	79.2	39.3%	Coca-cola	78.4	46%
IBM	78.8	26.9%	IBM	112.5	56%
Microsoft	59.6	22.9%	Microsoft	69.8	27%
McDonald's	42	43.9%	McDonald's	90.3	94%

4. Historical Background of Accounting for Brand Valuation

Accounting for brand valuation is not a very old paradigm. In fact, a serious debate on this aspect started during the 1980s when many British companies started taking over other rival firms. Since the transaction amount involved in these acquisitions was often more than the book value of the target firm, it forced the practitioners to give an account to the difference in the book value and acquisition value. This difference was associated with the goodwill and required to be written off which gave birth to the controversy as under these accounting rules the money paid over and above the fair value of identifiable assets is money lost without a compensating asset being acquired. This often turned into huge losses during the year of acquisitions.(Farquhar, Han, & Ijiri, 1992).

Many British companies started protesting to these accounting rules. They argued that this was not goodwill alone but identifiable assets. They started reporting acquired brands in the financial reports. One of the instances can be traced back to 1985 when Reckitt & Colman accounted the value of Airwick trademark acquired from Ciba-Geigy on its balance sheet. In August 1988, likewise in 1988 Grand Metropolitan reported the value of several brands bought from Heublein at worth £588 million on its balance sheet.

Some British companies even capitalized their home-grown brands. RHM(Ranks Hovis McDougall's) with the consultation of Interbrand succeeded in placing value of all its brands, both acquired and home-grown worth £678 million on its balance sheet.

5. Accounting Treatment for Brand Value

Much of the controversy regarding the valuation of the brand is related to its recognition as an asset in balance sheet. Brands can be reported in balance sheet only after it is qualified under assets definition.

International Accounting Standards 38 deals with the treatment of the intangible assets. IAS 38 prescribes that recognition of an item as an intangible asset requires an entity to demonstrate that the item meets: (Ifrs, 2012)

(a) the definition of an intangible asset; and (b) the recognition criteria.

This requirement applies to costs incurred initially to acquire or internally generate an intangible asset and those incurred subsequently to add to, replace part of, or service it.

An asset is identifiable if it either: (Ifrs, 2012)

is separable, i.e. is capable of being separated or divided from the entity and sold, transferred, licensed, rented or exchanged, either individually or together with a related contract, identifiable asset or liability, regardless of whether the entity intends to do so; or

(b) arises from contractual or other legal rights, regardless of whether those rights are transferable or separable from the entity or from other rights and obligations.

A brand meets both the above criteria of being treated as an asset. But IAS further recommends that an intangible asset shall be recognised if, and only if: (Ifrs, 2012)

(a) it is probable that the expected future economic benefits that are attributable to the asset will flow to the entity; and

(b) the cost of the asset can be measured reliably.(in case of internally generated intangibles The cost includes all the expenditures that can be attributed or allocated directly to creating, producing and preparing the asset from the date when the it was recognized as asset.

(Shodhganga))

Brand satisfies the first criteria, but it is very difficult to arrive at a reliable measurement criterion for the brand especially for home grown brands. For example, Coca-cola was established in the 1890s and since then it is has been continuously building its brand year after year. It is almost impossible to account all the cost incurred in the process of brand building with exact and reliable measures.

Apart from the measurement problems IFRS further dictates that "Internally generated brands, mastheads, publishing titles, customer lists and items similar in substance shall not be recognised as intangible assets."(Ifrs, 2012)

In case of acquisition, the intangible assets shall be measured initially at cost. As per IAS 38 the cost of a separately acquired intangible asset comprises: (Ifrs, 2012)

(a) its purchase price, including import duties and non-refundable purchase taxes, after deducting trade discounts and rebates; and

(b) any directly attributable cost of preparing the asset for its intended use.

6. Approaches to Brand Value Measurement:

There are numerous ways to measure brand value. Some of the prominent are following:

- Valuation based on Cost

Under this method the brands can be valued at either the actual cost incurred in the acquisition, building or maintenance of the brand or at the cost which would be incurred in case of recreating the brand in present business and economic conditions. The drawback of this method is that if we measure on the basis of actual cost it is not of much relevance with the passage of time and in case of replacement basis it is very complex to arrive at exact cost of recreating a brand under current situation.

- Valuation Based on the Premium Pricing

Under this method, it is assumed that brands hold a premium over the unbranded items.

The difference between the branded and unbranded products gives the base for valuation.

The major drawback of this method is that many brands do not have any unbranded rival.

Such as Boeing don't have any unbranded counterpart.
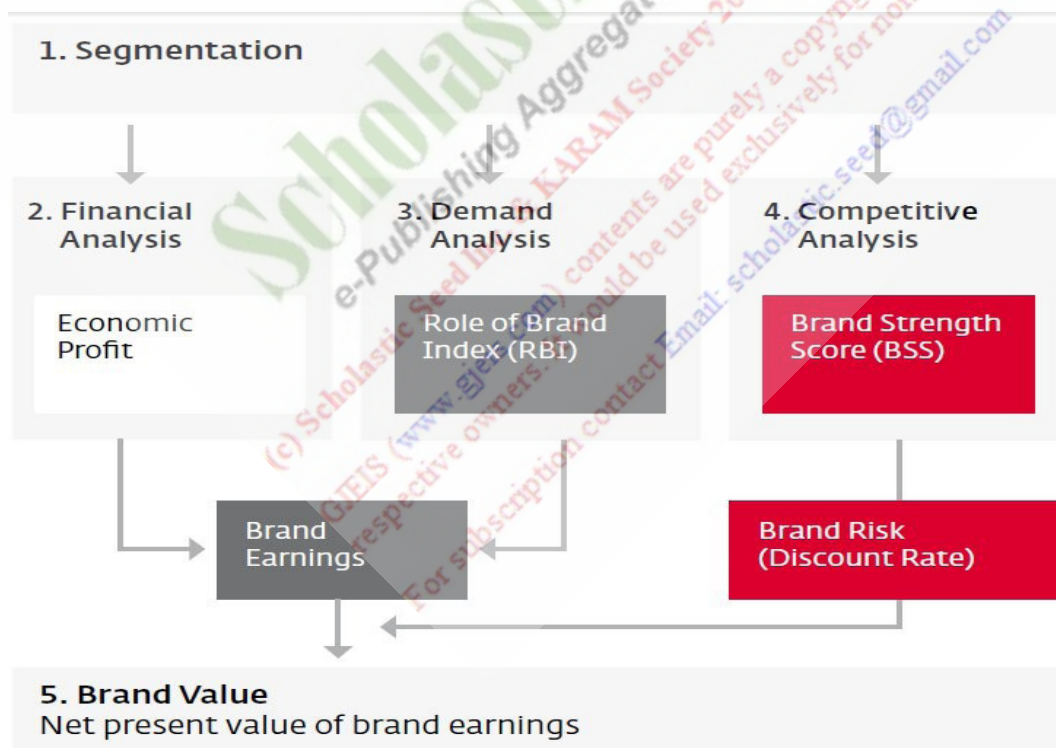
- Valuation Based on Market Value:

Figure 1.

This method is based on objective market value. It is one of the most logical methods since it provides the opportunity to compare across the companies and over a period of time.

- Valuation Based on Consumer Factor:

Consumer's perception and feelings towards the brand can also be used to measure the brand value. The biggest drawback of this method is that it is subjective in nature.

- Valuation Based on Future Earning Capacity:

It is one of the most appropriate method brand valuation and followed by practitioners widely. However, the biggest problem with this method is the assumption which it makes

i.e. the past trend is going to continue in future also without any change.

7. Interbrand's Approach to Brand Valuation

Interbarnd uses three components in their valuations of brands. These are : financial performance analysis, the role of brand in purchase decisions, the competitive strength of brands. These components are measured with respect to segments. ("interbrand brand valuation methodology," n.d.)

- Segmentation

It is defined in terms of customer group, geography, SBU, product or service category. Each segment analysed on every component i.e. financial performance, the role of brand and brand strengths.

Following figure represents the scheme of brand valuation by Interbrand:

Source: **Brand Valuation,** A versatile strategic tool for business, Interbrand(2014)

- Financial Analysis

It measures the overall economic profit.

- Role of Brand in Purchase Decisions

It measures the part of purchase decisions which can be attributable to the brand in comparison to other factors such as price, product features and convenience.

- Brand Strength:

Interbrand lists set of ten factors under categorized in internal and external factors:

- **Internal Factors:** o **Clarity** o **Commitment** o **Protection** o **Responsiveness**
- **External Factors** o **Authenticity** o **Relevance** o **Differentiation** o **Consistency** o **Presence** o **Understanding**

8. Benefits of Brand Valuation

The major benefits of brand valuations are :(Wood, 1995)

- It provides a realistic view of shareholder's funds

- Brand valuation gives a logical base to compare the firms operating in similar markets.
- Gives opportunity to raise capital easily by reducing gearing ratios
- Gives platform to compare brands across the portfolio · Help in future planning for brand management.
- Help in allocating the marketing resources accordingly
- It is useful in making the decision regarding the merger and acquisitions.
- It helps in raising funds by showing the worth of brand more clearly

9. Conclusion

In current business scenario brands are one of the most valuable assets for a company. A strong brand gives a sustainable competitive advantage. For marketers, the brands were always of valuable but the accounting treatment of the brand is still not considered as it should be. The problem with the accounting of brand lies in the very nature of brand itself. Since it is more of subjective in nature, it becomes very difficult to arrive at a universally acceptable quantified value of any brand. In case of acquired brand, it is a bit easy to determine the value of brand but for home grown brands it not as straight forward. Various institutions are working in the direction of finding a suitable and universally accepted method for treatment of brand value in financial statements.

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Impact of Social Media on Pharmaceutical Manufacturer

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Abstract

Now a days, manufacturers in this competitive market are fighting to stay ahead in the race whether they have already launched a product, product is in the market, launching a new product or it is still in a development phase to find out the people's demand. Social media is the platform for everyone now a days to track the activities online and the taste and preferences of the people can be tracked. Likewise the drug manufacturers are also pitching in social media to know about the side effects of the drugs when the drug will come to the market. Even though, they already tested the drug for any side effects but they are keen to know about the genuine feelings of consumers, which are shared on social media, about their drug. This paper delineate the side effects of drugs which are being used by the patients for any particular disorder where we have attempted to capture and analyze the information about some unbridled ramification of these drugs with an assumption that the significant portion of people who are under-treatment have acknowledged their genuine feelings. We have applied sentiment analysis followed by exploratory data analysis by taking non structured reviews into consideration. We have generated a word cloud of side effects which people had mentioned in their reviews. It emphasizes on the side effects of the anti-depressant medication and how they impact the human body. The analysis is very helpful to drug manufacturers as they can understand the genuine feelings of consumers and they can change or modify the drug accordingly.

Keywords: Analytics, Anti-depression, Drugs, Manufacturing, Sentiment, Text Analytics

1. Introduction

In the recent years there is an increasing trend in the drug prescription for the treatment of mental disorders i.e. depression. People generally take multiple medicines in order to normalize the level of their depression such as anxiety, sleep deprivation, loss of interest, anger, energy loss and etc. Below are some of the interesting facts shows the increment in the depression patients published by National health and nutrition examination survey [1,2]:

- Around 70% of the Americans are dependent on prescribed medicines which is highest as ever.
- Prozac is getting famous in American teenagers and adults as they are having it and besides that the other anti-depressant drugs such as Celexa, Effexor, Paxil and Zoloft are being used in astounding numbers.
- 23% of the women use anti-depressant in their 40's and 50's which is highest among the other age group.
- Women are 2½ times more likely to be taking an antidepressant than men.

- 14% of non-Hispanic white people take antidepressants compared with just 4% of non-Hispanic blacks and 3% of Mexican Americans.
- Antidepressant use does not vary by income status. All the drugs available in the market these days in order to treat depression have some or a few life threatening side effects. It is resilient to pick out chemical combinations responsible for a new symptom. Before a new drug enter into the market, it has to pass through certain level of tests and the success or failure of a particular drug may vary from a small group to the entire population. There are some side effects which are published by the manufacturer according to the clinical trials tested on a small group of population. The process of clinical trial of a particular drug is very short which can also give best results to the people who are involved in the process, but it may lead to the wrong conclusions in the later stage when the drug hits the market and doctors start to prescribe it to the population. In the recent years many anti-depressant has been banned from the market such as Seroxat, Prozac nation etc. and government warned people

not to opt for these medicine at least for certain age group of people. There are many programs where the prescription is monitored on regular basis just to make sure of their health and the safety of usage of the drug[3].

Some of the side effects are based on personal experiences of individuals which is exactly the attraction of our research i.e. to gather an information related to the side effects of a particular drug via Social media[4]. It has been proven that Social Media is the most widely used platform where people are leveraged to articulate their minds and emotions which will help others i.e. manufacturers to build a decision. Anyone now a days can be a part of social media to pen down or access information on anything under the sun. Pharmaceutical manufacturers are pitching in web to collect information which is mostly in the form in comment provided by the customer on a particular medicine, forums or direct chat[5]. User provided reviews are very much helpful for the pharmaceutical manufacturers to get a clear picture to their decision process. There are many methods i.e. statistical and linguistic (for example first logical order) which have been applied to the large dataset of consumer reviews or another valuable information i.e. rating and etc. to reach to various analysis. Since people are writing reviews on their feeling after taking the medications, an advantage is taken of the huge amount of information flowing on the web by accessing it via social media platforms and tried to find out the different side effects of the drugs on the different age group[6].

In this paper, a solution is proposed which will help to identify the different sorts of side effects in the people after having the anti-depressant drugs and it will help the pharmaceutical manufacturers to identify the combination of drugs, having more side effects, and they can change the chemical combination accordingly to reduce the side effects. For the analysis, the main problem was to find out the side effects caused by the particular chemical composition. An effort was put in the area of text analytics and tried to focus on those side effects corresponding to the chemical combination. A particular drug is never responsible for any side effects but there are different components which impacts on the human body. Our intention is to find out those components which are having an adverse effects. We have done sentiment analysis on the collected data so that the mood can be identified of an individual while writing a comment. This analysis will be a great help for pharmaceutical manufacturers in terms of providing right chemical combination, capture more market share and customer satisfaction.

The remainder of the paper is as follows: Section 2 describes the solution framework whereas Section 3 shows the numerical analysis. The results have been discussed in section 4. Finally, the paper has been concluded with future scope in section 5.

2. Solution Framework

A very few research has been cited on the side effects of drugs using the users data or company website review[7,8]. They have done the text mining to show the bad effect of drugs[3]. A few research is on unsupervised learning model to show the adverse effect of drugs[9]. In this study, we have considered much unstructured data from social media. This study considered one generic name i.e. Sertraline, which is highly prescribed medication for depression and found in many anti-depressant drugs. In order to find the side effects of the drugs, the WebMD[10] data is examined for the best results where people mention their reviews regarding health issues after taking a medications. WebMD[10] provides health news, advice and expertise. It also has a social forum where people discuss about their prescribed medicines and their side effects. The study works on an assumption that people have written the genuine comments and not intend to down-market any medicine and a particular doctor from the fraternity. The data captured consists of 6 sections i.e. the age group of the patient, the review about a drug, rating, gender and onset of the prescribed medication. This data helped us to find out some interesting insights while doing the exploratory data analysis. One of the major analysis is sentiment analysis which help us to straight away find out the reaction of a drug in a broader sense.

A methodology is proposed for this analysis which is represented in Fig 1.

Step 1. The important matrices such as the generic name of the medicine, age group, reviews, ratings, onset period and sentiment has been considered for this analysis as a major parameter to reach to any conclusion.

Step 2. Reviews were selected for a particular therapeutic class i.e. depression through Twitter search API with select keywords using certain filters. The first filter was selected as an anti-depressant medications where the second filter was for a particular drug.

Step 3. This step includes the deep down analysis of the extracted data. The side effects with the help of sentiment analysis and the word cloud has been identified. The motivation behind extracting the dataset on depression was to find out the side effects of the anti-depressant medication so that the frequent side effects could be concluded in the study.

Step 4. A study is done chemical composition of the medicines which are creating side effects in the human body so that the chemical combination can be analyzed in other widely used drug.

Step 5. A classification model was fit to approach the data initially to know the relationship between the different parameters and the corresponding sentiments.

R and Tableau are the tools used in the analysis. R is a highly competitive open source object oriented programming language and R studio open source integrated environment is used whereas

Tableau is commercial visualization tool which has the capacity to build highly interactive visuals with many other capabilities.

The next section will describe the numerical analysis based on the reviews of people on social media platform.
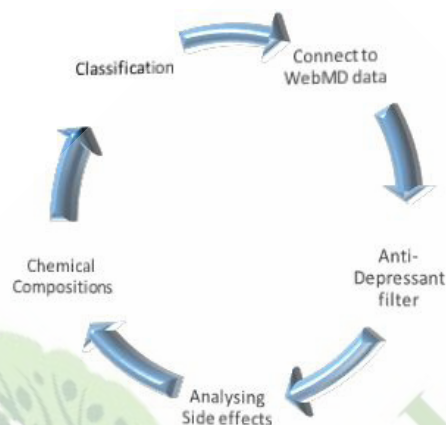

Figure 1.   Methodology for sentiments.

3. Numerical Analysis

A study has been done by considering all the common side effects and the chemical combination of Sertraline in the form of a table. Sertraline is one of the famous generic name which contains Sertraline; Zoloft; Dichlorophenyl; N-methyl; 4-tetrahydronaphthalen; amine.

N-methyl as a standalone chemical can cause Diarrhea, nausea, trembling and sexual dysfunction and etc. whereas tetrahydronaphthalen can cause sweating, blue-yellow blindness, painful and difficult urination, swollen glands and fruit like breathing odor. The solution framework out of this problem can be approached by considering the chemical combination of Sertraline and every component causes some or the other side effects. All the combination was broken in different and analyzed if any particular combination was responsible for any side-effect. A study shows the result in the form of numbers. Every combination is more or less responsible for every effect on the human body. Below figure shows the intensity of every combination on particular side-effect. The scale of the color shows the same i.e. the dark zone in the picture shows the high intensity for e.g. N-Methyl causes Bladder pain more than any other combination. Similarly Amine can cause dry skin and etc. The numbers quantify an effect value. These effect value were calculated by processing text analytics on side-effects where these value shows the frequency of side effects in the reviews. The study done can help a manufacturer to identify which combination is responsible in contributing the symptom so that they can optimize their drug accordingly. A study has been done by considering all the common side effects and the chemical combination of Sertraline in

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For predicting the sentiments from the WebMD data through other variables we have done CHAID analysis. In Fig 3, three variables are considered i.e. rating sensations, No of people who found the review helpful and rating effectiveness. To make this analysis more refined, there are some assumptions given below:

Figure 2. Intensity of each chemical combination on Side-effects.

- People are writing their genuine feelings and sentiments.
- No one had tried to down market or promote any particular medicines available in the market.
- People those who are under-treatment and taking medicine have the same body type and following the doctor's advice.
- The medication have the same effect and side effects on every age group.
- People are having proper meals before taking any drug.
- Every body type is same and not having any disease.

We have also done text analysis and sentiment analysis. We have provided the word cloud to understand the more common and less common side effects among different people. We will discuss all the results in the next section.

4. Result and Discussion

The intention of the approached solution was to produce a result where the impact of social media on pharmaceutical manufacturer and the side effects from the anti-Depressant could be seen. Data was extracted from WebMD which is one of the leading website in providing information on medicine, doctors and other medical aid.

The study was initiated with exploratory data analysis by analyzing the reviews and applied sentiment analysis on the same to make manufacturer understand the combination in details to make the drugs better. In Fig 4 the dispersion of sentiments of the people who are prescribed with anti-depressant pill is mentioned.
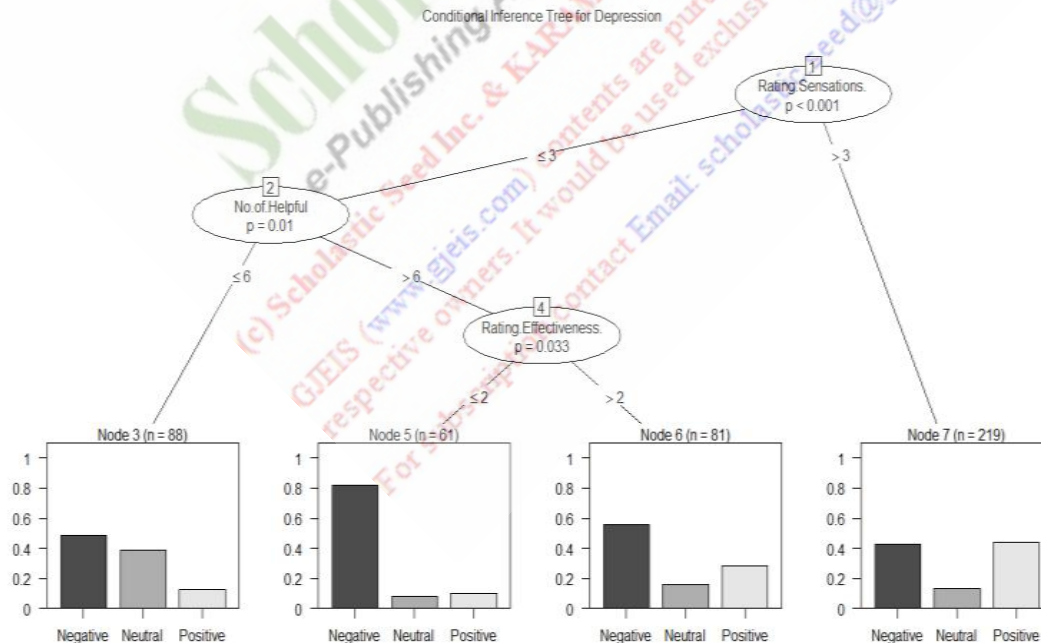

Figure 3. Tree Based Model.

Major segment is not happy with these prescription as 51.45% are having negative views on it whereas 30.51% are happily consuming these drugs and we can assume that they are finding it useful.

Similarly Fig 5 shows the onset period with the polarity as it is visible that negative are more than positive in every onset date which means that it mostly produces a side effect. Apparently in Fig 5, it is analyzed that negative sentiments are more than positive sentiments in every onset. In less than one month, positive sentiments are 7.57% with 12.69% negative. Similarly in less than 6 months, positive sentiments are 9.13% with 13.14% of negative sentiments. It is visible that people find some relief initially when they are prescribed with any anti-depressant drug but eventually it affects people when they continue it for years as percentage of positives are curtailing down with increased onset date.

The sentiments have also been analyzed through CHAID analysis in Fig 3 which is helpful for pharmaceutical manufacturer to identify the distribution of sentiments by incorporating the other variables i.e. ease of use, Helpful, effectiveness and sensations. According to Fig 3, If the rating sensation is less than equals to 3 then it will jump to No. of helpful and if the rating is less than equals to 6 then the result will be Node 3 i.e. Negative will rise followed by neutral and positive but if the score is more than 6 then it will move to rating effectiveness and if the rating in effectiveness is less than equals to 2, then result will move to Node 5 and Negative will rise even more, neutral will curtail and positive remains same as it was in Node 3. The value of positive and neutral is increased unlike negative in Node 6 as the rating effectiveness is more than 2. Node 7 shows the straight answer i.e. Positive is more than negative and
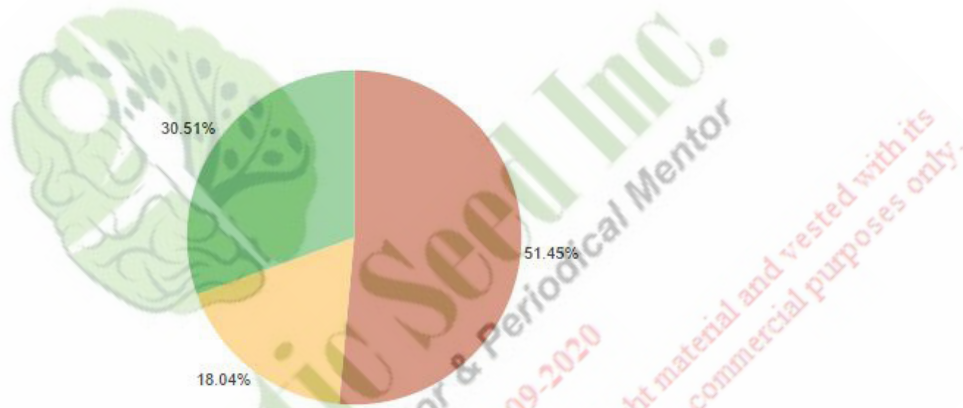

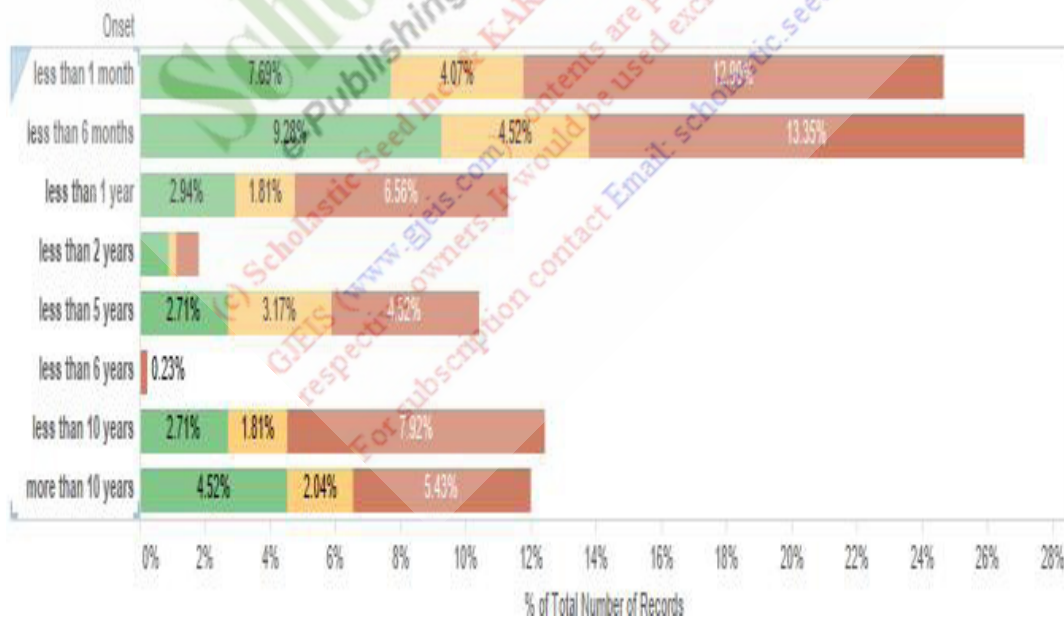Figure 4.   Distribution of sentiments.

Figure 5.   Onset with the polarity.

neutral where the rating sensation is more than 3. It means that all the variables contains some significant relationship with each other and sentiments are highly impacted by the ratings. We have done the analysis on the overall sentiments of consumers. The social media data has been further analyzed on the basis of other variables like ease of use, effectiveness and sensations.

The study was initiated by taking one generic name Sertraline which is widely prescribed by the doctors to the new or old patients. Since Sertraline is very famous, effort was put in the direction to find out "why people prefer this?" and considered 3 parameters i.e. ease of use, effectiveness and sensations where people had rated on the scale of 1 to 5. Fig 6 shows that Sertraline is easy to use and it is rated as 4.3/5 with low sensations i.e. 3.5. This study will help the pharmaceutical manufacturer to manufacture of drugs with such a chemical combination which is easy to use with less sensations.

Another focus of this study is to find out the side effects of Sertraline which is a generic name and the word cloud was generated based on the reviews from WebMD website. Fig 7 below shows the more common side effects in the people after consuming sertraline such as unusual behavior, mood change, skin rash, diarrhea, difficulty with breathing, chest pain and etc. The size here show the frequency of these side effects in out term document matrix. On the contrary there are some less common side effects shown in Fig 8, such as unusual facial movements or postures, weight gain, hair loss, Dyspepsia, bloating, Overactive reflexes, thirst confusion, blurred vision etc.

This above in-depth analysis proves that there are some chemical combination like Amine, N-Methyl, Sertraline, and Zoloft etc. which impacts human body differently in the form of sweating, headache, dry throat and mouth, Anxiety etc. also the polarity of people are measured with the help of sentiment analy-

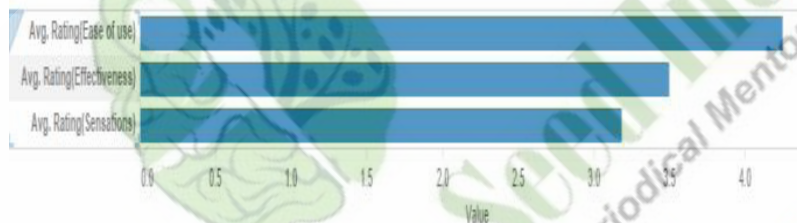
Figure 6.   Average rating of Sertraline.

Figure 7.   More Common Side effects.
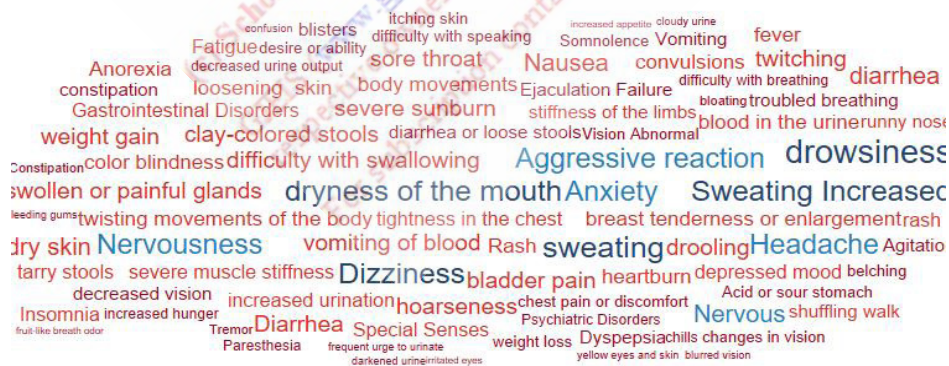
Figure 8.   Less Common Side effects.

sis where it was identified that majority of the people aren't happy with drug consumption whereas the polarity changes when the onset time increases to 1 year, 5 year or more than 10 years. Also the ratings were aggregated and concluded that these drugs are easy to use, but the effectiveness and sensations are less. The side-effects were categorized in more common and less common i.e. unusual behavior, sores, welting, blisters, skin rash hives or itching and dizziness, nervousness, dryness or mouth, sweating, aggression respectively.

5. Conclusion

The work we have done basically shows the power of social media and how it affects positively on manufacturers and people as to stay ahead of the curve in this competitive market, one should understand the demand of the market be it a consumer goods like mobile, car etc. Social media channels provides the platform to the manufacturer to analyze the demand of the market for manufacturing the next gen products by eradicate the error and challenges in the previous versions. In this study we can conclude that depression is rapidly increasing in the society in all the age groups and comparatively females are using more anti-depressant drugs than men. The side-effects of Sertraline (Generic Name) has been mentioned in the form of word cloud and also the study was drilled down in terms of its chemical compositions where many side-effect were noticed. There are variation in people's sentiments and most of the people are talking negative about Sertraline.

This work is just a preliminary demonstration of how Social media has impacted the pharmaceutical manufacturer and people now share a same bridge to discuss about their prescription and feeling after taking medications. The targeted patients are suffering from depression and shared their experiences on WebMD which is a leading website for providing information on different medical aspects.

The side effects are shown which helped pharmaceutical manufacturer to understand the customer context behind consumption and conversation about the product. The study suggested to pharmaceutical manufacturer that which chemical combination should be preferred for anti-depressant drugs.

By plugging in various factors i.e. Ease of use, effectiveness and sensations, we can predict social media activity. It helps in deciding what to choose and what it can cause.

In future this study will not decipher the impact of any medicine for depressed but will deep dive into other social media platform like Facebook, twitter, instagram and etc. The text and the image what people write and post has got the power to show

the internal polarity of a human being. The study in future will analyze the text of individuals and predict the depression rate with the help of social media which will help pharmaceutical brands to manufacture perfect combination of drugs for different segments of people.

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Implementation of Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) in Manipur (2015-16): An Assessment

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Abstract

Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) is demand driven , self targeting employment generating poverty alleviation scheme which was launched by the UPA government in 2005 with full of hope to eradicate the problems of poverty and unemployment in the rural areas of India by targeting to provide at least 100 days of employment at each rural households. It is the only employment-generating programme, that a beneficiary can claim legally. The scheme was introduced in Manipur in the year 2008 with lot of hope to minimise the problem of poverty and unemployment in the state but after the eight years of implementation, the programme failed to deliver the expectations the people had on it. In this paper, an assessment of the performance of MGNREGS in Manipur of the year 2015-16 has been made.

Keywords: MGNREGS, Scheme, Employment, Social, Execution, Development

1. Introduction

Poverty and unemployment are the two main barriers in the pave of growth and development of a nation. The nation who succeeds in crossing these barriers easily solves the problems of poverty. We all know that poverty is a curse in the mankind. Poverty is the source of unemployment, social exclusion, crime and other social, political and economic problems. It has been an important impediment in the way of growth and development of a country. We can even compare poverty to a curse in the development of a country. India suffers from poverty and is still far more behind the other developed countries. According to World Bank, India has 30 percent of its population under Below Poverty Line at 224 million in year 2013, which is largest number of population below poverty line in the world. Rural poverty has been always a big reason for higher rate of poverty in India. In order to pave India in the way of development, all the sources and issues related to poverty need to be checked and solved. Without taking care of this poverty related issues and problems, a country cannot attain the targeted growth and development rates. In India,

since independence, many developmental plans have been formulated and adopted by the different government. Among those developmental plans, using public employment as a social security measure and for poverty alleviation measure in rural areas is very common. After three decades of experimentation, the government launched major schemes like Jawahar Rozgar Yojana, Employment Assurance Scheme, Food for Work Programme, Jawahar Gram Samridhi Yojana and Sampoorna Grameen Rozgar Yojana that were forerunners to Mahatma Gandhi NREGA

MGNREGS is a demand driven employment programme which was introduced with an aim to guarantee at least 100 days of unskilled employment to all the poor families in rural areas of India. This scheme is different from other employment programmes on the basis of two important facts viz. it is demand driven and it is a right based employment opportunity. The scheme has a lot of expectations considering its main objectives like employment generation, food security, alleviation of poverty, preventing migration and overall rural development. Since it was launched in the year of 2006, there are a lot of mix reaction from different states about its performance and success.

MGNREGS was implemented in three phases:

(a) Phase I - started in 200 district on 2February 2006

(b) Phase II - extended the implementation to more 130 districts in financial year 2007-08   (113 districts in 2007-08 and 17 districts of Uttar Pradesh from 15 May 2007).

(c) Phase III - extended to all other remaining districts in the Indian union from 1st April 2008

On 2nd October 2009, the scheme was renamed as Mahatma Gandhi National rural Employment Guarantee Scheme (MGNREGS).

2. Objectives of MGNREGS

Important objectives of MGNREGS consist of ensuring social protection for the most vulnerable people living in rural India through providing employment opportunities, Ensuring livelihood security for the poor through creation of durable assets, improved water security, soil conservation and higher land productivity, Strengthening drought-proofing and flood ,management in rural India, Aiding in the empowerment of the marginalised communities, especially women, Scheduled Castes (SCs) and Scheduled Tribes (STs), through the processes of a rights-based legislation, Strengthening decentralised, participatory planning through convergence of various anti-poverty and livelihoods initiatives, Deepening democracy at the grass-roots by strengthening the Panchayati Raj Institutions (PRIs), Effecting greater transparency and accountability in governance. Above the empowerment of unskilled population of the rural areas, empowerment of marginalised communities like women, SCs , STs are are clearly mentioned in the objectives of the scheme.

3. Important Features of MGNREGS

- Adult members of a rural household, willing to do unskilled manual work, may apply for registration in writing or orally to the locally Gram Panchayat.
- The Gram Panchayat after due verification will issue a job Card free of cost.
- The job Card should be issued within 15 days of application.
- A job Card holder may apply for the employment under the scheme to the Gram Panchayat and Panchayat will issue a dated receipt of the written application for employment.
- The gram panchayat must provide the work within the 15 days of the application otherwise daily unemployment allowance must be given to the job card holder by the state.
- Any work under MGNREGS should be provided within 5 km radius of the village. In case work is provided beyond 5 km, extra wages of 10 per cent are payable to meet additional transportation and living expenses.

- Payment of wages is mandatorily done through the individual/joint bank/post office beneficiary accounts.Wages are to be paid as per the State-wise Schedule of Rates(SoRs). Payment of wages has to be done on a weekly basis and not beyond a fortnight in any case. Equal wages will be provided to both men and women.
- At least 1/3rd beneficiaries shall be women who have registered and requested work under the scheme.
- Worksite facilities such as day cares of children for the women workers, drinking water and shade have to be provided at all worksites.
- Planning and Implementation of works of a Financial year along with the order in which each work is to be taken up, site selection, etc. are the responsibility of the Gram Panchayat and it is decided in open assemblies of the Gram Sabha (GS). At least 50 per cent of works will be allotted to Gram Panchayats for execution.
- Permissible works predominantly include water and soil conservation, afforestation and land development works.
- A 60:40 wage and material ratio has to be maintained. No contractors and machinery is allowed.
- The Central Government bears the 100 per cent wage cost of unskilled manual labour and 75 per cent of the material cost including the wages of skilled and semi-skilled workers.
- Transparency and accountability is an important feature to make MGNRES to protect the scheme from corruption, fraud, misused of fund and the other unwanted implementation factors in the course of implementation through out the country. Social audit is an important part to scrutinise all the records and works under the Scheme are to be conducted regularly by the GS. Grievance redressal mechanisms and rules have to be put in place for ensuring a responsive implementation process. All accounts and records relating to the Scheme are available for public scrutiny by using Management Information System (MIS) and Information communication technology (ICT).

Nationally, the total household worked under this scheme in the FY 2015-16 is around 4.8132 crores with total individual worked under this scheme is 7.2257 crores in FY 2015-16. The total persondays generated under this scheme in the FY 2015-16 is around 235 crores while the target was 239.11 crores persondays. Out of the whole persondays created, 55.25 % is women, 22.28 percent is Schedule Caste, and 17.75 percent is Schedule Tribe in the FY 2015-16. Average days of employment provided in the FY 2015-16 are 48.8 days. It is found that the national average day of employment is even less than the half of the targeted minimum number of employment days (100 days) according to the MGNREG Act .The total numbers of households completed 100 Days of Wage Employment in the FY 2015-16 is 48,48,013. Average national wage rate under this scheme is Rs 154.09 in the

FY 2015-16. Only 36.98 percent payments are generated within the 15 days of completion of work in 2015-16.

4. The Manipur Scenario

The present paper is an attempt to make a critical assessment about the implementation of the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) in Manipur during the financial year 2015-16. The study is based on the secondary data sources which are available at the official website of Mahatma Gandhi National Rural Employment Guarantee Act (www.nrega.nic.in) , Economic survey of Manipur, census abstracts and published papers related with the MGNREGS in Manipur.

The name "Manipur" literally mean the land of gems which was officially introduced in the early eighteen century during the reign of Hinduism Garibaniwaza (1709- 1748). Geographically, Manipur is one of the north eastern state in India surrounded by Nagaland in the north, Mizoram in the south, Myanmar on the East and South East and Assam in the west. It has a total area of 22,327 sq. km,   and having a population of 27,21,756 (2011 census). Manipur lies between 23.830 N and 25.680 N latitude and between 93.030 E and 94.780 E longitude. Manipur is physically divide in two part viz. Hill and valley. The hill part cover nearly 90 percent (20,089 sq. km) of the total area of the state and the valley is surrounded by the the hills like a bowl shape. There are 9 districts in Manipur viz. Thoubal, Imphal West, Imphal East, Bishnupur Churachandpur, Senapati, Ukhrul, Tamelong and Ukhrul. The population of Manipur as per 2011 census was 28.56 lakhs comprising 14.39 lakhs of males and 14.17 lakhs of females of which, the rural population is 1,736,236 and the urban population 834,154. Population of Manipur constitutes nearly 0.24 % of the total population of India. The population growth rate of Manipur is found to be higher than that of India. The population growth rate of Manipur in 2011 is 24.50 % as against All India growth rate of17.70 %. Chandel has recorded the highest decadal growth rate in rural population (23.2%) and Imphal East (69.2%) the highest decadal growth rate in urban population during 2001 -2011.The density of population of Manipur as per 2011 census was 128 persons per sq.km. The sex ratio for the state as a whole has improved from 974 females per 1000 males in 2001 to 985 females per 1000 males in 2011 in rural areas, it

Figure 1   Manipur Map.

is 976 while it is 1026 in urban area. The birth rate of population per annum in the rural areas of Manipur is 14.6 in 2007 and the death rate is 4.4 in the same period. The urban birth rate is 15.1 in 2013 where the urban death is 4.2 in the same period. Out of the 28.56 lakh population, 3.41 % are scheduled castes communities and 40.88 % are of scheduled tribes. The ST population was 11.67 lakhs as against 7.41 lakhs in 2001 Census. The total SC population was 97 thousand in 2011 census as against 60 thousands in 2001 Census. In terms of literacy, Manipur ranks fifth among the North Eastern States of India as per the final figures of the 2011 census. The literacy rate is 76.94 percent in 2011 with (males 83.58 percent and females 70.26 percent). The Gross State Domestic Product (GSDP) of Manipur for 2013-14 at current prices is estimated to be Rs. 14,323 crores. At constant (2004-05) prices, GSDP in 2013-14 is estimated at Rs. 8,330 crores as against Rs. 7,843 crores. The Net State Domestic Product (NSDP) at current prices for the year 2013-14 is estimated at Rs. 12,559 crores. Per Capita Income (PCI) which is generally considered as the most effective indicator showing the average size of the income and the standard of living of the people. The net PCI of Manipur at current and constant (2004-05) prices in 2013-14 are estimated to be Rs. 41,573 and Rs. 24,042 respectively showing an increase of 10.40 % and 3.94 % over the previous year.*(Economic survey of Manipur 2015-16)*

The MGNREGS was launched initially on 13th April, 2006 at District Headquarter, Tamenglong by distributing Job Cards to registered applicants. The total number of households for which job cards have been issued was 18,568 in 2006-07. During 2007-08, Chandel and Churachandpur districts have also been covered under the scheme. Imphal East, Imphal West, Thoubal,

Bishnupur, Senapati and Ukhrul have also been covered during 2008-09.

As required under the MGNREGS, the Government of Manipur has formulated a scheme called the Manipur Rural Employment Guarantee Scheme (MREGS). The scheme will focus on the following admissible works:

(i) Water conservation and water harvesting;

(ii) Drought proofing (including afforestation and tree plantation);

(iii) Irrigation Canals including micro and minor irrigation works;

(iv) Provision of irrigation facility to land owned by households belonging to Scheduled Castes and Scheduled Tribes or to land of beneficiaries of land reforms or that of the beneficiaries under the Indira Awaas Yojna of the Government of India.

(v) Renovation of traditional water bodies.

(vi) Land Development;

(vii) Flood control and protection works including drainage in water logged areas;

(viii) Rural connectivity to provide all weather access; and work which may be notified by the Central Government in consultation with the State Government.

According to the table no 1, the approved labour budget for this scheme is Rs 245.56 Lakhs in the FY 2015-16. The approved labour budget in the FY 2014-15 is found to be lowest in the last four years that is only Rs 39.93 lakhs while it is Rs 311.02 lakhs in FY 2013-14 and 414.65 Lakhs in FY 2012-13. A Total of around 4.74 lakhs Households worked in the FY 2015-16, 4.69 lakhs in FY 2014-15, 4.55 Lakhs in FY 2013-14 and 4.57 Lakhs in FY 2012-13 under this scheme. The total persondays generated

Table 1. Performance of MGNRES in Manipur

Indicator	FY 2015-2016	FY 2014-2015	FY 2013-2014	FY 2012-2013
Approved Labour Budget[In Lakhs]	245.56	39.93	311.02	414.65
Persondays Generated so far[In Lakhs]	75.33	101.17	113.23	285.11
SC persondays % as of total persondays	2	3.06	1.45	1.49
ST persondays % as of total persondays	57.52	51.56	65.86	64.05
Women Persondays out of Total (%)	37.26	38.27	35.25	34.01
Average days of employment provided per Household	15.9	21.58	24.86	62.4
Average Wage rate per day per person(Rs.)	189.96	174.93	153.01	143.99
Total No of HHs completed 100 Days of Wage Employment	1	44	2	2,422
Total Households Worked[In Lakhs]	4.74	4.69	4.55	4.57
Total Individuals Worked[In Lakhs]	4.85	4.99	5.05	5.67
Differently abled persons worked	859	890	958	666

Table 2. District-wise Persondays Generated of Manipur FY 2015-2016

Sl.No	Districts	Projected Persondays	Persondays generated	Persondays achieved (%)
1	IMPHAL EAST	1818510	978061	53.78
2	IMPHAL WEST	1527718	584820	38.28
3	SENAPATI	4362601	1514491	34.72
4	CHANDEL	1737179	591155	34.03
5	BISHNUPUR	1533721	484273	31.58
6	TAMENGLONG	1882600	541495	28.76
7	CHURACHANDPUR	3974553	1105529	27.82
8	THOUBAL	3236954	892756	27.58
9	UKHRUL	4482388	840722	18.76

Source: www.nrega.nic.in

under this scheme in the FY 2015-16 is around Rs 75.33 Lakhs. It is learned that the persondays generated in the year 2015-16 is lowest among the last four years that are 101.17 Lakhs in the FY 2014-15, 113.23 Lakhs in FY 2013-14 and 285.11 Lakhs in FY 2012-13. The average days of the employment provided per household in the FY 2015-16 is only 15.9 days and it is the lowest in the last four years and very low comparing to the targeted 100 days of work under the scheme.

In the above table number 2, the details of the whole projected persondays, generated persondays and percentage of the achieved persondays for each district is given for the financial year 2015-16. It is found that maximum numbers of persondays were projected in the Ukhrul district (4482388) followed by Senapati District (4362601) and Churachandpur (3974553). However, Imphal East district has achieved more than 50 percent of the targeted persondays in this financial year. On the other hand, only 18.76 percent of the targeted persondays has been achieved by the Ukhrul District.

The following Chart No 1 & 2 shows the targeted persondays comparing to the generated persondays for each financial year from 2012-13 to 2015-16. It is shown that in case of Manipur, the MGNREGS failed to generate the projected persondays in the last four years except in the 2014-15 (1.01 crores person days were generated while only 0.4 crores persondays were projected) and the achieved average persondays are continuously very less from projected persondays. In the FY 2015-16, only 0.75 crores
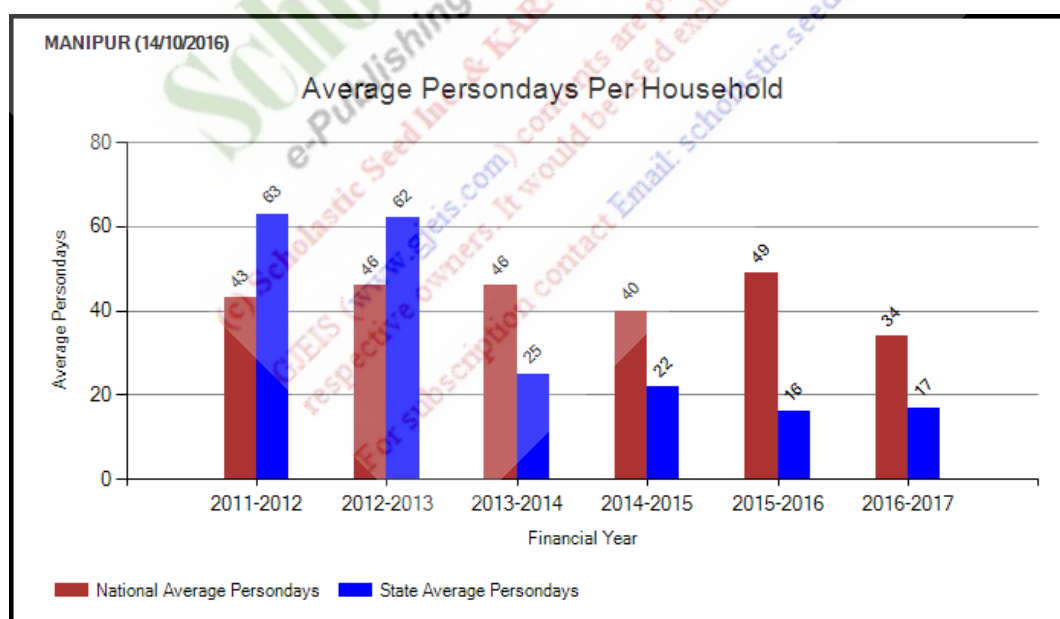

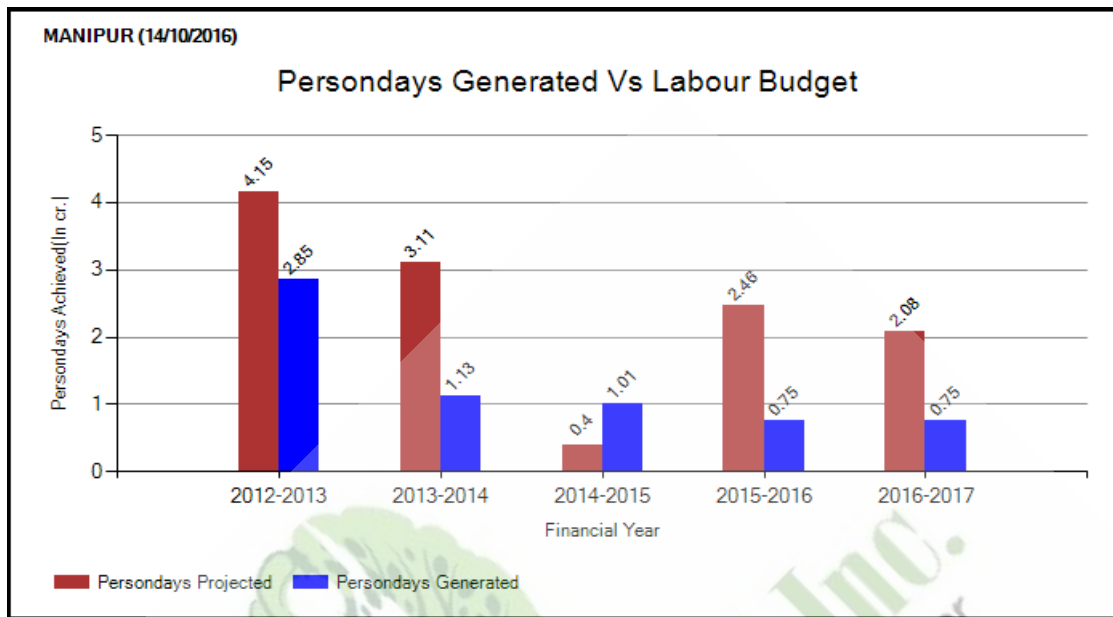**Chart 1.** Average persondays per household in Manipur.

Chart 2. Persondays generated vs Labour budget in Manipur.
Source: www.nrega.nic.in

persondays were generated while the target were to generate 2.46 crores persondays.

5. Empowerment of SC, ST and Women

It is also found that the percentage of SC persondays as of the total persondays generated under this scheme in the FY 2015-16 is around 2 percent. And it is around 3 percent in FY 2014-15, around 1.45 percent in FY 2013-14 and 1.49 percent in the FY 2012-13. Regarding the percentage of ST Persondays as of the total persondays generated under this scheme in the FY 2015-16 is around 58 percent. And it is around 52 percent in FY 2014-15, around 66 percent in FY 2013-14 and around 64 percent in the FY 2012-13. It is learned that the percentage of persondays created for ST is far more than that of SCs in the last four years. Regarding the women participation in this scheme in Manipur, it is found that only 37.26 percent of the total persondays created is women in the FY 2015-16. It is 38.27 percent in FY 2014-15. 35.25 percent in FY 2013-14 and around 34 percent in FY 2012-13. Comparing to the national rate of women participation in this scheme, it is found that the national rate is higher than the Manipur in the last four years. The national women persondays created is always above 50 percent in the last four years which shows the higher participation of women in MGNREGS than man in the last financial years. But women persondays created in

Manipur state is always below 40 percent which shows the lower participation of women in MGNREGS as compared to man in the last financial years.

According to the Table no. 3, it is found that maximum numbers jobcards have been issued to SC household in Bishnupur district (7663) and to ST households in Senapati district (73637) in the FY 2015-16. Above this the two districts also have been reported for providing maximum employment to SC households (Bishnupur 7499) and to ST household (Senapati 73673). Imphal East has been reported for providing maximum numbers of employment to the women by giving employment to 40941women under this scheme. Regarding the generation of the persondays, Bishnupur again leads other districts in Manipur by generating maximum SC persondays of 71625 followed by Imphal West (29919). Again Senapati District again leads other districts in Manipur by generating maximum ST persondays of 1389521 followed by Churachandpur (1082230). Imphal East has been reported for generating maximum women persondays by generating 530333 persondays in FY 2015-16.

Regarding the numbers of the household who have completed the 100 days of work, only one household is reported to complete the employment of the whole 100 days of work in the Manipur state. It is very important to explain the reason for enabling to provide 100 days of work to only one household among the total 538236 registered household in Manipur in this financial year.

Table 3. Details of the employment under MGNREGS in Manipur in FY 2015-16

| S. No	District	HH issued jobcards				No. of HH Provided Employment				EMP Provided	No. of Person days generated					Families Completed 100 Days			
		SCs	STs	Others	Total	SCs	STs	Others	Total	No. of Women	SCs	STs	Others	Total	Women	SCs	STs	Others	Total
1	BISH-NUPUR	7663	135	39922	47720	7499	124	38661	46284	13966	71625	1318	411330	484273	146322	0	0	0	0
2	CHAN-DEL	17	30430	4797	35244	17	29888	4820	34725	10515	294	507455	507455	591155	176082	0	0	0	0
3	CHU-RA-CHAN-DP	5	58686	1296	59987	3	55773	1244	57020	16327	40	1082230	1082230	1105529	315596	0	0	0	0
4	IM-PHAL EAST	1563	2058	90185	93806	1162	1154	71045	73361	40941	23282	15790	15790	978061	530333	0	0	0	0
5	IM-PHAL WEST	2959	873	57614	61446	2556	705	46087	49348	30097	29919	8111	8111	584820	342260	0	0	0	0
6	SEN-APTI	264	73637	6533	80434	264	73673	6542	80479	20713	5077	1389521	1389521	1514491	389202	0	0	0	0
7	TA-MEN-GLONG	6	27528	2651	30185	6	27513	2649	30168	8135	104	493881	493881	541495	143076	0	0	0	0
8	THOU-BAL	2334	799	77170	80303	1915	264	52635	54814	32743	19372	5016	5016	892756	490971	0	0	1	1
9	UKHR-UL	69	48193	849	49111	68	46818	568	47454	15436	1205	829715	829715	840722	272882	0	0	0	0
	Total	14880	242339	281017	538236	13490	235912	224251	473653	188873	150918	4333037	4333037	7533302	2806724	0	0	1	1

Source: www.nrega.nic.in
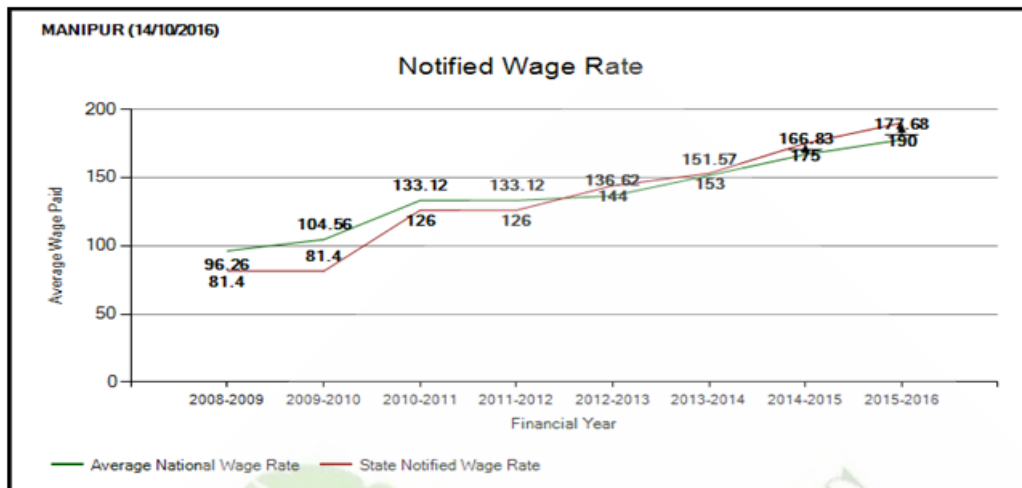
Chart 3. Notified wage rate of MGNREGS in Manipur.

Chart No. 3 showed the details of the trends of wage rate of MGNREGS. Average Wage rate per day per person in the FY 2015-16 is around Rs 190. And it is around Rs 175 in FY 2014-15, around Rs 153 in the FY 2013-14 and Rs 144 in the FY 2012-13. Comparing to the average national wage rate, it is found that the state wage rate is same or above the national average wage rate in the last four years, however it is also found that the state wage rate is lower than the national average before the FY 2011-12.

Average days of employment provided per Household in the FY 2015-16 are around 16 days. And it is around 22 days in FY 2014-15, around 125 days in FY 2013-14 and 62 days in the FY 2012-13. It is found that the national average days of employment provided per Household in the Financial year 2015-16 is 48.87 days which is very higher than the state average. It is also interesting to know that, the national average days of employment provided per Household for the last four years are always above 40 days; however it is sharply falling from an average of 62.4 days in year 2012-13 to 15.9 days in year 2015-16. It is a sign of failure and hindrance in the implementation of MGNREGS in Manipur.
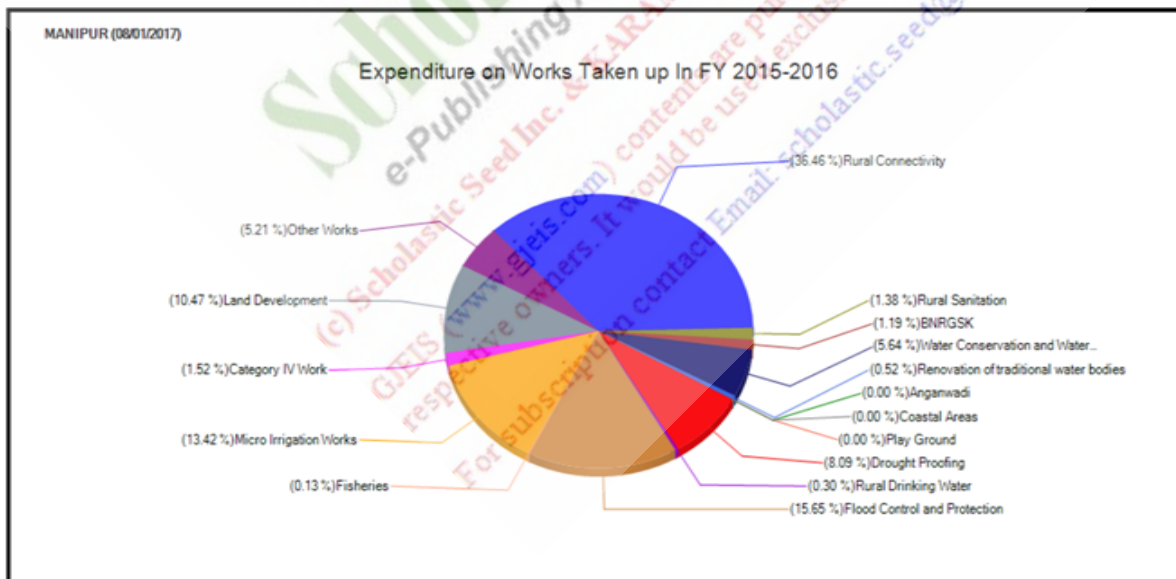

Chart 4. Details of expenditure of MGNREGS of FY 2015-16 in Manipur.
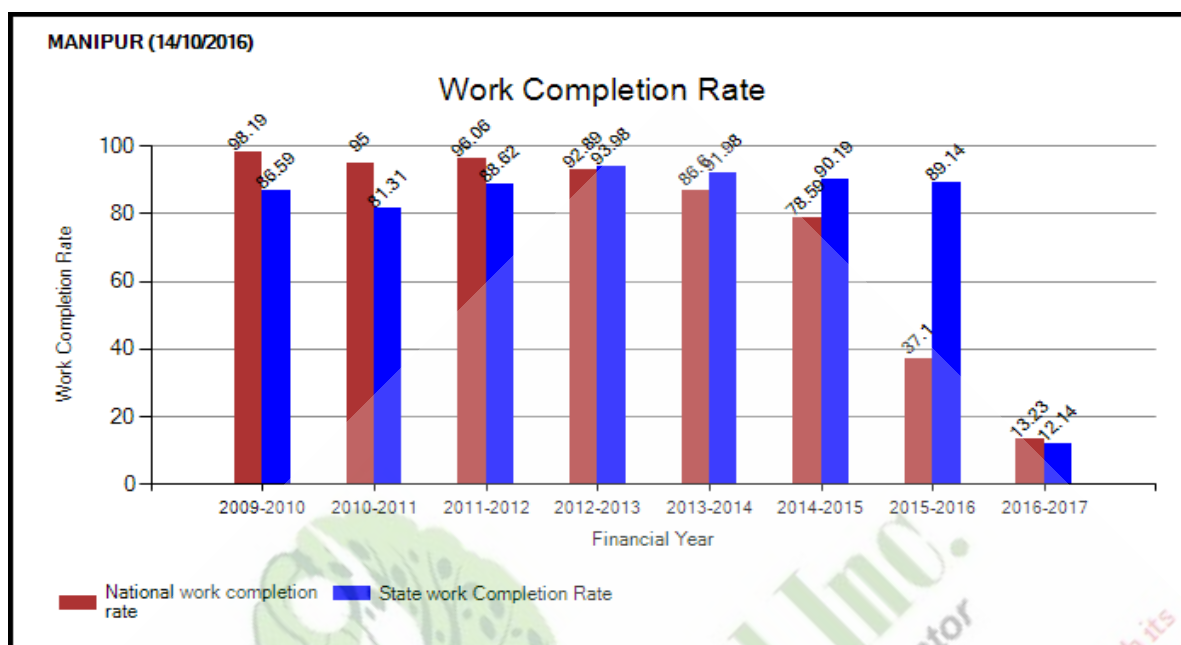Source: www.nrega.nic.in

Chart 5.   Work completion rate of MGNREGS in Manipur.
Source: www.nrega.nic.in

Regarding the total numbers of Households completed 100 Days of Wage Employment of the state under this scheme is negligible in the FY 2015-16 by showing only one household. The situation is same for the last four years by showing only 44 Households in FY 2014-15 and only 2 Households in the FY 2013-14. However, the situation is mysteriously different in the year 2012-13 as it is recorded that a whole of 2,422 Households completed 100 days of wage employment.

6.   Financial Performance

Out of the total available Rs 29214.2 Lakhs, only Rs 25532.29 Lakhs was released by the centre in FY 2015-2016 and only 80 percent of the total funding is utilised. However the utilization of fund is above 90 percent in the FY 2014-15 and 2012-13. It is found that the fund utilisation in the financial year 2012-13 is 101.5 percent. Around 14425 Lakhs was spent on wages in FY 2015-16 which is lowest in the last four years.

Table No. 4 described the financial expenditure in MGNREGS in Manipur. A 33.11 percent of the total expenditure in the FY 2015-16 is utilised on the material expenditures and skilled wages, 6.73 percent is used for administrative expenses. Above this it is interesting to know that not a single penny was transfer through EFMS to the beneficiaries for this scheme in Manipur for the last four FYs. Percentage of payments generated within 15 days of work in the FY 2015-16 is around 83 percent of the total

payment made. It is 88.49 percent in 2014-15, 76.08 percent in 2013-14 and 86.78 percent in 2012-13.

Chart No. 4 revealed the details of the expenditure on works taken up in the FY 2015-16, 36.46 percent of the total expenditure is spent on rural connectivity, 10.47 percent on land development, 13.42 percent on micro irrigation works, 15.65 percent on flood control and protection works, 5.64 percent on water conservation works, 8.09 percent on drought proofing, 0.30 percent on rural drinking water and remaining 6.89 percent on other works like renovation of traditional water bodies, fisheries, category IV works etc.

Chart No. 5 defined the work completion rate of the state remain averagely higher in the last four years comparing to the national averages. Work completion rate of the state in the FY 2015-16 is 89.14 percent while it is only 37.1 percent for national average. Again in FY 2014-15, it is 91.98 percent while it is only 78.59 percent for national average.

Chart No. 6 described the details of the work taken up in the FY 2015-16, 34.76 percent of the total works are based on rural connectivity, 10.19 percent on land development, 10.96 percent on micro irrigation works, 8.32 percent on flood control and protection works, 6.14 percent on water conservation works, 12.88 percent on drought proofing, 0.30 percent on rural drinking water and remaining 8.23 percent on other works like renovation of traditional water bodies, fisheries, category IV works etc.
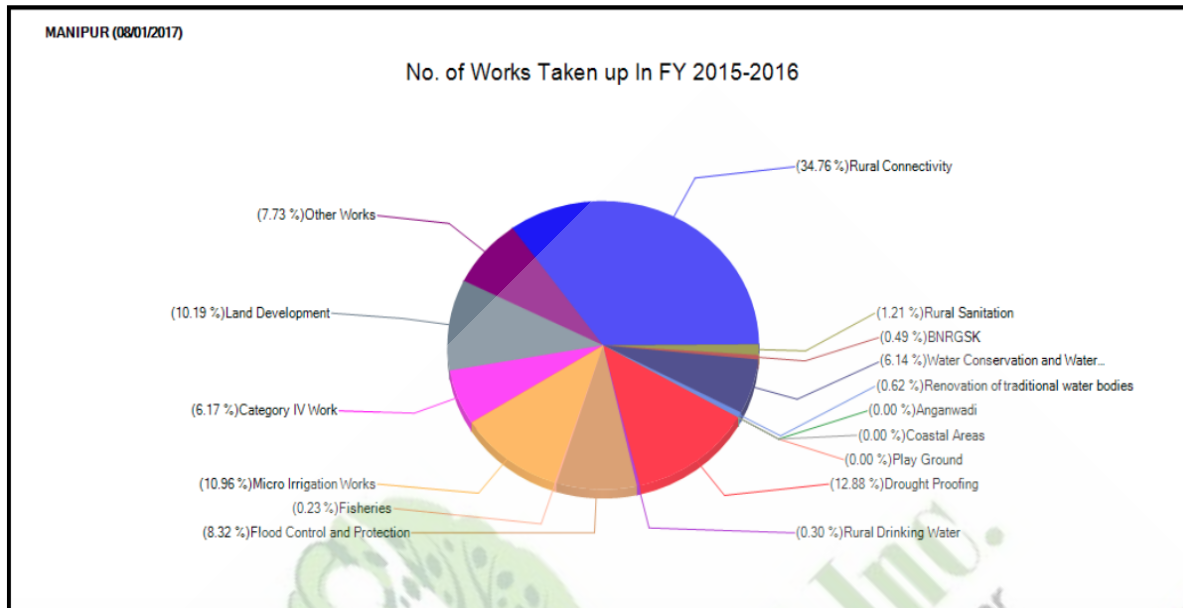
Chart 6. Details of expenditure of MGNREGS of FY 2015-16 in Manipur.
Source: www.nrega.nic.in

7. Conclusion

MGNREGS is a demand driven, self targeting and legally guaranteed employment programme which is very important for the unemployed, poor, unskilled villagers in India. It is one of its kind in the world and it utilises the work force potential of Indian rural areas by developing the far rural areas in the country. The scheme was with full of hope when it was introduced in 2006 for first time by the contemporary UPA government. The scheme was different from other poverty schemes as it gives every rural household a legal right to demand at least 100 days of unskilled works in a year. The scheme also had other main objectives to promote gender equality, social equality, rural infra structure, agricultural activities, financial activities and local self governance etc. However, the real scenario of implementation and its contribution to socio-economic development of the rural area is found to be far behind from the dreamt achievement under this scheme. *Implementation of MGNREGS* in Manipur is also an example of failure of MGNREGS. Only an average of 15.9 days of employment in a year under MGNREGS shows the ineffectiveness of the rules and regulations and policies of the scheme to provide a minimum of 100 days of employment in a year. It is totally contradicted with the main objective of MGNREGA to provide at least 100 days of unskilled works in a year. It is impossible for a rural household to depend on the mere MGNREGS wages for its basic household expenditures on food, medicine education, etc. as the cost of living is very high this days. Hence attempt must be made to increase the number of working days from the current numbers of employment in order to make the rural peo-

ple of Manipur reliable on MGNREGS for their basic household expenditure. Participation of women under this scheme regarding Manipur state in financial year 2015-16 is also found lower comparing to the national average. Only 37.26 percent out of the total persondays generated in the year 2015-16 for Manipur were women while it is 55.25 percent as national average. Being a state with a higher sex ratio at rural area, the state must have a higher participation of women in the MGNREGS employment. It is also irony to learn that only 79.14 percent of the total available fund for the state under this scheme were utilised in the year 2015-16 while an average of 15.9 days only employment were allotted out of targeted 100 days. Above this, the work completion rate in the year 2015-16 is only 89.14 percent (even though it is higher than the national average 37.1 percent). It is very important to understand the reasons for the failure to achieve the targeted higher number of employment days and completes all the targeted works if the fund is available for utilisation. Problems like lack of awareness, irregular payment of wages, corruption, lack of transparency and accountability, shortage of effective grievance system etc. make the scheme completely unreliable for the rural households for their socio-economic development.

Transparency and honesty among the implementing officials, panchayat officials, and other stakeholders must be improved and cooperation among them is very necessary to make the scheme a boon for the rural poor, unemployed households. A poor state like Manipur is at the end necessity of a scheme like MGNREGS which possess the potential to eradicate poverty, unemployment and inequality.

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Skill Development Training Programme: A Case Study of IGNOU

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Abstract

There are two important education systems. One is distance education and the other is skill development training. Distance education is an important education system provides education to the adult learners where ever they want and when ever they want. This type of distance education reaches to the door steps of the learners of masses with learner kits. The skill development training is nothing but providing training in different skills required for employable for example carpenter training, motor mechanic skill training, electrical technician skill training, computer operator skill training, construction worker skill training, beautician skill training, hair cutting skill training, hospitality and clinical heath care skill training etc;. According to Jain (2013), skill development is seen as a means to empower the individual and improve his/her employability. This paper discusses about importance of skill development and its impact on Indian GDP growth rate. Now days all the states are establishing skill development centres/skill development institutes in their own state to enhance the capability of skilled man power. The central government is also emphasizing on skill development to train the youth in different employable skills. The central government is providing a budget for skill development through Skill India initiative. In this paper, the role of IGNOU in distance education and skill development training has been discussed. The skill development training programme as a case study on electrical technician programme run by one of its school (School of Engineering and Technology) has been analyzed in the paper.

Keywords: Skill, Training, Worker, Construction, Development, IGNOU

1. Introduction

Open and Distance Learning (ODL) mode is one of the oldest mode for providing education to the adult learners, employed learners, house wife etc. This method was first implemented in A.P. state and designed various graduation programmes like, B.A., B.Com., MBA etc; Main moto of these programme was to provide graduate education to the uneducated youth, working youth or house wife, who wants to improve their education qualification while working. In India, there exists various forms of distance education system. For example:

   (i)   Correspondence Education
   (ii)   Distance Education
   (iii) Continuing Education
   (iv) Life Long Learning
   (v)   Skill Development Education

2. Skill Development Education

The paper will discuss about Skill Development Education and its implications, impact on the GDP. Since 10 years the Government of India developing new policies for enhancing the capacity of skilled man power available in India. Earlier Govt. in 2010 initiated it as Skill India and created a separate wing under MHRD to make success of developing 3 Crore of skilled man power available in the country by 2022. But present Govt. plan is to develop 500 million skilled man power available in the country by 2022 under Skilling India project.

The ministry has established different skill development and knowledge centres across the country. Which are National Skill Development Corporation (NSDC), Skill Development Institutes (SDI), National Skill Development Authority (NSDA) etc; The govt. has released funds to various institutes and corporations

who are involving in Skill Development Mission and developing skill manpower in various disciplines such as;

    (i)   Computer skilled man power

    (ii)   Hospital services skilled man power

    (iii)   Hospitality services skilled manpower for Air Lines and Hotels.

    (iv)   Skilled man power in electrical section.

    (v)   Skilled man power in motor mechanics

    (vI)   Skilled man power in construction

    (vii) Skilled man power in painting

    (viii) Skilled man power in sensing

    (ix)   Skilled man power in security training

    (x)   Skilled man power in electronics and hardware

3. Literature Review on Skill Development in India

Indian govt. has taken great initiative of make in India to enhance the manufacturing capacity, as well as exporting Indian products for getting foreign money. It enhances the India GDP growth. When manufacturing Industries are coming up with fast phase, but there is need of skilled man power available according to the specific industries here the Institutes and universities plays vital role in giving training to the unemployed and uneducated youth in specific skills like, computers, electronics hardware, electricians, masons, plumber, painting mechanics, CNC Machining etc;.

According Uttar Pradesh Skill Development Mission (UPSDM) the state govt. is going to develop 45 lakh youth in skill development by 2016-17. The UPSDM is having keen interest in developing skilled man power in various skill development areas by collaborating with govt. and private institutes, who are providing skill training to the youth having age between 14 and 35. UP govt. is providing this skill training to the youth on free education initiative. UP govt. also planned to modernize the Industrial Training Institutes (ITI's) according to the industry requirements. The ITIs should provide various skill development courses to the youth as per industry requirement (TOI 28/11/15).

According to Prime Minister of India Narendra Modi, if we modernize all the ITI's in India and run all the skill development courses excellently, we may expect lakhs of youth will get employment in manufacturing and skill development areas. Indian Prime Minister Mr. Narendra Modi says that "If we have to promote the development of our country then our mission has to be Skill Development and Skilled India".

Job oriented skill training is more important for immediate placement after training. In China, about 9 crore youth are get-

ting skill developments training, but in India it is only 40 lakhs youth are getting training in skill development. So there is a need of skilled man power development in India according to the Industry requirements.

Skill Development training is becoming more important for growth of GDP of India. In recent past, UPSC of India is planning to set up a new cadre called as Skill Development Services (SDS) like IAS, IPS etc. The UGC of India also wrote letters to all the Universities and colleges to implement skill development courses in their existing curriculum or they may develop new skill development programmes according to the needs of the Industry. The Pradhan Mantri Kaushal Vikas Yojana (PMKVY), planning to develop 2.4 million skilled trained manpower youth in 2015-16.

Pradhan Mantri Kaushal Vikas Yojana (PMKVY) is an unique skill development initiative taken by the Government of India. Under this scheme, the trainees will be offered a financial reward and a government certification on successful completion of training and assessment, which will help them in securing a job for a better future (TOI, 17/12/15). Now a days skill development, skill training is gaining very importance because the central and state governments are fussing on improving skilled manpower to 1.5 crore by 2020.

In Delhi, the Delhi Urban shelter Improvement Board (DUSIB) providing shelter to homeless around 20000 people. The board is planning to focus on improving the quality of their lives by providing skill development courses and giving training on acquiring skills in various fields, so that they can earn them self by gaining skills. The DUSIB has asked the social welfare department to identify skill development courses for homeless people and train them accordingly (HT, 20 Dec. 2015).

In recent past, National Institute for the Mentally Handicapped (NIMH), Secunderabad, designed and developed various skill development courses specially for persons with mental retardation. The NIMH is offering various skill development courses to the persons with mental retardation at its main campus, Secunderabad and its Regional centers at Noida, Navi Mumbai and Kolkata (TOI 22/12/15). Telangana govt. has strong opinion on skill development programmes for educated unemployed youth. Telangana Govt. has set up an high civilized institution named as "Telengana Academy of Skill and Knowledge" (TASK)" centre in Hyderabad to train the educated youth in specific skills and knowledge such as computer software and hardware. The Telangana govt. is planning to set up its TASK cnetres in all the districts of Telangana and planning to train and develop around 1.5 lakhs skilled manpower by 2020.

4. Establishment of Skill Development Institutes (SDIs)

Announcing various projects is good, but there is a need of developing good strategies, best practices, identifying and establishing new centers. All the governments are failing in establishing and implementing the new projects. Here, I would like to explain you about the establishment of Skill Development Institutes (SDIs) for skilling India in various disciplines. The Skill Development Institutes (SDIs) should be established in IITs, NITs, and IIITs and well known State Government Engineering Colleges, by giving a special status and allocating special budget under skill mission project. These SDIs will work to identify different skills required for different projects continuously. The SDIs also plans to start all short term skill development programmes, which are useful for the different industries at various levels. Through these SDIs, we may develop skilled manpower available readily for the industry requirements. Through these each SDI, we will certify about 500 learners every year initially for 3 years continuously. The SDIs will strive to enhance this capacity in next consequent years.

(i) These SDIs will work towards achieving "Academic Excellence Award" for skilling India and under the "Make in India" project.

(ii) These SDIs will work for achieving "Awareness Creation Excellence Award" for "Make in India", "Smart Cities" and "Swatch Bharat" projects.

(iii) These SDIs will work for gaining "Skilled Manpower Development Award" for "Make in India" and "Smart Cities" projects.

In this way these SDIs will progress by developing need based skill development programmes to fulfill the needs of the Industry according the government plans. With this, I hope the need of the establishment of these SDIs is understood.

5. Skill Development Training Programme in Electrical Engineering

There is a high demand of the electricity in the country, either for agriculture, housing or industry. To develop sufficient power there is need of various resources available on hand for producing sufficient electricity. Mainly it is very important of trained man power available in specific field that is in power sector. It is also important that the trained man power should be available at various levels, starting from skilled electrician, skilled electrical supervisors and managerial skills in managing the power plant efficiently. The demand for power may increase in the coming

10 years due to more number of industries may come up under " Make in India" project announced by Prime Minister of India, Narendra Modi. The "Make in India" slogan is in the boom in various countries in recent past when our PM visited various countries. It is expected that more number of foreign investors, NRIs may invest in India for establishing manufacturing industries. Keeping all these in mind, we have planned to develop trained man power readily available in this power sector by launching various skill development programmes.

For *developing* required trained man power in the power sector at various levels such as:

(a) Skill development programme for level-1 (i.e; 8 pass outs)

(b) Skill development programme for level -2 (i.e; 10 and 12 Pass outs)

(c) Skill development programme for level-3 (i.e; Diploma holders)

6. Conduction of Conferences and Workshops on Skill Development

Under these SDIs, we can conduct various workshops, conferences, seminars for getting awareness and success in implementation of our PM's dream mission projects, "Skill India", "Make in India", "Smart Cities", "Swatch Bharat" etc;.

(i) By conducting workshops, conferences, seminars on "Skill India" project, we may bring awareness about challenges, strengths, advantages and opportunities for employment creation, skill development and economic development.

(ii) By conducting workshops, conferences, seminars on "Make in India" project, we may bring awareness about challenges, strengths, advantages and opportunities for employment creation and economic development.

(iii) By Conducting workshops, conferences, seminars on "Smart Cities" project, we may bring awareness about advantages, challenges in infrastructure development, strengths and opportunities for employee creation, skill development and economic growth of states and the India.

(iv) By conducting workshops and conferences on "Swatch Bharat" project, we may bring the people together to getting knowledge on "Swatch Bharat" and its impact on clean and green India. It also helps people to participate in "Swatch Bharat" project at home, at office and in different societies formed by them. "Swatch Bharat" project is a mission to make India clean and green by best practicing day to day work hobbies and culture with spending minimum resources and minimum cost. By implementing "Swatch Bharat" mission effectively all the people get their own satisfaction and achieve the great change in their work culture.

7. Case Study on "Competency Certificate in Power Distribution" at IGNOU

IGNOU has planned employment related technician training for 8th pass and ITI holders employed in Electrical Sector. In Engineering and Technology areas, the University has planned to develop employment related skill development programmes aiming at increased job potential and economic advantage for the learner. Towards this, the University has identified the manpower training needs of employment sector and has launched its 6 months skill development programme on "Competency Certificate in Power Distribution (CCPD)" for employed technicians. After successfully completion of the programme, the learner will get "*Competency Certificate in Power Distribution*". This programme is designed to provide specialized on the job training of electrical power distribution knowledge appropriate for upgrading the 8th pass manpower engaged in managing power distribution tasks.

In concrete terms, the University proposes to identify specific areas in skill development programmes in consultation with employing agencies at central and state levels including Governmental, Public and Private Sector organizations and Professional Bodies, so as to reflect in the curriculum design, the functional education and training needs of the targeted learner group at the workplace. Subsequently, the University visualizes that these industrial organizations and professional bodies and their professionals and experts will participate with the University in the tasks of preparation of instructional material for such functional curriculum as also in its implementation, thereby making the programme preparation and implementation endeavor a participative outcome between the University and Industry. The methodology of instruction in this University is different from that of the conventional universities. The Open University system is more learner-oriented, as the student is an active participant in the teaching and learning process. Most of the instruction is imparted through distance rather than face-to-face communication.

The university follows a multimedia approach for instruction. It comprises:

- *Written Study Material*: The written study material for both theory and practical components of the programme is supplied to the students in batches of blocks for every course booklet comprises 3 to 5 units.
- *Audio-Visual Material Aids*: The learning package contains audio and video cassettes which have been produced by the University for better clarification and enhancement of understanding of the course material given to the student. A video programme is normally of 25-30 minutes duration. The audio tapes are run and video cassettes are screened at the study centers during the hours of the counseling session.
- *Counseling Sessions:* Normally counseling sessions are held as per a schedule drawn before hand by the Coordinator. They are held on week-ends, that is to say, Saturday and Sunday of the week. There will be a minimum of 10 counseling sessions of 2 hours duration for each course (20 hours for each course on an average) of the programme devoted to theoretical aspects.
- *Teleconferencing and EDUSAT Lecturers*: Some of the lecturers will be telecast through teleconferences and some will be telecast through interactive EDUSAT lecture sessions.

The Study Centre will organize counseling sessions for all courses of study. Here, students can take help from the counselors in their study. The counselor will also organize sessions on audio-video programmes. The counseling sessions will be conducted on every Saturday and Sunday and also on government holidays. The laboratory practicals will be conducted at the study centres and as well as at specific study centres identified for this particular programme on Government holidays, Saturday and Sundays. After completing the counseling at study centres, they need to write the Term End Examinations at the IGNOU examinations centres available throughout in India during June and December every year. After passing the TEE the students will be issued a grade card, provisional certificate.

The enrolment status data of "Competency Certificate in Power Distribution (CCPD)" is Shown in Figure 1 as follows: These data are on the basis of the candidates sponsored for training by the activated programme study centres during the mentioned period.

8. Conclusion

Skills are very much important for performing any task or a machining operation. Those acquired specific skills for particular operation will be able to perform very well. The learners who are having the certificate on specific skill training will be able to get the job or he may startup his own enterprise and will become an entrepreneur. That is the reason the skill training got very high importance from central government as well as state governments. In the paper, role of IGNOU in distance education and skill development training has been discussed. A case study has been developed to describe the skill development training programme on electrical technician.
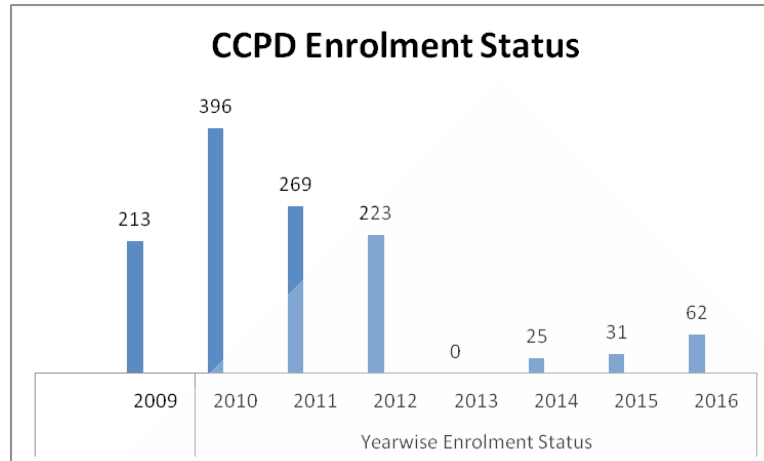
Figure 1. Year Wise Enrolment of Students in CCPD.

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A Study of MICE Tourism Dynamics in Auto Expo 2016

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Abstract

Business tourisms sector, which is also known as MICE – Meetings, Incentives, Conferences and Exhibitions Sector - is a high value, high visibility niche tourism sector. It is one of the fastest growing sectors of tourism industry. As per International Congress and Convention Association, International Convention Industry is estimated to be US $ 280 billion. India ranks 31st globally with a share of US $ 4.8 billion, and a potential to be among the top 20 destinations in the world for hosting international conventions, exhibitions and events. Auto Expo is Asia's largest automotive show. From providing a platform to the Indian automotive industry for showcasing its expertise to becoming a sourcing hub for the global automobile industry to launch itself in the Indian market, Auto Expo has evolved significantly since its inception in 1985. In view of the growth potential of business tourism sector and its impact on nation's economy, this research paper envisages to contribute to the understanding of MICE Tourism dynamics in Auto Expo with respect to the perceptions of four key players, viz., delegates visiting the event; exhibitors; venue management; and key organizers. The study profiles the delegates and measures their perceptions with respect to their purpose of visit, and satisfaction levels in respect of venue infrastructural facilities and variety of automobiles exhibited. The paper also studies the various categories of organizations exhibiting in Auto Expo; their purpose of participation; the degree to which their business outcomes have been met; and their satisfaction levels with respect to venue infrastructure. The paper also discusses the roles and perceptions of key organizers like ACMA, CII and SIAM in sponsoring the event. Finally, it also studies the strategies formulated by India Expo Mart (Venue) in marketing Auto Expo to major stakeholders, thereby providing a comprehensive understanding of MICE Tourism dynamics.

Keywords: Auto Expo, India, MICE Tourism, Tourism Marketing

1. Introduction

1.1 MICE Tourism

The meetings, incentives, conventions and exhibitions (MICE) sector emerges as one of the fastest growing components of tourism worldwide (Che - Chao Chiang, 2012). The Meetings Industry has come of age. It has firmly placed itself at the centre of tourism as one of the key drivers of the sector's development and an important generator of income, employment and investment. In addition to important business opportunities, the Meetings Industry provides immense benefits to the broader economy as it generates on average a higher spending level, reduces seasonality, contributes to the regeneration of destinations, spreads knowledge and enhances innovation and creativity (UNWTO, 2014). It is at the high quality, high yield end of the tourism spectrum, complementing the leisure tourism (Pantelescu, The business travellers' motivation and behaviour, 2011). Business travel generated INR1,085.1bn (16.5%) of direct Travel & Tourism GDP in 2014 and is expected to rise by 6.6% per annum to INR2,202.2bn in 2025 (WTTC, 2015). The Indian Convention Industry is currently at a nascent stage, contributing only a small proportion of the world conventions business (ICPB & IIM).

1.2 Business Expositions

Business expositions or trade shows are market events of a specific duration, held at intervals, at which a large number of companies present the main product range of one or more industry sectors and mainly sell it on the basis of samples (Kirchgeorg, Springer, & Ka¨stner, 2009). Trade shows are major industry marketing events (Gottlieb, Brown, & Drennan, 2011). For many years, involvement in trade shows has had a regular slot in companies' communication mix. It is of considerable interest because the stimulus it provides acts as a catalyst to economic productivity both on home markets and abroad (Kirchgeorg, Springer, & Ka¨stner, 2009). They grow the visitor base by attracting people who are primarily attending the event rather than having chosen that destination exclusively on the basis of its own merits (UNWTO, 2014). The objective of trade show organizers is to create highly effective shows that result in positive outcomes for both exhibitors and visitors, as a strong relationship between visitor perceptions' of trade-show effectiveness and post-show purchase intention appears to exist (Gottlieb, Brown, & Drennan, 2011). Despite their global popularity, comparatively little academic research has been done on trade shows (Gottlieb, Brown, & Drennan, 2011).

1.3 Auto Expo

The Auto Expo is jointly organized by Automotive Component Manufacturers Association of India (ACMA), Confederation of Indian Industry (CII) and Society of Indian Automobile Manufacturers (SIAM). . It is Asia's largest and the world's second-largest motor show, organized biennially in New Delhi, India (CII, Auto Expo 1986 - 2010 : Miles & Milestones, 2015). The Auto Expo was conceived in the year 1985, and the 13th edition of the event was organized between 5th to 9th February, 2016 at India Expo Mart, Greater Noida. The event has become a preferred launch platform for automobile manufacturers across the world. Delhi - NCR hosts the highest number of tradeshows and conventions in the country (ICPB & IIM). The main venues in the city to host Auto Expo are Pragati Maidan (part of India Trade Promotion Council) and India Expo Center, Noida. Auto Expo, like major trade shows also serves as an indicator for technological and social trends in the automobile industry. A total of sixty eight organizations participated in the 13th Auto Expo 2016 (http://autoexpo-themotorshow.in/, 2016). These include automobile manufacturers; components and accessories manufacturers, universities and other marketing companies. Previous studies show that marketing of trade shows has an impact on its sales and non-sales performance (Moriarty, Jones, Rowley, & Teahan, 2008). It is therefore important to study the dynamics of Auto Expo, with a focus on perceptions of participants. The findings of the study will give deeper insights in understanding the perceptions of delegates and exhibitors, which in turn will help in better organization of the event.

2. Objectives of the Study

The specific objectives of the research are to study the:

1. Behavioral aspects and perceptions of participating Exhibitors and Delegates visiting Auto Expo with respect to the facilities at the venue

2. Perceptions about outcomes of the exhibition

3. Research Methodology

3.1 Data Collection

The data for the present investigation was collected using both primary and secondary sources. The data with respect to MICE tourism dynamics of Auto Expo was collected through secondary sources like annual reports, past studies and relevant websites. The data with respect to behavioral aspects and perceptions of the respondents on various aspects of the study was collected through primary sources, using two set of structured questionnaires, personally administered to the respondents.

The first questionnaire was designed for delegates visiting Auto Expo. It sought information about certain behavioral aspects like the time they intend to spend at the event, their purpose of visit and intentions to purchase vehicles in near future. It also sought their perceptions towards infrastructural facilities available at the venue, and their level of with respect to the number and variety of automobiles exhibited. Finally, the delegates were asked to make suggestions for improvements in future.

The second questionnaire was designed for the business organizations exhibiting their products in the Auto Expo. It measures their perceptions with respect to the infrastructural facilities available at the venue and their level of satisfaction with respect to business outcomes and sought suggestions for improvement

3.2 Sample

The sample for collecting primary data for the study was selected using 'Convenience Sampling Method'. The researchers personally visited India Expo Mart, the venue for the Motoring Show of Auto Expo 2016 and collected the required information from the delegates visiting the event and corporate representatives of the organizations exhibiting in the event. In total, responses were collected from 103 delegates and 45 representatives of the exhibiting organizations.

3.3 Analysis

The data for the study was analyzed using summary statistics and non – parametric tests like Mann – Whitney U Test and Kruskal – Wallis Test of independent samples on Statistical Package for Social Sciences (SPSS) 21.

4. Sample Structure

4.1 Delegates

The 103 respondents to the first questionnaire i.e. the Delegates questionnaire were classified on the basis of gender, age – groups, nationality, occupation and annual income. The results show that 73.8% respondents were males and the remaining 26.2% were females. Further, about 72% respondents were up to the age group of 25 years, another 20.4% were between 25 and 35 years of age and 7.8% were above 35 years.

96.1% of the respondents were Indians and the remaining 3.9% were foreigners. Regarding occupation, a majority of 54.4% of the respondents were 'Students', followed by 24.3% of the respondents belonging to 'Self – employed & Business' category closely followed by 21.4% in the 'Service' category

A significant majority i.e., 76.7% of the respondents reported their annual income to be 'Up to Rs. 10 Lakhs' and 23.3% reported it to be 'More than Rs. 10 Lakhs'.

4.2 Exhibitors

A total of 45 responses were collected for the second questionnaire, of which 22.2% were from 'Four – Wheeler and Commercial Vehicles' organizations, 20% from 'Two – Wheeler' category, and a huge 46.7% belonging to the category 'Components, Accessories & Others' and the remaining 11.1% were of 'Universities' category which included educational institutions of higher learning.

A significant 64.4% of the companies had an annual turnover above Rs. 20 Crores, and the remaining 35.6% of the companies have reported their annual turnover to be below Rs. 20 Crores.

5. Results and Discussions

5.1 Behavioral Aspects - Delegates

The behavioral aspects of delegates visiting the event are studied from five broad perspectives, namely, 'The source through which they heard about the event'; 'The average time visitors intend to spend at the event venue'; 'The primary purpose of visiting', 'Have they attended Auto Expo in any previous years' and finally, 'Whether they intend to buy any vehicle in the near future'. Insights in to these perspectives is important for the organizers and exhibitors to better understand the delegates' behavior and

help them customize their offerings in the most optimal way. For example, Source of hearing about the event will help them target the most popular media to advertize and reach out to their target audience. The average time, a respondent spends in Auto Expo reflects the average disposable time visitors have in their discretion. This is important from two perspectives. Firstly, how organizers can plan the hall layout and how exhibitors can plan the display of most important products and services in order to maximize their business outcomes. Insights on future purchase intentions help the exhibitors to forecast the demand of their offerings and to gauge the interest shown by visitors in their products.

5.2 Source of Information

A careful analysis of these behavioral aspects show that the most popular media through which delegates hear about Auto Expo is 'Social Media'. A significant 35.9% delegates have reported having heard about the event on popular social media sites like Face Book, Twitter and LinkedIn. It is closely followed by 29.1% from 'Word of mouth' and 27.2% from 'Newspapers'. Traditional media like Television and FM Radio have scored low as only 7.8% and 9.7% respondents have reported having heard about the event on these media.

5.3 Intended Time Spend

In respect of the average time spend by delegates in Auto Expo, 37.9% of the respondents intend to spend between 2 hours to 4 hours at the venue, closely followed by 29.1% of the respondents who intend to spend 4 hours to 6 hours and 21.4% who intend to spend more than 6 hours. However, a significantly low, 11.7% of the respondents intend to spend less than 2 hours at the venue.

5.4 Purpose of Visit

The primary purpose of visiting Auto Expo by 48.5% respondents was reported to 'Witness new vehicle launches'. An equal, 10.7% respondents reported to have visited for reasons of 'Business' and 'Professional Networking'; and coincidentally an equal 21.4% respondents have reported to visit for 'Academic' reasons and 'Leisure'. This shows that how big a platform, Auto Expo is for exhibitors to launch their new vehicles and for delegates to professionally network with each other, apart from providing people a venue to rejuvenate and relax.

5.5 Frequency of Visit

Almost an equal, 49.5% respondents are repeat visitors and reported to have attended Auto Expo in the previous years. This reflects the dearth of opportunity that lies ahead of organizers and exhibitors to further strengthen their brand image and make

visitors enthusiastic to visit their stalls through a correct mix of promotion strategies through reportedly popular, social media.

5.6 Purchase Intentions

A promotion strategy for a brand may be considered effective, if it generates a purchase desire in its target audience. Hence, it's important to study the purchase intentions of visitors. A majority, 51.5% respondents have reported to have intentions of purchasing a vehicle in the near future. Of these respondents, 22.3% have reported to purchase a vehicle 'Within 6 months to 1 year'; 19.4%, 'Within 3 months to 6 months' and 9.7%, 'Within 3 months'. As already mentioned, this statistics help companies to forecast their sales.

5.7 Behavioral aspects - Exhibitors

The behavioral aspects of the organizations exhibiting in Auto Expo are studied from two broad perspectives, namely, 'Frequency of participation' and 'Primary purpose of participation'. The frequency of participant signifies how regular an organization is in exhibiting at Auto Expo. It gives an opportunity to the company to showcase its offerings and get an early customer response. Purpose reflects the rationale behind an organization exhibiting at Auto Expo. Insights on these two parameters are important from the point of view of both organizers and visitors. Organizers can customize their venue and price offerings to repeat participants and ensure that their business outcomes are better met. Visitors tend to have a positive brand image of organizations exhibiting innovative products every time.

5.8 Frequency of Participation

The results show that majority 51.1% organizations are regular participants and exhibit 'Every time'. 42.2% organizations have reported to have participated for the 'First time' in Auto Expo 2016, whereas, only 6.7% organizations have reported to be participating 'Sometimes'.

5.9 Primary Purpose of Participation

There are various purposes for which organizations participate in Auto Expo. The most common purpose, as reported by 48.9% exhibitors is 'New product launches'. This is closely followed by 'Company image promotion', as reported by 46.7% organizations. 'Establishing new business relationships' is close third with 37.8% responses. The other purposes as reported are 'Strengthening distribution networks' and 'Booking order for future sales' by 17.8% and 6.7% organizations

6. Delegates' Satisfaction in Respect of Infrastructural Facilities

Overall satisfaction with infrastructural facilities as perceived by the responding delegates has been reported in the Table 1. It may be observed that the median satisfaction score for each of the infrastructural facility, on a five point scale, has worked out to be 4 indicating above average satisfaction across all the respondents

Table 1. Age wise and Occupation wise differences in satisfaction

Factors	Average (Median Score)	Age-wise				Occupation-wise			
		Upto 25 Years	25 years to 35 Years	35 Years to 45 Years	Kruskal Wallis Sig Value	Service	Self-employed and Business	Students and Others	Kruskal Wallis Sig Value
Hall Layout	4.00	4.00	5.00	4.00	.056	5.00	4.00	4.00	.050
Transport Connectivity	4.00	4.00	4.00	3.50	.113	4.00	4.00	4.00	.337
Parking Facilities	4.00	4.00	5.00	3.00	.025	3.50	4.00	4.00	.397
Information Desk	4.00	4.00	4.00	3.50	.437	4.00	4.00	4.00	.898
Online Ticket Booking	4.00	4.00	5.00	4.50	.213	5.00	4.00	4.00	.252
Cleanliness	4.00	4.00	4.00	4.00	.396	4.00	4.00	4.00	.821
Entertainment	4.00	4.00	4.00	5.00	.541	5.00	4.00	5.00	.043
Food Court	4.00	3.00	4.00	3.00	.011	4.00	4.00	3.00	.087

6.1 Differences in Level of satisfaction

Differences in the perceived level of satisfaction of respondents categorized on the basis of age show that the median score of satisfaction for each of the factors for the three age groups ranged from 3.00 to 5.00. However, the value of the Kruskal Wallis test examining the significance of difference was found to be within acceptable limits at 5% level for all factors except two factors, namely 'Parking Facilities' and 'Food Court'. In other words, the null hypothesis for these factors is rejected indicating that the respondents belonging to '25 Years to 35 Years' age group perceived significantly higher level of satisfaction than the other two age groups. For all other factors, the null hypothesis indicating no difference is accepted.

Similarly, the differences in the perceived level of satisfaction, worked out on the basis of occupation, as depicted in Table 1, revealed that the median satisfaction score across these categories ranged from 3.00 to 5.00. Kruskal Wallis test values at 5% level of significance shows significant differences in two catego-

ries of factors, namely 'Hall Layout' for which respondents citing 'Service' as their occupation had significantly higher satisfaction level and 'Entertainment' for which 'Self employed and Business' category respondents had lower satisfaction For all the remaining factors the null hypothesis indicating n difference is accepted

The gender wise and level of income wise differences in the perceived satisfaction with infrastructural facilities have been reported in Table 2 as follows

As shown in the Table 2, the median satisfaction score of Males and Female respondent, for all factors except 'Online ticket booking' and 'Entertainment' worked out to be 4. However the score of Male respondents for the factor 'Online ticket booking was high at 4.5 as against 4 for the Female respondents. As against this, the median score of Males for the factor 'Entertainment' was lesser at 4 as compared to the score of Female respondents, at5. The Mann Whitney test examining the significance of differences shows that at 5 percent level, these differences were statistically insignificant. Thus the null hypothesis that there is no difference in the level of satisfaction on the basis of gender is accepted.

Table 2. Gender-wise and Income wise differences in satisfaction

Factors	Median	Gender-wise			Income-wise		
		Male	Female	Mann – Whitney U Test Sig Value	Up to Rs.10 Lakhs	More than Rs. 10 Lakhs	Mann – Whitney U Test Sig Value
Hall Layout	4.00	4.00	4.00	.493	4.00	4.00	.183
Transport Connectivity	4.00	4.00	4.00	.860	4.00	3.50	.157
Parking Facilities	4.00	4.00	4.00	.504	4.00	4.00	.826
Information Desk	4.00	4.00	4.00	.371	4.00	3.00	.007
Online Ticket Booking	4.00	4.50	4.00	.897	5.00	4.00	.052
Cleanliness	4.00	4.00	4.00	.952	4.00	4.00	.044
Entertainment	4.00	4.00	5.00	.132	5.00	4.00	.145
Food Court	4.00	4.00	4.00	.641	4.00	4.00	.990

Further, the median score of satisfaction of respondent categorized on the basis of level of income, as shown in the Table 2, ranges between3 and 5 for different factors. ,showing wide variations particularly with respect to the factors Transport, Information Desk, Entertainment and On Line Booking However , the Mann Whitney U test which was used to analyze the significance of differences in the values between the two income groups was found to be significant only with respect to the factor Information desk . This shows that the respondents in the income group of l0 Lakhs or less perceived significantly higher level of satisfaction with respect to this factor than those belonging to the group whose income was more than Rs 10 Lakhs.

7. Exhibitor's Satisfaction with Respect to Venue Infrastructure

Table 3 shows that the average satisfaction with respect to 'Wi-Fi availability' at the venue was below average. While, for factors 'Foreign exchange counters' and 'Panel of service providers', exhibitors were moderately satisfied. Exhibitors showed above average satisfaction for factors 'Transport connectivity', 'Parking facilities', 'Information Desk', 'Business centers & Meeting rooms', 'Storage & warehousing facilities', 'Security arrangements' and 'Media Rooms'. The maximum level of satisfaction was with respect to 'Layout of exhibition halls'.

Table 3. Exhibitor's satisfaction with venue infrastructure

Venue Infrastructure Factors	Average (Median Score)	Business Category					Company Turnover		
		Four-Wheelers & Commercial Vehicles	Two - Wheelers	Components, Accessories and Other Co.	Universities	Kruskal – Wallis Test Value	Upto Rs. 20 Crores	More than Rs. 20 Crores	Mann Whitney U Test Value
Layout of exhibition halls	5	5	4	5	5	.945	5	5	.762
Transport connectivity	4	3	4	4	5	.834	4.50	4	.719
Parking facilities	4	3.50	4	4	4	.702	4	4	.990
Information desk	4	4	5	3	4	.035	4	4	.768
Business centers & Meeting rooms	4	3.50	4	3	4	.489	4	3	.863
Storage & Warehousing	4	4	4	3	4	.325	3.50	4	.863
Foreign exchange counters	3	3	3	3	3	.612	3	3	.990
Panel of service providers	3	3.50	3	4	3	.862	4	3	.568
Central Wi-Fi	2	3	3	3	4	.180	3	2	.061
Security	4	4.50	5	4	4	.034	4	4	.218
Media rooms	4	3.50	5	3	4	.015	3	4	.583

While analyzing the significance of difference in satisfaction levels across the four business categories, the Kruskal – Wallis test scores at 5% level of significance show that satisfaction of 'Components, Accessories and other Companies' was significantly lower for the factors 'Information desk' and 'Media Rooms'; and the satisfaction level of 'Two – wheelers' was significantly high for the factor 'Security arrangements'.

In respect of differences in the level of satisfaction amongst responding exhibitors categorized on the basis of turnover of their firms, the Mann – Whitney scores, as given in Table 3 indicate that there is no significant difference in the satisfaction level.

8. Satisfaction with Business Outcomes

The perception of responding exhibitors regarding outcomes of the exhibition was taken on a five point scale from low to high. It may be observed from Table 4 that the overall median score

for the outcomes 'Trade enquiries generated', 'Business deals finalized' and 'Networking opportunities leveraged' worked out to be 4, while the same for the outcome 'Visitor's footfall', was maximum at 5 indicating above average to very high level of satisfaction with respect to the outcomes.

Analyzing the level of satisfaction with the four outcomes across the four Business categories of exhibitors, it may be observed from Table 4, that median scores for different outcomes ranged from 3 to 5. However, the value of the Kruskal – Wallis test was not found to be within the acceptable limits of 5 percent significance. This shows that there was no difference in the level of satisfaction from all the outcomes amongst all the four categories of respondents.

The results in Table 4, also indicate that level of satisfaction was above average for all business outcomes except 'Visitor's footfall', where it was maximum for exhibitors having annual turnover to be 'Up to Rs. 20 Crores' and 'Above Rs. 20 Crores'. Further, there was no significant difference found in their satisfaction, as indicated by the Mann – Whitney scores.

Table 4. Satisfaction with business outcomes

Business Outcomes	Average (Median Score)	Business Category				Company Turnover			
		Four-Wheelers & Commercial Vehicles	Two - Wheelers	Components, Accessories and Other Co.	Universities	Krusskal – Wallis Test Value	Upto Rs. 20 Crores	More than Rs. 20 Crores	Mann Whitney U Test Value
Trade enquiries generated	4	4	4	4	4	.309	4	4	.850
Business deals finalized	4	4	3	4	3	.539	4	3	.418
Networking opportunities leveraged	4	4	4	4	4	.996	4	4	.532
Visitors footfall	5	5	5	5	4	.275	5	5	.915

9. Satisfaction with Number and Variety of Automobiles Exhibited

In respect of number and variety of vehicles exhibited, the general level of satisfaction of responding delegates for both Indian and foreign automobiles were perceived to be above average. However, delegates were found to be relatively more satisfied with foreign automobiles than Indian Automobiles, as the median satisfaction scores were computed to be 5 and 4, respectively. Age-wise distribution of median satisfaction score for the Indian automobile manufacturers for the three age – groups of respondents was found to be 4, 4 and 4.5. While for the foreign automobile manufacturers, it was 5, 4 and 5. The value of Kruskal Wallis test analyzing significance of difference in the level of satisfaction was found to be significant for the Indian automobile manufacturers.

The two exhibits that attracted the attention of a large percent (40%) of the respondents were BMW and Audi. This was followed by Maruti Suzuki (20%), Ford (20%) and Honda (19%). Other exhibits which attracted the attention of visitors include Mahindra & Mahindra, Jaguar Land Rover and Toyota.

Of the automobile models exhibited, the most attractive model, as per the views of about one – third of the respondents was BMW i8.this was closely followed by Ford Mustang (22%) and Audi R8 (20%). Some of the other models found attractive by responding delegates were 'Honda Navi' and 'Mahindra Thar'.

10. Suggestions for Improvement

Though the general level of satisfaction with the arrangements and organization of Auto Expo was found to be above average, several suggestions were made by the delegates and exhibitors for improvements in the future. Some of the important suggestions were to make good quality food available to the visitors at reasonable rates. A large number of delegates suggested that greater number of new cars to be displayed with relatively more price related information. It was suggested by many delegates that the venue for the Motor – show should be shifted back to Pragati Maidan, as it is centrally located and comparatively convenient to reach than India Expo Mart. 'Arrangements for smoking rooms', 'Upgraded mechanism to control crowd at the venue' and 'Improvements in drinking water facilities' were among other important suggestions reported. Wi-Fi facility was reported to be an important aspect of the infrastructure. Both exhibitors and delegates suggested better Wi-Fi connectivity at the venue. Another important area of improvement suggested by the responding participants was in transport connectivity to the venue.

11. Conclusion

The study examined behavioral aspects and perceptions of exhibitors and delegates visiting Auto Expo 2016, with a view to know their satisfaction.

It was observed that 'Social media' and 'Word of mouth' were the most important sources of disseminating information about Auto Expo. Most of the delegates intended to spend up to six hours in the exhibition and reported their purpose of visit was to witness new vehicle launches. About half the responding delegates were repeat visitors with an intention of purchasing a new vehicle within six months to one year.

The primary purpose of exhibitors to participate in the event was to showcase their offerings and to solicit an early customer response. About half of the exhibitors were regular participants in the Auto Expo, while another two – fifths participating for the first time.

Overall satisfaction of the responding delegates with different infrastructural facilities was found to be above average. However, significant differences in satisfaction were found in the delegates categorized on the basis of age groups, income level and occupation.

All exhibitors had above average to high level of satisfaction with respect to business outcomes of the event, with significant differences reported in satisfaction in venue infrastructure by exhibitors belonging to different business categories.

The exhibits that attracted the attention of delegates the most were BMW and Audi, with BMW i8, Audi R8 and Ford Mustang being the most sought after models.

Some of the important suggestions for improvement made by the participants were in respect of making quality food available at reasonable prices, more information to be made available for vehicles displayed and providing better Wi-Fi connectivity at the venue.

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Sustainability and Resilience: Shelter in Emergencies

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Abstract

Millions of shelters are lost every year due to disasters. During shelter construction and recovery interventions, a number of factors should be considered during planning and designing to ensure sustainability and resilience. This paper makes recommendations for safe and sustainable shelter recovery programming.

Keywords: Resilient Shelters, Sustainable Shelter, Sustainable Infrastructure, Shelter in Emergencies

1. Introduction

There has been an increase in frequency and magnitude of disasters across the world. Studies on linkage between disasters and development indicate that disasters can both destroy the development gains as well as throw open opportunities for development (Stephenson & DuFrane 2016)[8]. One of the worst impact of disasters is damage to shelter and therefore there mass construction of shelters by humanitarian actors, government as well as communities themselves. It is important that construction in disaster prone areas whether new or reconstruction should take into account the safety security and gender aspects for sustainability.

2. Sustainability and Resilience

Sustainability is the ability of being endured (Merrium-Webster 2016). It is the ability of systems and processes to maintain or defend. USAID defines resilience as the ability of people, households, communities, countries, and systems to mitigate, adapt to, and recover from shocks and stresses in a manner that reduces chronic vulnerability and facilitated inclusive growth (USAID 2011). In view of these definitions, it is important to understand what are the key elements of a sustainable and resilient shelter. Through extensive literature review, the following elements have emerged as the determining factors for sustainability and resilience of shelters:

1- Program Design
2- Technical design
3- Material
4- Safety and security (including safe failure)
5- Habitability and relevance
6- Flexibility and diversity
7- Significance and long term impact of shelter projects

3. Program Design

This is a critical stage. The planning for shelter needs to be based on a detailed shelter assessment with participation from community members and potential owners. Design options should be shared with details of pros and cons. The skill and cost required for maintenance and repair are also key factors that need to be shared with the future owners.

4. Technical Design of Shelter

In a sustainability assessment of shelters to identify the best strategy for post disaster construction in terms of using local material versus global materials, it was found that there was no direct association between construction material and sustainability of shelters. The key factor contributing to strength and sustainability of shelter solutions was the use of appropriate design(Escamilla et al. 2014)4. One of the major cause of loss of lives during disasters is poor shelter design and the benefits of

a good resilient shelter design go beyond economic and social benefits(ISET-International 2013)6.

5. Material Options for Mass Housing

Mass housing is a critical part of urbanization. It is important to understand the benefits and limitations of the various available options. Temporary shelters of relief shelters are meant to meet the immediate needs of people displaced due to disasters. One of the issues in community shelters is the need for privacy. During the third NOAH workshop, a group of participants were motivated to develop solutions for partitions using vegetable fibres and a number of designs were created using banana straw (Barbosa 2014)2

Monolithic concrete construction systems using plastic or aluminum frameworks help in rapid construction of similar units with minimal involvement of labor and equipment. For economic reasons, it is most suitable for large projects with more than 500 houses. It also requires high capital cost for initiation. Another technology involves use of Polystyrene core panel system. Self extinguishing expanded polystyrene sheet is sandwiched between sheets of welded wire fabric mesh. These panels finished on site are made of different types like single panel for structural uses, internal partition and walls. Double panels are also used. The panel system has high load carrying capacity, and good acoustic behavior. It also provides energy efficiency as well as fire resistivity (BMTPC 2014)3.

Air Shelter House technology uses panels made of Thermal Reflective Multilayer System (TRMS) and is useful for making a shelter or emergency tent. It can also be used for creating external or internal thermal skins. The advantage of this technology is that it enables fast assembly of a healthy private that respects human dignity by non skilled workers (Imperadori et al. 2014)5.

6. Safety and Security of Shelters

A shelter is much more than a structure. It is a place where a person feels safe and secure. It is very important that shelter construction projects whether post disaster recovery projects or a peace time housing for all initiative, should consider the risks of various shocks and build the house for resilience. It should also provide a sense of privacy to the people living inside the shelter. As much as possible, the structural risks should be minimized through appropriate design and material (Sphere Project). Shelter projects very often focus only on the structural safety aspect, but other needs like the need for appropriate spaces for adolescent boys and girls are left un-attended.

7. Habitability and Relevance

According to a study by CARE India, ensuring adequate access to safe water must be considered in all shelter programs. Several shelter projects involving relocation still report no occupancy because no thought was given to other necessary services and facilities. Some of the negative impacts of poor shelter planning include deprivation of the communities from facilities like health, disruption of access to markets directly hitting the income of households and lack of access to clean drinking water nearby. Habitability also depends on availability of land, cost of basic services, law and order and environmental vulnerability. The rapid urbanization in Dhaka has negatively impacted habitability due to high demand for infrastructure and public services with increasing population density (Ahmed 2014)1

8. Flexibility and Diversity

The shelters constructed should be built with strong foundation and basic structure to provide for possible vertical or horizontal expansions in future. The designs should be customized considering the different cultural and social contexts and needs.

9. Discussion and Conclusion

A participatory approach should be the basis of all shelter programming. Community members, technical experts, government officials should together look at all aspects of shelter to propose the most appropriate solution.

Following recommendations were made by a study conducted by CARE India Solutions for Sustainable Development on Post Disaster Shelter in India (CARE 2016)7:

a. Governance should be integrated into all shelter projects as a part of community engagement and participation to promote ownership.

b. Shelter projects should be seen as a complete ecosystem. Adequate safe water supply should be ensured.

c. Livelihoods support in combination of shelter programming e.g. providing cash for work post disaster supports the communities in recovering soon. If the livelihood opportunities are very far from shelter sites, it is likely that the people will either sell off their houses or will go deeper into poverty.

d. Housing, land and property rights of women and girls must be strongly addressed in shelter programs.

Following a disaster, a comprehensive assessment of shelter needs segregated by sex, age and disability should be carried out and the plan should be informed by the findings of such assessments.

Once disaggregated needs have been assessed a range of shelter solutions should be offered to address varying needs. Reconstruction of shelters should consider future risks and efforts should be made to build back safer.

Shelter planning should also consider the carbon footprint of getting construction materials from different locations. Appropriate building materials should be identified.

A plan for capacity building of communities as well as local masons on disaster resilient construction as well as on techniques for repair and maintenance should also be developed. If possible a maintenance manual should also be developed, explained and handed over to the owners of shelters.

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Review on Creativity Techniques for Product Development

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Abstract

Today, the market became competitive. Each and every day we need to provide something new that helps to link the consumer to gain their focus and lead to success and profit. The concept of providing something new which is useful can be termed as "Creative Product Development". The individual's perception for creative development of product may differ. The selection of creativity technique depends on the type of product. This paper contains the review of various few selected creativity techniques that can be applied to solve the problems and challenges faced during the product development stage where the multiple dimensions are taken in to consideration.

Keywords: Creative Problem Solving, Conceptual Design, Creativity Techniques, Innovation, Product Development

1. Introduction

In a previous era design of new product was an isolated activity, but in a modern industrial company the design of a new product is not an isolated activity. Product design is embedded in a larger process, which is called = product development'. Product development includes the development of a new product integrated with the plans for its production, distribution and sales. Product development is primary part of the product innovation process (*Refer Fig.1*). Product innovation encompasses all activities that finally lead to acceptance of a new product in a market[5].

The first part of the innovation process is called =product planning'. In this phase it is decided what product(s) will be developed and when. Product planning has two parts:
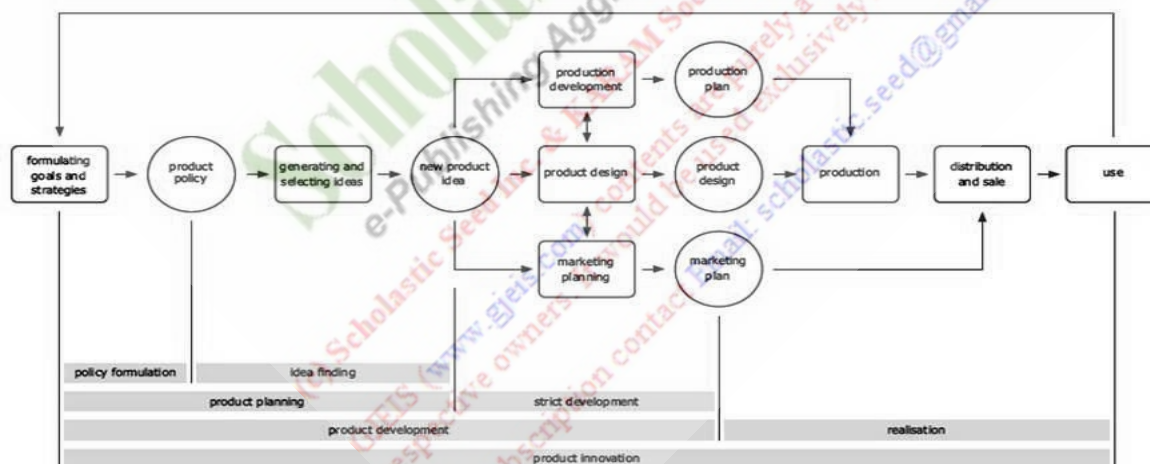

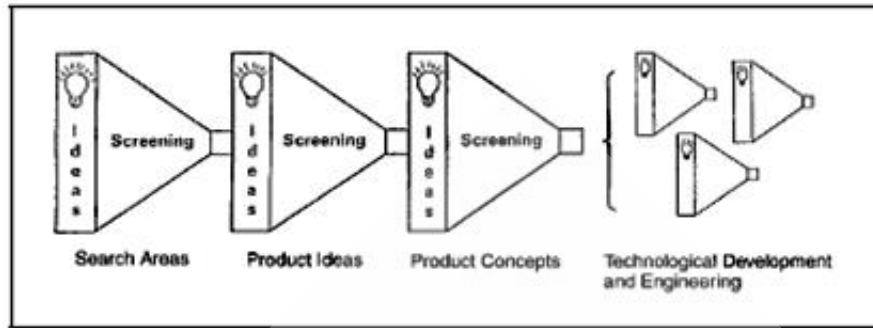Figure 1. The Phases of the Product Innovation Process.

Figure 2. Creative Inputs in the Product Innovation Process.

=Policy formulation' and = Idea finding'

When the process of product design starts, multiple problems that require creative solutions are triggered. These problems comprises of recognizing customer needs, generating innovative ideas for new product and its applications, development of concepts, altering various manufacturing processes, finding solutions for technical problems and developing new launching concepts[2]. Main objectives of a creative thinking process is to think beyond limitations, to build interest, to drop normal, conventional ideas and procedures, to rely on the imagination, and to consider multiple solutions and alternatives generated through the divergent and random selections[1]. In this way each problem ends with number of solutions. Through number of solutions achieved by creative inputs, one can be selected through screening and evaluation during product innovation process (*Refer Fig.2*). Each solution can be further checked technically as well, by experience or by applying creativity techniques systematically.

New product ideas are developed through the brilliant ideas generated by the efforts of highly creative individual. Although this method of new product ideas development is successful still an organization can not depend on a few highly creative individuals because of following reasons:

Within an organization only few people, approximately 10% of total, can be labeled as=highly creative'.

Because of limited resource, the productions of useful ideas are also limited.

2. Basics of Creativity and Innovation

The knowledge and experience are set in a fixed lines and paths in a human brain. The human brain follows these structured paths in a normal logical mode. Due to this conventional mode of thinking, original ideas or novel solutions to a given problem cannot be generated. When people leave these structured paths and start to merge their previous knowledge and experience that have no obvious relationship results into creative thinking.

Creative thinking can be stimulated by Heuristic Principles (i.e., searching, investigative or examining) such as association, generalization, integration, separation, deviation, and transfer of structures between problems which are not interconnected. Creativity techniques are based on these specific heuristic principles, which are integrated into the rules of the techniques and must be properly applied[2].

2.1 Creativity

Creativity is the process of generating something new that has value. There are many original ideas and concepts, but many of them are may not have value and hence may not be considered creative. Hence, creativity is a learned skill that enables us to define new relationships between concepts or events, which seemed actually isolated before, and which results in a new entity of knowledge.
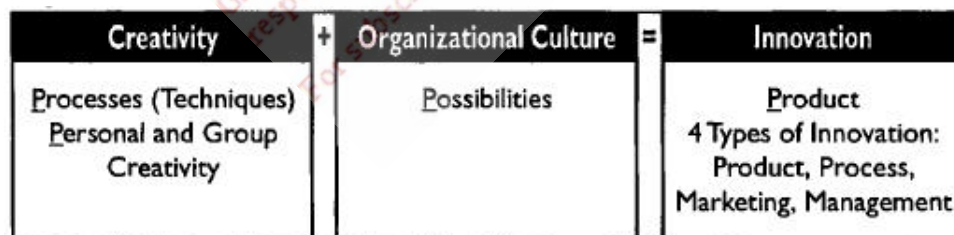

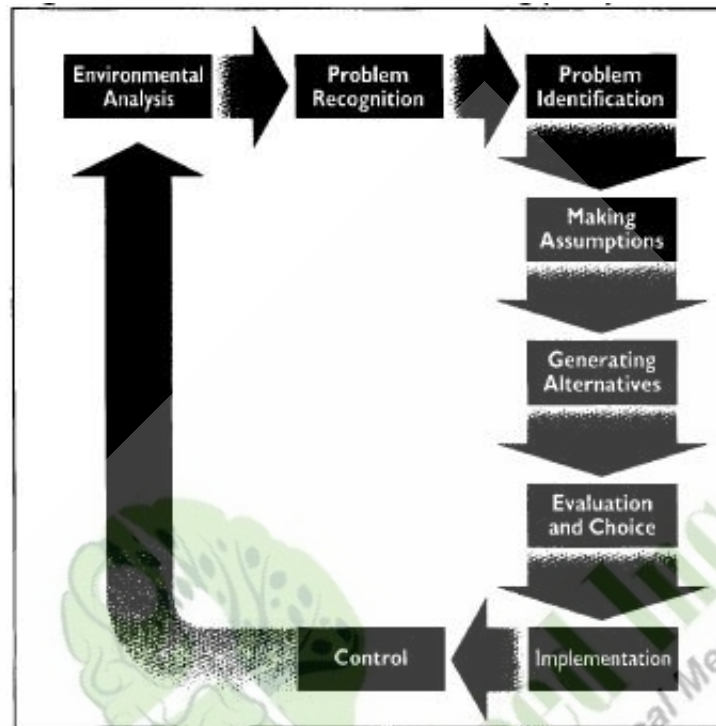Figure 3. Relation of Four P's.

Figure 4.   Creative Problem Solving (CPS) Processes.

There are two ways to increase the creativity, either by learning techniques/ processes or by increasing personal and group creativity. If these techniques are followed with the right possibilities and in appropriate culture than it results into innovation.

The levels of creativity and innovation can be raised by understanding of four P's:

- Product
- Possibilities
- Processes/ Techniques
- Personal & Group Creativity

The first P- Product is achieved only after achieving the remaining 3 P's (*Refer Fig.3*). The product is the result of the creation/innovation process. Creative product doesn't mean only originality, but it should have value. The possibilities for creativity and innovation must exist for innovation. To increase the creativity of problem solving, several techniques can be used within an organization, which requires time as well as efforts to learn. These processes are aimed to increase creativity in all stages of the problem-solving process. Personal creativity can be increased by following bilateral efforts[3]:

- Increasing the use of the right brain (if right handed) or vice versa
- Raise Level of perceptions and cross the restricted boundaries (freeing from socialization)

2.2 Innovation and its Types

The process of change in organizations and its market contribution to win customers through the development of sustainable competitive advantage is termed as—Innovation|[4]. There are four principal types of innovation:

1. Product Innovation: It results in new products/ services, or increasing the quality of existing products/ services.

2. Process Innovation: It results in enhanced processes (operations, finance etc.) within the organization to improve effectiveness and efficiency.

3. Marketing Innovation: It is related to the marketing functions of promotion, cost and distribution, product functions like packaging or advertising.

4. Management Innovation: It improves the way of management within the organization.

3. Creative Problem-Solving (CPS) Process

Fundamental part of organizational life is problem solving. Every time problems are raised when a person starts to produce a product/ service and decisions are made to solve these problems. Some member of an organization thinks of a new way every time to reduce costs invents a new product/ service to improve the

function of an organization. To achieve this, problem solving is taking place, but it's not creative always. Following are the basic eight stages in the creative problem solving process (*Refer Fig.4*)[3]:

* Analyzing the environment
* Recognizing a problem
* Identifying the problem
* Making assumptions
* Generating alternatives
* Choosing among alternatives
* Implementing the chosen solution
* Control

Some expected results of the creativity process are:

* New product and process ideas innovation
* Continuous improvement of products or services
* Increase in productivity
* Increase efficiency
* Rapidity and flexibility
* Improved quality of products or services
* High performance

4. Creativity Techniques

Once the problem is analyzed, the conceptual design (creative act of finding new ideas and concept) phase begins. Product ideas and concepts have to be generated after formulation of design problem, product vision and listing of product requirements. An Idea is a first thought that comes to mind, in form of simple drawing usually, without any properties, shape, specification, materials etc. whereas concepts are more developed, have all the details and technical solution principles.

The process of developing initial ideas into concepts and offering realistic solutions to the design problem through creative thinking is termed as —Conceptual Design|. It is a divergent and convergent process in which ideas are generated, sorted, tested, evaluated and developed into concepts (*Refer Fig. 5*).

Ideas are generated through creative techniques. The techniques which encourage creative action and gives solutions to problems are called 'creativity techniques'. Creativity techniques are very useful in the design process as it gives huge quantity of ideas within a short period of time. Most of these techniques are general and valid to wide variety of problems. Creativity techniques are classified as follows:

1. Inventorying Techniques: All kind of information around an issue in terms of ideas or data etc are collected and recalled using these techniques.

2. Associative Techniques: Huge amount of ideas and options are generated through association within short period of time as it encourages spontaneous reactions to ideas expressed earlier.

3. Confrontational Techniques: Ideas are generated thinking outside the references and boundaries. This leads to completely new, unexpected viewpoints which bring the solution of a problem.

4. Provocative Techniques: Assumptions and preconceptions are identified and broken within the references and boundaries. Ideas will appear strange at first, but when forcefully fitted within the set boundaries it gives new ideas. It contains the principle of making the strange familiar and the familiar strange.

5. Intuitive Techniques: Formation of a new perspective on the original issue can be done using these techniques. It has great influence on motivation and enthusiasm of the team members.

6. Analytic-Systematic Techniques: It is based on the analysis and systematic description of a problem, sub problems, and the systematic varying and combining of these solution variants.
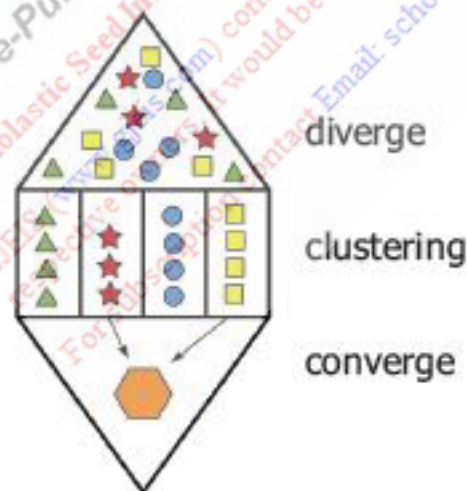

Figure 5.   Creative Diamond.

There are approximately 189 creativity techniques (Refer Annexure I) under the above various categories. But the major question arises is when and how to process with these techniques in an organization for finding the solution for the raised problem. The following few techniques are explained further.

- Assumption Busting
- Brainstorming
- Browsing
- Creative Problem Solving
- Dimensional Analysis
- Flow charts
- Gap analysis
- Laddering

- Listing
- Simplex
- Six Thinking Hats
- SWOT Analysis
- Trigger Method
- Using Experts
- Value Engineering
- Visualizing a Goal

4.1 Assumption Busting

- List all the obvious assumptions which is not much challenging.
- Examine each assumption by asking under what conditions it would not be true.
- Start to make assumptions as you challenge some assumptions
- Add these to the list, and challenge them later.
- Force the assumption to be true through finding several ways.

4.2 Brainstorming

- The basis of Brainstorming (Introduced by Alex Osborn) is to increase the volume of possible ideas by sharing a problem across 5-10 members to obtain a wider array of different ideas within short time.
- With a group of people brainstorming is a powerful technique as it helps to create new ideas for solving problems through motivation of team members.
- Brainstorming is not a random activity but it needs to be structured and must require to follow brainstorming rules.
- Prepare a group
- Present the problem
- Guide the discussion

5. Browsing

The browsing technique is normally used to find the creative literature which can be further utilized for product development.

Basically following are the three types of browsing:

o Purposive browsing: Seeking a defined piece of information intentionally.

o Capricious browsing: Observing material randomly without a definite goal.

o Exploratory browsing: Looking for creativeness significantly.

5.1 Creative Problem Solving (CPS)

- It is a thoughtful or measurable creativity technique.
- CPS is the well-structured process of finding creative solutions beyond the conventional thinking for a problem raised in an organization.
- Following are the stages of CPS suggested by Van Gundy (1988's)
o Mess Finding
o Data Finding
o Problem Finding
o Idea Finding
o Solution Finding
o Acceptance Finding

5.2 Dimensional Analysis

The process of exploring the problem or evaluating options through checklist that relates to Five Ws and H.

- The technique is associated more with human relations rather than a technical nature.
- Following checklist are the types of dimensions for this technique:
- Substantive Dimension (=What?')
- Spatial Dimension (=Where?')
- Temporal (=When?')
- Quantitative (=How much?')
- Qualitative (=How serious?')

6. Flow Charts

- A flowchart is a type of diagram that represents an algorithm, workflow or process, set of rules, methodology and their order by connecting them with arrows.
- This diagrammatic representation explains a solution model to a given problem.
- During decision phase, action planning where chains of events are likely to change dynamically, the flow diagrams is required.

6.1 Gap Analysis

- It is a systematic analysis throughout the whole area of a given technology for remained or generated =gaps'.
- It is used to highlight insufficient areas in existing technology that are open for creative inputs and improvements.
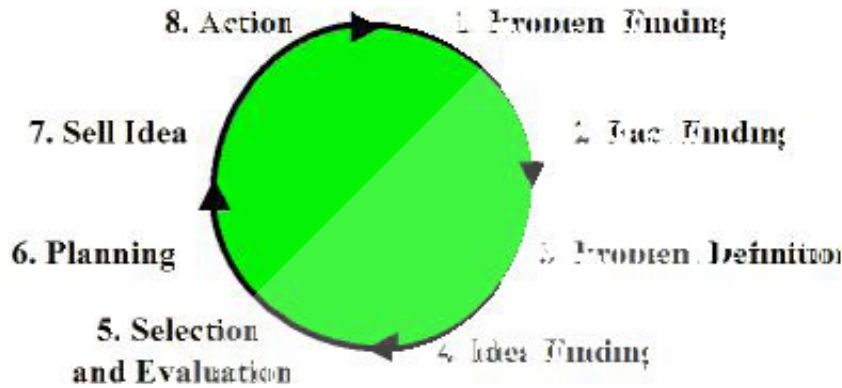
• 4

Figure 6. Simplex Process.

6.2 Laddering

Laddering is the technique to create ideas by switching to and fro between different levels of abstraction.

Following are the sequential steps to apply this technique:

o Define the existing ideas
o Ladder UP
o Ladder Down again
o Ladder UP again
o Ask Why? Or So What?

o Construct-triad method

6.3 Listing

• Listing is a derivative of the attribute listing technique.
• Writers use this simplest strategy to generate ideas initially.
• During this phase the ideas and experiences are listed within a described time limit.
• Then write down as many ideas as you can without stopping to analyze any of them

Table 1. 1 Six Thinking Hats

	White Hat thinking This covers facts, figures, information needs and gaps.
	Red Hat thinking This covers intuition, feelings and emotions.
	Black Hat thinking This is the hat of judgment and caution. It is a most valuable hat.
	Yellow Hat thinking This is the logical positive. Why something will work & offer benefits.
	Green Hat thinking This is the hat of creativity, alternatives, proposals, interesting & changes.
	Blue Hat thinking This is the overview or process control hat.

6.4 Simplex

- The industrial-strength creativity tool which takes the DO IT method to next level of sophistication.
- Simplex is a continuous cycle (*Refer Fig. 6*) rather than a straight line process.

Figure 6. Simplex Process.

6.5 Six Thinking Hats

- There are six metaphorical hats.
- The thinker can put on or take off, which is essential, one of these hats to indicate the type of thinking being used.
- When done in group, everybody wear the same hat at the same time.

6.6 SWOT Analysis

- Technique used to find the Strength and Weakness (Internal Factors) of an individual and to study various Opportunities and Threats (External Factors) attached along with individual/ activity.

o Strengths: Check Advantages – Be Realistic – List Characteristics.

o Weaknesses: Check Limitations – Be Realistic – List Unpleasant.

o Opportunities: Look For Interesting Trends, Available Useful Opportunities.

- Changes in the market, Social Patterns, Lifestyle changes, new technologies, Government Policies etc.
- Alterations in government policies.

o Threats: Think For Obstacles, Competitors, and Changes in Technology, bad debt or cash-flow problems.

6.7 Trigger Method

- It is an analysis based on repetition. One idea triggers another and another and so on. The process is repeated unless and until possible thoughts are generated.
- Problem is defined, debated and ideas noted
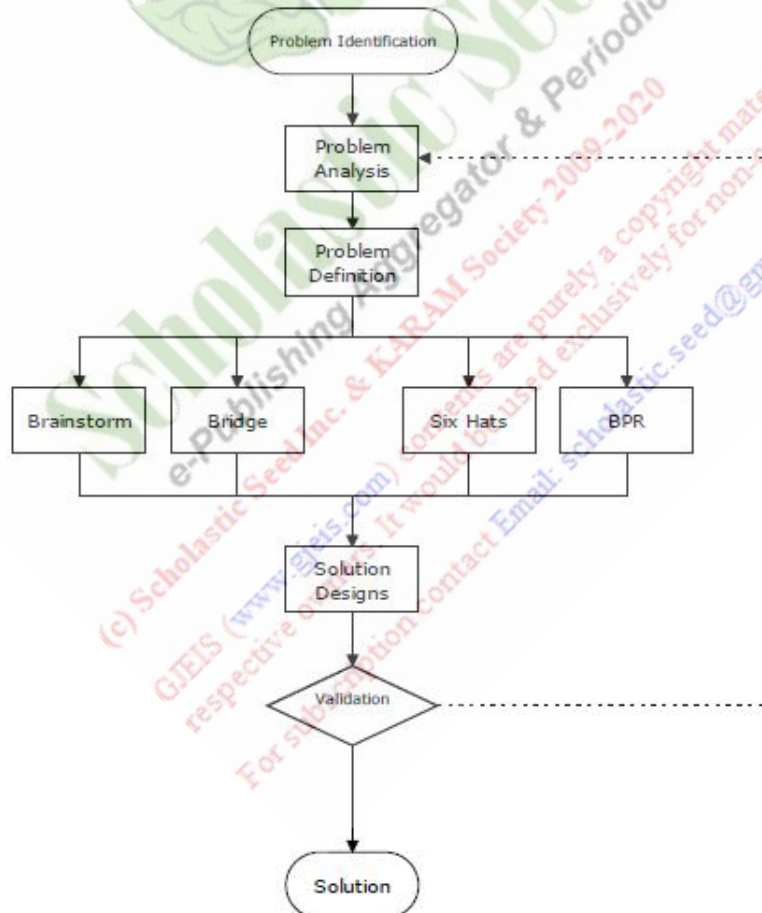- A selection of these ideas are collected

Figure 7.   Creative Thinking Generic Process Model.

- Then few are randomly gets selected and displayed which are used as=triggers' to generate more ideas

6.8 Using Experts

- When the project / activity / product will reach in its final stage at that time various parameters which are crucial are discussed or solved by taking opinions from the experts.
- This includes factors like cost, technical feasibility, and technical development etc.
- The process is carried out by expert to expert questionnaire or by expert survey method.

6.9 Value Engineering

- The technique by use of which, the usefulness of a product will be maximized via the most cost effective means:
o Identify its Basic Function - Secondary Function - Supporting Functions
   o Cost-Effectiveness
   o Ideas to improve each Function Systematically

6.10 Visualizing A Goal

- Set your goal by settling on the aim – Collect Details – Think Positive – Work Regularly – Pursue the goal, until it is achieved – once the goal attained, move onto the next goal.

7. Conclusion

Creativity is the process of diverging, sorting and then converging to the definite ideas. Further the creative techniques are used to solve the problem raised during the process of product development. The various types of techniques are reviewed and mostly used techniques are summarized together. These techniques may be followed in a random sequence without any comparison as per the requirements for development of the product.

Development of product receives a lot of interest within industry. Their business success depends on their capability to continuously develop products using creative and innovative product development in terms of many parameters of product like aesthetics, ergonomics and its functionality. Creativity is a complex human phenomenon that is widely believed to be difficult to analyze and inaccessible to precise measurement. The product value entirely depends on the aspect of creativity. More the creative product more will be its value in market. The techniques which are listed above are further used to develop a prototype in future.

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Annexure I

7 Step Model	Circle Time	False Faces	Laddering	Problem Inventory Analysis - PIA	Sticking Dots
Adaptive Reasoning	Clarification	Fishbone Diagram	Lateral Thinking	Problem Reversal	Stimulus Analysis
AIDA	Classic Brainstorming	Five Ws and H	Listing	Productive Thinking Model	Story Writing
Algorithm of Inventive Problem Solving	Cognitive Acceleration	Flow charts	Listing Pros and Cons	Progressive Hurdles	Strategic Assumption Testing
Alternative Scenarios	Collective Notebook	Focus Groups	Metaplan Information Market	Progressive Revelation	Strategic Choice Approach
Analogies	Comparison tables	Focusing	Mind Mapping	Provocation	Strategic Management Process
Anonymous Voting	Component Detailing	Force-Field Analysis	Morphological Analysis	Q-Sort	Successive Element Integration
ARIZ	Concept Fan	Force-Fit Game	Morphological Forced Connections	Quality Circles	Super Group
Assumption Busting	Consensus Mapping	Free Association	Multiple Redefinition	Random Stimuli	Super Heroes
Assumption Surfacing	Constrained Brain Writing	Fresh eye	NAF	Rawlinson Brainstorming	SWOT Analysis
Attribute Listing	Contradiction Analysis	Gallery method	Negative Brainstorming	Receptivity to Ideas	Synectics
Backwards Forwards Planning	Controlling Imagery	Gap Analysis	NLP	Reciprocal Model	Systematic Inventive Thinking
Body storming	Crawford Slip Writing	Goal Orientation	Nominal Group Technique	Reframing Values	Talking Pictures
Boundary Examination	Creative Problem Solving	Greetings Cards	Nominal-Interacting Technique	Relational Words	Technology Monitoring
Boundary Relaxation	Criteria for idea-finding potential	Help-Hinder	Notebook	Relaxation	Think Tank
Brain Sketching	Critical Path Diagrams	Heuristic Ideation Technique	Observer and Merged Viewpoints	Reversals	Thinkx
Brainstorming	Decision seminar	Hexagon Modelling	Osborn's Checklist	Role Storming	Thril
Brain writing	Delphi	Highlighting	Other Peoples Definitions	SCAMMPERR	TILMAG
Browsing	Dialectical Approaches	Idea Advocate	Other Peoples Viewpoints	SCAMPER	Transactional Planning
Brute think	Dimensional Analysis	Idea Box	Paired Comparison	Sculptures	Trigger Method

Bug Listing	Disney Creativity Strategy	Ideal Final Result	Panel Consensus	SDI	Trigger Sessions
Bullet Proofing	DO IT	Imagery for Answering Questions	Paraphrasing Key Words	Search Conference	TRIZ
Bunches of Bananas	Do Nothing	Imagery Manipulation	PDCA	Sequential-Attributes Matrix	Tug of War
Card Story Boards	Drawing	Imaginary Brainstorming	Personal Balance Sheet	Similarities and Differences	Unified Structured Inventive Thinking
Cartoon Story Board	Escape Thinking	Implementation Checklists	Pictures as Idea Triggers	Simple Rating Methods	Using Crazy Ideas
CATWOE	Essay Writing	Improved Nominal Group Technique	Pin Cards	Simplex	Using Experts
Causal Mapping	Estimate-Discuss-Estimate	Interpretive structural Modeling	PIPS	Six Thinking Hats	Value Brainstorming
Charrette	Exaggeration	Ishikawa Diagram	Plusses Potentials and Concerns	Slice and Dice	Value Engineering
Cherry Split	Excursions	Keeping a Dream Diary	PMI	Snowball Technique	Visual Brainstorming
Chunking	F-R-E-E-Writing	Kepner and Tregoe method	Potential Problem Analysis	SODA	Visualizing a Goal
Circle of Opportunity	Factors in selling ideas	KJ-Method	Preliminary Questions	Soft Systems Method	Who Are You
			Problem Centred Leadership	Stakeholder Analysis	Working with Dreams and Images

A Genetic Algorithm based Approach in Predicting and Optimizing Sickle Cell Anaemia

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Abstract

A good amount of information is hidden in medical data which can be analyzed using various computational techniques. Meta-heuristics play a vital role in producing optimal or near optimal results to complex problems. Genetic algorithms are a robust adaptive optimization method based on biological principles. The research is important because it is necessary to detect and cure certain diseases like Sickle Cell Anaemia which prove to be fatal many a times, if not taken care of. In the proposed work we present the application of genetic algorithm (differential evolution) to predict sickle cell anaemia and optimize the results. We also propose a new crossover operator in differential evolution. The algorithm gives us optimized values of the following blood components (parameters)- HB, RBC and MCH. With these values it can be shown that patients whose functional value is less than or equal to the best value suffer from sickle cell anaemia. With such an approach for data analysis these patients can be cured on time. Further we conclude that data mining algorithms can make it easier and less time consuming to predict and optimize the parameters.

Keywords: Differential Evolution, Genetic Algorithm, Meta-heuristics, Sickle Cell Anaemia

1. Introduction

Computers have certainly changed and turned our lives in all ways. They have revolutionised all fields of science, be it, chemistry, biology, physics, mathematics, social sciences, engineering. In medicine, computers have changed the way of diagnosis of a disease. On a ground level, when computers are able to give decisive answers to problems in view of given symptoms, it surely reflects the amount of advancement in the field of computer and computing technology. The basic unit of working is the development of a software (can be thought of as several thousand lines of code) which is responsible to carry out these decisions given some input parameters. The design of algorithm plays a vital role in the development of an algorithm. A high level algorithmic framework called as meta-heuristics, which help to build strategies for developing heuristic optimization techniques, are employed. The term was coined by Glover (1986) and combines the Greek prefix meta- (metá, beyond in the sense of high-level) with heuristic (from the Greek heuriskein or euriskein, to search)

[15]. For complex problems metahueristics are able to provide a more viable solution. They are best fit to be applied to real life optimization problems.

Genetic algorithm (GA) are a type of metahuetristics which are governed by laws of genetics. GA's find optimal solution to complex problems[1]. In this method, some individuals are generated containing various properties and features[1-3]. In order to diversify the population, mutation and crossover are used to produce generation with different traits[1-3,9,11-13]. These two operations play a vital role in capturing the randomness in data. Several approaches have been used to propose crossover and mutation operators[9,17-21]. The process of reproduction continues till a population of most fit individuals is generated. It is interesting to note that, GAs search the solution space in iterative manner while other derivative methods search only a single point. Moreover, the difference also lies in the way the genetic algorithms and other derivatives use the transition rules. GA's use probabilistic rules whereas deterministic approach use deterministic rules[15]. In this paper, we discuss an application of Differential Evolution[16,18-20],

a popular genetic algorithm to optimize the diagnosis of sickle cell anaemia. Sickle cell anaemia is a type of anaemia where the patient develops crescent (sickle) shaped Red Blood Cells (RBC). This is a genetic disease for which no subtle cure is available. The associated problems with this disease can be minimised if detected early. The medication can also help relieve pain and prevent further aggravation[5]. For more technical details[4,6,14] can be read on sickle cell anaemia

2. Related Work

The concept of evolutionary algorithms (EA) was to apply ideas from the theory of natural selection to navigate through large search spaces[21]. The problem with EA's of "getting stuck" with local optimum was effectively dealt with novel search heuristics. With studies in[9,12,13,17-22] we could understand the novel search strategies such as particle swarm optimization and differential evolution for numerical optimization that were hardly known outside the search heuristics. Improved differential evolution for automatic clustering has been studied in[18]. These methods gave an insight into a different approach where evolutionary technique produced effective results for clustering. Although there are other evolutionary techniques such as particle swarm optimization, simulated annealing, random search that have been studied for a while but differential evolution because of its robustness, ease of implementation and less use of control parameters proved to be a very effective optimization technique[17,19]

With the interest of studying the application of evolutionary strategies a brief look at the basic factors/blood components (RBC, MCH and Hb) that are affected in Sickle cell anaemia are discussed here. MCH, acronym for Mean Corpuscular Haemoglobin, is the average amount of haemoglobin found in red blood cells. It is measured in picograms.

RBC stands for Red Blood Cells. They carry oxygen. Normal RBC range in Males is 4.7 to 6.1 million cells per micro liter (cells/mcL) and in females is 4.2 to 5.4 million cells/mcL. People suffering from anaemia have RBC in the range 2.37-3.73cells/mcl[6,14]

Table 1. Normal and anaemic range of RBC, MCH and Hb[6]

Blood components	Normal Range	Anemic Range
RBC(cells/mcl)	4.2 - 6.1	2.37 – 3.73
MCH (pg)	25.63 - 29.23	26.52 – 32.16
Hb (g/dl)	25.63 - 29.23	6.63-10.87

Hemoglobin abbreviated as Hb or Hgb, is the iron-containing oxygen-transport metalloprotein in the red blood cells. It is measured in g/dl. A short summary of the variation in the values of these factors is given in Table 1.

Genetic algorithms (GA) as a complete entity, in which knowledge of this emerging technology can be integrated together to form the framework of a design tool[2]. In the following section we describe differential evolution and propose a new crossover operator for better optimization of the results.

3. Proposed Work

Differential evolution (DE) is an optimization technique that is suitable for problems where objective functions are non-linear, non-differentiable, noisy, flat, multi-dimensional, have many local minima, multiple constraints or stochasticity. DE has emerged as a strong, robust, simple yet effective optimization technique. The concept with every evolutionary algorithm is fitness or objective function. In our work the objective function is a minimization function that attempts to minimize the distance between the actual and the predicted value. In the following section, we provide a brief description of the working procedure of differential evolution and the proposed modification in the crossover operator.

3.1 Working Procedure

The ith individual vector (chromosome) of the population at time step (generation) t has d components (dimensions) i.e.

$$X_i(t) = [X_{i,1}(t), X_{i,2}(t), ..., X_{i,d}(t)] \tag{1}$$

For each individual $X_k(t)$ of the current population S_{pop}, DE randomly samples three other individuals, i.e., $X_i(t), X_j(t)$ and $X_m(t)$, from the same generation. It then computes the difference of $X_i(t)$ and $X_j(t)$, scales it by a factor f and creates a trial offspring X_{off} by adding the result to $X_m(t)$. Many strategies for creating trial offspring have been summarized in[19]. The strategy can be chosen according to the requirements of the application and we chose to use "DE/best/1". Thus, for n^{th} component of each individual,

$$X_{off} \begin{cases} X_{best,n(t)} + f(X_{i,n(t)} - X_{j,n}(t), \text{if } rand(0,1) < Cr \\ X_{k,n}(t), \qquad\qquad\qquad \text{otherwise} \end{cases} \tag{2}$$

If the new offspring, X_{off}, yields a better value of the objective function, it replaces its parent in the next generation otherwise the parent is retained.

Differential evolution is selected for optimization procedure because of its effectiveness and ease of adaptation to the objective function. The scope for improvement in DE lies in the adaption of its scale factor f and crossover rate Cr. Simple adaptive and self-adaptive variants for f and Cr have been devised to improve the performance of the algorithm without causing any additional burden[21,22]. Instead of a constant scale factor and crossover rate, studies propose variations in these parameters[18-22]. The random variation in scale factor has been studied in[20] where the scale factor f is varied in a random manner in the range [0.5, 1]. The behaviour of DE is influenced both by the mutation and the crossover operator (F and Cr respectively).

Generate S_{pop} individuals of the initial population pseudo-randomly;

for i=1 to S_{pop}
         compute $f(X_i)$;
end-for
for i=1 to S_{pop}

/* **mutation***/
select three individuals $X_i(t)$, $X_j(t)$ and $X_{best}(t)$,
generate rand(0,1);   /* *random number generated for computing i^{th} scale factor value**/
compute $f_i = 0.5 * (1 + rand(0,1))$;

/* *for every i^{th} individual value, the generated random number gives a different scale factor value in the range [0.5,1]**/

compute $X_{off} = X_{best,n(t)} + f_i (X_{i,n(t)} - X_{j,n(t)})$;

/* *$X_{best(t)}$ value is chosen from the current population that minimizes the objective function & is problem dependent.*
$X_{i,n}$ and $X_{j,n}$ are chosen randomly from the population(forecasted enrollment values)**/

/* **crossover***/
$X_{off} = x_{off}$;
for j = 1 to n

       generate rand(0,1);
       compute $Cr_i = 0.5 [(f_{av}/f_{min}) - f_i + rand(0,1)]$;
/* *f_{av} is the mean scale factor value (0.75) and f_i is the scale factor value for i^{th} individual**/

       if rand (0,1) < Cr_i ;
$X_{off} = X_i$;
       end-if
end-for

/****selection***/
if $f(X_{off}) < f(X_i)$

/* *if the offspring yields a better fitness value then it replaces the parent in next generation**/

       $X_i = X_{off}$;
end-if
end-for

Figure 1.   Differential Evolution pseudocode.

3.2 Proposed Modification in Crossover Operator

Crossover operation is used to increase the potential diversity of a population. The two basic types of crossover variants are-binomial and exponential. In binomial case the *Cr* parameter explicitly determines the probability of a vector to be replaced by a mutated one whereas in exponential the *Cr* parameter decides how many vectors will be mutated. The detailed description of these variants can be found in[22]. A Linearly decreasing crossover rate Cr with time from 1.0 to 0.5 has been studied in[18]. The time variation of *Cr* was expressed in terms of the maximum & minimum crossover rate, maximum and minimum number of iterations. We propose to vary this crossover rate in a random manner using

$$(3)$$

$$Cr_i = 0.5 * \left[\frac{f_{av}}{f_{min}} - f_i + rand(0,1) \right]$$

Here, f_{av} is the mean value of scale factor, f_{min} is the minimum value and f_i is the value of scale factor for i^{th} candidate solution. If the adaptive crossover rate of the ith solution is close to Cr_{min} ($Cr_{min} = 0.5$) then Cr_i tends to be a small value and if it it close to Cr_{rmax} ($Cr_{max} =1.0$) then Cr_i tends to be large. So, we use this variable crossover rate Cr_i for the ith candidate solution for iteration *k*.

For the sake of clarity, the pseudo-code highlighting working principles of the modified DE are shown in figure 1. As usual, the main phases of modified DE are – mutation, crossover and selection. During mutation, three individual vectors $X_i(t)$, $X_j(t)$ and $X_m(t)$ are randomly chosen from the current population S_{pop}, where the difference of $X_i(t)$ & $X_j(t)$ is scaled by a variable scale factor f_i and the result is added to $X_{best}(t)$ [$X_m(t)$] which is the best individual vector, highly dependent on problem under consideration, (Qin *et al.*, 2005) yielding the best fitness value for i^{th} population vector. After mutation, the crossover rate is computed for the ith vector using eq. (4). If the offspring vector (X_{off}) successfully satisfies the condition in eq. (3) then, it is admitted to the next generation otherwise the parent vector is retained.

4. Experimental Analysis and Results

Dataset for 37 patients where the values of HB (haemoglobin values), RBC(red blood cells) value and MCH(Mean Corpuscular Haemoglobin) values[7] are taken. Dataset which contains upper bounds and lower bounds of HB, RBC and MCH of healthy people and those suffering from sickle cell anaemia[6].
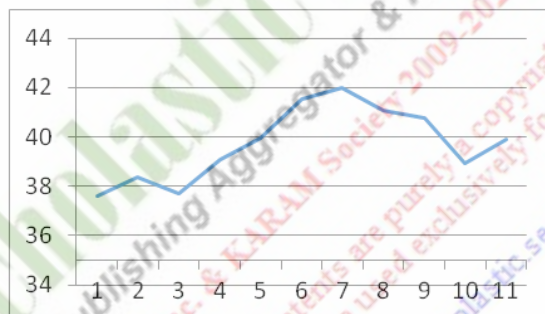

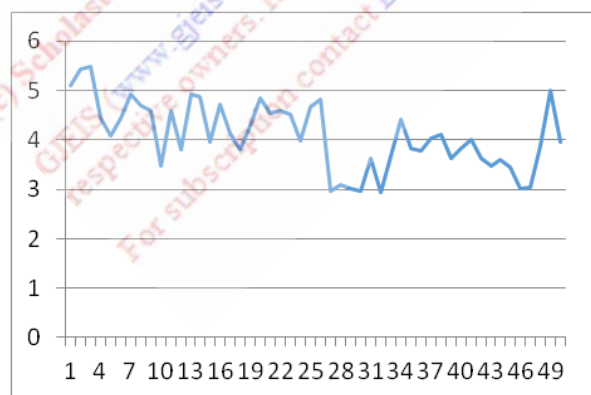Figure 2.   *(Generation Number(x axis) vs Average Fitness(y axis)).*

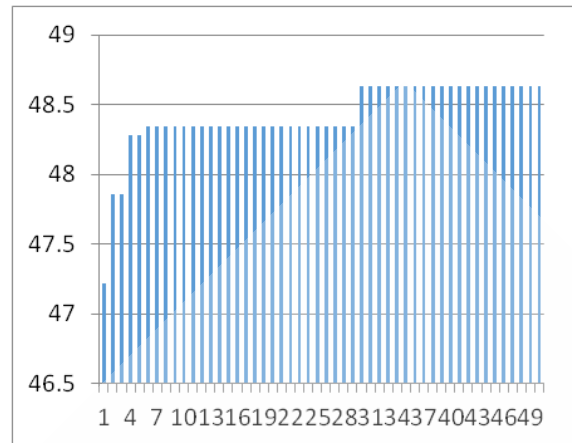Figure 3.   *(Generation Number(x axis) vs Standard Deviation (y axis)).*

Figure 4. *(Generation Number(x axis) vs Best Value (y axis)).*

The results observed are depicted by the following graphs:

Where **every 1 unit of x axis = 5 generation no.**

The graph shows how average fitness varies with generation number implying that for every generation number a new fitness is calculated according to the objective function.

In figure 3 the graph shows how standard deviation varies with generation number which implies that for every generation number, a new mean is calculated and the deviation changes.

In figure 4 the graph shows how best value varies with generation number implying that for different generation numbers .i.e. for a particular range the best value remain same until a new and more optimized result is obtained after repetitive iterations.

The results include calculation of optimized values of HB, RBC and MCH. A best value of the object function is generated. Function value of dataset of patients is calculated. With the above results patients suffering from sickle cell anaemia can be identified. Patients whose function value is less than or equal to the best value suffer from sickle cell anaemia.

5. Conclusion

The research considers different attribute values involved in case of sickle cell anaemia patients. Optimized values of different attributes are calculated using differential evolution and according to an objective function the value using these attributes is calculated.

The research uses differential evolution technique i.e the steps are followed to find out substantial values of certain attributes for a person suffering from sickle cell anaemia. Differential evolution is best suited method for this purposed as it provides the best results in calculating optimized values. We also propose a new crossover operator for understanding the stochasticity.

In future the algorithm could be combined with different data mining techniques like neural networks or techniques like artificial intelligence to obtain more accurate results.

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Servqual used in a Vodafone India

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Abstract

Vodafone India is a leading telecomm services provider in India. It is a subsidiary of Vodafone, a British Telecommunication giant. After the acquisition of Hutch (Joint Venture of Hutchison and Essar) by Vodafone, the company has shifted its focus to the Indian markets and has managed to capture a significant portion. To understand the performance of the telecommunication services by Vodafone India, we have undertaken a research study through the Servqual Instrument which measures the quality of services on twenty two parameters.

Keywords: Social Media, Vodafone, Customer, Satisfaction, Servqual

1. Introduction

In today's business environment, the success of a business depends a lot upon the level of satisfaction of its customers. Word of mouth, social media, all play an important role in creating a brand image of the product. In such a case, existence of a service gap can cause significant damage to the business of the company.

2. Literature Review on Servqual

Servqual is a quality management framework. It was developed in the mid-1980s by Valarie Zeithaml, A. Parasuraman & Leonard Berry to measure quality in the service sector. It is a research instrument that consists of twenty two questions on five dimensions, i.e. tangibility, reliability, responsiveness, assurance and empathy.

Servqual helps in understanding the gap between what the customer expects and what he/she perceives about the company.

SERVQUAL has been previously used in telecommunication industries in various cultural contexts with high reliability and validity. 'SERVICE QUALITY AND CUSTOMER SATISFACTION IN THE CELLULAR TELECOMMUNICATION SERVICE PROVIDER IN MALAYSIA' is a research conducted by Anantha Raj A. Arokiasamy and Dr. Abdul Ghani Kanesanbin Abdullah in Malaysia. The research concluded that the importance of responsiveness in influencing customer satisfaction indicates that a strong relationship between the management and customers' should be emphasized for long term sustainability. The
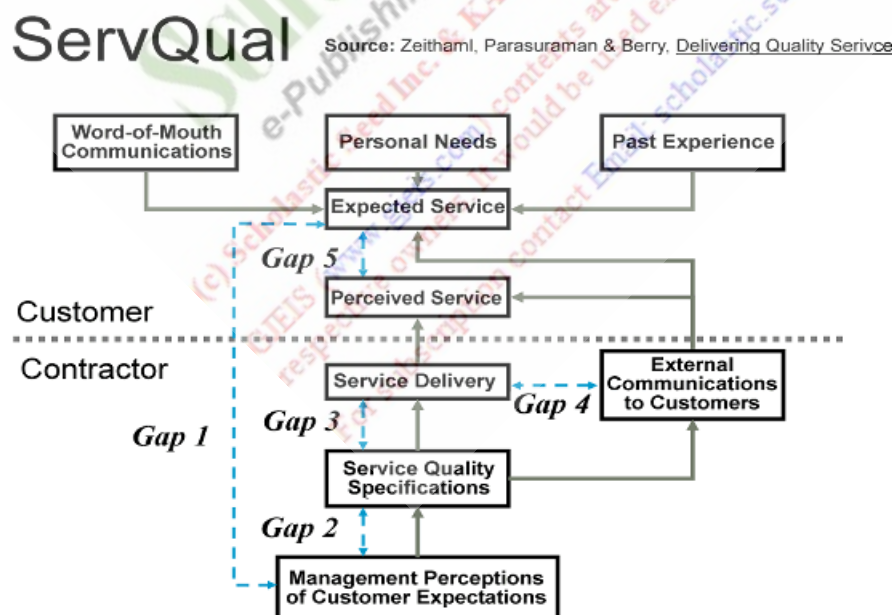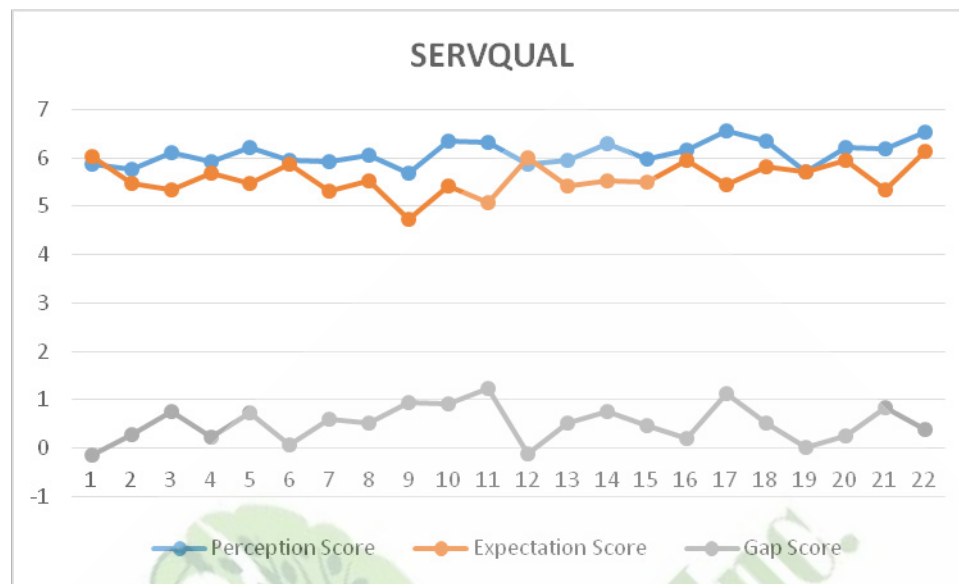
management's strategy should be directed to focus on improving customer responsiveness to strengthen loyalty.

3. Servqual Scale

The five dimensions of the Servqual Scale are:
- **Reliability**: It refers to the consistency of services with respect to performance and dependability.
- **Tangibles**: It refers to the physical aspects of the services as physical facilities, appearance of personnel and tools & equipment used for provision of services.
- **Responsiveness**: It reflects the willingness or readiness of employees to provide quick services to customers.
- **Assurance**: It refers to the employees' knowledge, courtesy and their ability to incorporate trust and confidence.
- **Empathy**: It refers to the magnitude of caring and individual attention given to customers.

4. Objectives of the Study

The objective of our study is to understand the level of satisfaction of the consumers with Vodafone India through SERVQUAL on the following parameters:
- Tangibles
- Reliability
- Responsiveness
- Assurance
- Empathy

5. Research Methodology

To research on the satisfaction of consumers of Vodafone India, a structured questionnaire based on the Servqual instrument was administered both online and offline.

The sample size taken was ninety which consisted of telecommunication users of Vodafone as well as other Companies. Out of these, twenty users were eliminated as they belonged to other companies. Therefore, the total number of respondents came to seventy.

The questionnaire consisted of 22 questions based on 5 dimensions i.e. tangibles, reliability, responsiveness, assurance and empathy.

6. Data Analysis

The hypotheses of the study are:

Null Hypothesis: Ho = The Customer's perception of Vodafone India and expectations of excellent telecommunication companies are equal

Alternate Hypothesis: H1 = The Customer's perception of Vodafone India and expectations of excellent telecommunication companies are not equal

7. Discussions

Servqual GAP= Consumer Perceptions - Consumer Expectations
The Servqual Gap can be depicted graphically as follows:

To analyze our results further, we have applied T Test to the responses for all the 22 questions on the basis of five parameters, i.e. tangibles, reliability, responsiveness, assurance and empathy.

The analyses is as follows:

8. Inference

The Table depicts that after applying T Test to the parameter of TANGIBLES, the critical value from the test turned out to be less than 0.05.

In such a case, the null hypothesis should be rejected and the alternate hypothesis should be accepted.

Therefore, it can be concluded that tangibles of Vodafone India, i.e. the physical facilities, equipment, personnel and communication materials are lower than the customer's expectations.

Thus, a gap exists in tangibility and Vodafone India must improve its physical facilities at Vodafone stores

9. Inference

The Table depicts that after applying T Test to the parameter of RELIABILITY, the critical value from the test turned out to be less than 0.05.

In such a case, the null hypothesis should be rejected and the alternate hypothesis should be accepted.

Therefore, it can be concluded that users of Vodafone India do not consider it reliable in terms of zero call drops, fulfilment of promises etc.

Thus, a gap in reliability exists and Vodafone India must fulfil the promises it makes to its users.

10. Inference

The Table depicts that after applying T Test to the parameter of RESPONSIVENESS, the critical value from the test turned out to be less than 0.05.

Table 1. Calculations to Obtain Unweighted Servqual Score

Average Tangibles SERVQUAL Score	0.62
Average Reliability SERVQUAL Score	1.83
Average Responsiveness SERVQUAL Score	1.91
Average Assurance SERVQUAL Score	1.37
Average Empathy SERVQUAL Score	1.49
Total	7.22
AVERAGE (= Total / 5) UNWEIGHTED SERVQUAL SCORE	1.44

TANGIBLES

	Variable 1	Variable 2
Mean	6.278	5.0
Variance	0.013425926	0.039074074
Observations	70	70
Pearson Correlation	-0.165746219	
Hypothesized Mean Difference	0	
Df	3	
t Stat	-7.274816726	
P(T<=t) one-tail	0.002680366	
t Critical one-tail	2.353363435	
P(T<=t) two-tail	0.005360731	
t Critical two-tail	3.182446305	

RELIABILITY

	Variable 1	Variable 2
Mean	5.8956	5.163333333
Variance	0.010222222	0.011166667
Observations	70	70
Pearson Correlation	-0.711083162	
Hypothesized Mean Difference	0	
Df	4	
t Stat	-12.31428478	
P(T<=t) one-tail	0.000124919	
t Critical one-tail	2.131846782	
P(T<=t) two-tail	0.000249838	
t Critical two-tail	2.776445105	

RESPONSIVENESS

	Variable 1	Variable 2
Mean	6.0797	5.3875
Variance	0.001736111	0.008402778
Observations	70	70
Pearson Correlation	-0.551515152	
Hypothesized Mean Difference	0	
Df	3	
t Stat	-21.84210199	
P(T<=t) one-tail	0.000105024	
t Critical one-tail	2.353363435	
P(T<=t) two-tail	0.000210049	
t Critical two-tail	3.182446305	

In such a case, the null hypothesis should be rejected and the alternate hypothesis should be accepted.

Therefore, it can be concluded that users of Vodafone India, do not consider it responsive enough in solving customer queries and complaints.

Thus, a gap in responsiveness exists and Vodafone India should train and encourage its employees to give prompt reply to consumer problems.

In such a case, the null hypothesis should be rejected and the alternate hypothesis should be accepted.

Therefore, it can be concluded that in terms of assurance, Vodafone India does not perform up to the customer's expectations.

Thus, a gap exists and the employees of Vodafone India should encourage employees to reflect courteous behavior towards its users.

11. Inference

The Table depicts that after applying T Test to the parameter of ASSURANCE, the critical value from the test turned out to be less than 0.05.

12. Inference

The Table depicts that after applying T Test to the parameter of EMPATHY, the critical value from the test turned out to be less than 0.05.

ASSURANCE

	Variable 1	Variable 2
Mean	6.028	5.479166667
Variance	0.091365741	0.006736111
Observations	70	70
Pearson Correlation	-0.764194388	
Hypothesized Mean Difference	0	
Df	3	
t Stat	-7.998766072	
P(T<=t) one-tail	0.002039198	
t Critical one-tail	2.353363435	
P(T<=t) two-tail	0.004078397	
t Critical two-tail	3.182446305	

EMPATHY

	Variable 1	Variable 2
Mean	5.863333333	5.233333333
Variance	0.030194444	0.010555556
Observations	70	70
Pearson Correlation	-0.420104365	
Hypothesized Mean Difference	0	
Df	4	
t Stat	-12.97427603	
P(T<=t) one-tail	0.000101808	
t Critical one-tail	2.131846782	
P(T<=t) two-tail	0.000203616	
t Critical two-tail	2.776445105	

In such a case, the null hypothesis should be rejected and the alternate hypothesis should be accepted.

Therefore, it can be concluded that with respect to empathy, i.e. putting yourself in the shoes of others, Vodafone India does not perform well.

Thus, a gap in empathy exists and Vodafone India must try to understand the specific needs of its users.

13. Recommendations

Application of T Test as well graphical representation of the Servqual gap indicates that Vodafone India has not been able to eliminate gaps with respect to tangibility, reliability, responsiveness, assurance and empathy.

With respect to each parameter, we would like to recommend the following:
- Vodafone Stores are an important contact point for customers. Improving the physical conditions in such stores, providing more information pamphlets in such stores.
- Call dropping is a major concern that affects reliability of calls. Increasing the number of towers to improve call quality is recommended for Vodafone India.
- Many customers complain that they have to wait for a long time to get their complaints registered with telecom companies. Thus, increasing the number of employees to handle customer queries and training them to handle them is recommended.

- When a customer decides to use a particular telecom network, he/she instills his confidence in that operator. Assuring customers that Vodafone India has their best interest at heart through personal frequent communications is recommended.
- Empathy is an important parameter for customer satisfaction. Vodafone India is recommended that they conduct market analysis to understand customers' requirement in terms of call rates, data charges, special offers etc.

14. Limitations

- Although an online form was administered to cover Vodafone India users across India but the majority of respondents were from Delhi only

- The sample size was 90 out of which 20 respondents were not Vodafone users therefore, the actual sample size was 70 which does not represent the whole customer base.

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Biographical Note

A Town Planner, Architect and Great Initiator Economic Develop

Jean-Louis Missika
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As a Deputy Mayor of Paris he is in charge of town planning, architecture, economic development and competitiveness will give a special lecture about Reinventer Paris, one of worlds biggest and most ambitious urban development projects fully based on participation that defined new use for as many as 23 sites. Jean-Louis Missika has been successively Adviser to the President of the French public broadcaster Antenne 2 (1979-1984), Research Director at the Prospective Research Department of the INA (National Institute of radio and television) (1985-1986), Editor of the journal Mediaspouvoirs (1986-1988), Head of the Prime Minister Information Service (1988-1991), Director at the General Management of the Groupe de la Cite (1991-1993), Executive Vice-president and Managing Director of the SOFRES Media Department (1993-1995), Managing director of pollster BVA (1995-1998) and Vice-president of ILIAD (2007-2008). Jean-Louis Missika taught Media Sociology at the Post-Graduate. Political Science Department of the Paris Institut d'Etudes Politiques and was the chair professor of economics and management of the digital industry and the new media at the Conservatoire National des Arts et Metiers.

The "Digital for all, Now" cause is gradually being taken up the Paris City Council. From co-creation between departments to co-governance with citizens, the City of Paris is working on making digital technology a performance driver for innovative public politics. But in order to make the French capital a truly smart city, it needs to be organised and agile-thinking. And this is precisely what Jean-Louis Missika, Deputy Mayor of Paris in charge of town planning, architecture and economic development, is working on.

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Naviscent builds exceptional customer experience enhancing capabilities for tablet, mobile, web and enterprise software. Established in 2006 and founded on a culture of customer centered research, design and engineering principles, Naviscent has headquarters in Silicon Valley CA, a participant recruiting center of excellence in the Space Coast in Florida and locally based researchers covering all major markets across the US and in 14 countries in Europe, Asia, Middle East, South America and Australia.

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Founder and Principal
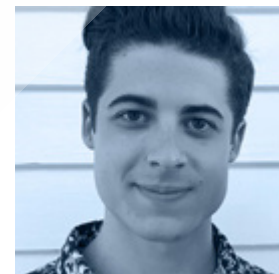Philosophy: Without Research, it's just an opinion
Experience: Research, Usability, Customer Experience, Enterprise Software, Mobile.
Community Service: Keynote speaker, Advisor and Board Member to several non-profits and technology start-ups.

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OUR PEOPLE

SIU-AIU Conference on Internationalization of Higher Education 2017

'The Changing Landscape of Internationalization in Higher Education'
Internationally valued and locally relevant education for all

8, 9 and 10 April 2017, SIU Lavale Campus, Pune, India

Concept Note

Overview: The SIU-AIU Conference will be held in the city of Pune, Maharashtra, India, from 9th to 10th April 2017. A Curtain Raiser in the form of a Round Table Discussion will be held on 8th April 2017.

The Conference is titled "The Changing Landscape of Internationalization in Higher Education" and is organized jointly by the Association of Indian Universities (AIU) and the Symbiosis International University (SIU).

It is fitting that the event is being held in the city of Pune, which has rightly earned the sobriquet of "Oxford of the East". Pune has been in the vanguard of international education—the most prominent evidence of which is that it has traditionally been the city to draw the most international students in India.

The Conference marks the beginning of a new stage in the initiatives on internationalization of higher education in India. The theme of the event and the scope of its reach make the Conference a most extraordinary event, without previous instance. It is hoped that the event will advance new dialogues around the subject and emerge as the wellspring of as yet unexplored perspectives and opportunities.

Hosts: The collaboration between the Association of Indian Universities (AIU) and the Symbiosis International University (SIU) for the purpose of convening this event is an opportune alliance.

The AIU, founded in 1973, is a Government of India organization, which oversees important monitoring and advisory functions and facilitating-coordinating services amongst higher education institutions, the Government of India, and allied agencies. The Association functions as a common platform on which institutions collaborate in cross-exchange of ideas and initiatives and as a leading bureau of information and communication pertaining to higher education. It is of note that the AIU serves an important representative role for institutions: It speaks for and acts on behalf of institutions in India and neighboring countries. (It is relatable that the AIU grants associate membership to many universities in neighboring countries.) The idea of bringing together institutions on a common platform emerged from the deliberations of "Conference of the Vice Chancellors of Universities" in 1924.

The Association is specifically entrusted with the task of promotion of

internationalization of higher education in India through multiple pathways. The AIU is responsible for coordinating institutional initiatives, collecting and disseminating data on international students, and making recommendations to other Government of India bodies on internationalization. It routinely convenes symposia on internationalization on behalf of the Government and institutions in India (and neighboring countries).

The Symbiosis International University, Pune, India, is a premier institution in India. The University boasts a sterling academic record, which is consistently vouched for by the NAAC and premier ranking publications. It was established with the express mission to "promote international understanding through quality education". The University is part of the larger family of Symbiosis, which was set up in 1971 to champion the cause of welfare of international students in Pune.

The University includes constituent institutes/departments in faculties as diverse as management, law, engineering, design, media and communications, computer studies, health sciences, and humanities and social sciences. The University's physical presence reaches across the country to campuses in Pune, Nashik, NOIDA, Bengaluru, and Hyderabad.

The University, its life-force being internationalization, counts amongst its proudest achievements the fact that the number of international students is on a steady ascent, as is the record figure of academic collaborations with foreign institutions. The University has on its grounds students from eighty-five countries! The curriculum, teaching-learning processes, research, and academia-industry interface are at the forefront of global advances, designed with the view to bring home an educational experience that is authentically international.

Above all is emphasized the significance of preparing students for global stewardship. At Symbiosis, global citizenship is an ideal that is intertwined with social responsibility and volunteerism. The students, indeed all members, are encouraged to see themselves as responsible contributors to civic life on the global platform.

Background: Internationalization has long been considered an unquestioned, self-evident goal in higher education. Nonetheless, the emergence of globalization necessitates that internationalization be seen not merely as an extraneous "nice to add" advantage but a persuasive intention to thrive in the global higher education landscape, which has unique occupational and entrepreneurial interests.

Accompanying the emergence of globalization is the phenomenon of "massification" in higher education—increase in the base of higher education co-horts—and the attendant phenomena of "tertiarisation" and "differentiation". All of these signify a metaphorical movement away from elitism, towards egalitarianism and the ideal of education as *collective good*.

This proposition is uniquely relevant to developing countries, which are afflicted with a common set of systemic challenges. Higher education, the core of human resource development, must embrace the "global knowledge economy" model if a country aspires to succeed in nation-building exercises and scale the global value chains.

It is inferred that the concept of internationalization, as it has traditionally been understood, is due a review. The salience of higher education systems in developing countries warrants perspective alteration to facilitate workability in the higher education sector and the graduate labour market.

Rationale: The Conference will make an appeal for internationalization of higher education, while placing emphasis on "internationalization at home" and the specific context of Indian institutions.

In its ordinary acceptation, the concept of internationalization refers to academic cross-border mobility, which includes student and faculty mobility, program mobility, and institutional mobility. Indeed, mobility has been shorthand for internationalization for quite some time. The cases that mobility is conditional upon substantial investment and that the traditional direction of mobility has been from South to North make it an elitist proposition, carrying the risk of promoting inequitable selectiveness. It has been demonstrated that only two percent of the total higher education demographic across the globe is internationally mobile. It is the remaining ninety-eight percent of students for whom the conversation on internationalization at home assumes particular significance.

In divergence from the reference on mobility, "internationalization at home" denotes those aspects of higher education that operate outside the realm of cross-border mobility. This is a paradigm shift, which encourages institutions to look *inwards* at re-defining institutional-academic processes and practices such that they are "internationalization-informed".

Purpose: The Conference is organized to explore internationalization in a comprehensive and multi-level framework. It will focus on elaborating an analytic outline that challenges institutions and educationists to open the opportunities for international education to all those who comprise the higher education co-hort. The discussions are planned with a definitive focus to emphasize operability by delving into grounded practices to infuse a *home-grown* ethos of internationalization across all common institutional spaces.

The sub-themes are anchored in a context that does not assume generous resources or extra-institutional policy incentives. The track sessions are designed around the idea that institutions must be introspective as they devise strategy to re-define academic and other spaces resourcefully.

Highlighted in the sessions will be the significance of creating an institutional ecosystem for internationalization. This will include wide-ranging subjects such as the varied theoretical concepts in understanding internationalization of higher education, internationalization in respect of the regulatory framework and public policy, internationalization as an institutional mission and organizational practice, "best practices" across institutions, limitations of cross-border mobility, and inter-cultural integration. Also explored will be the academic practices that serve the goal of positive student learning outcomes, including elements of curricular and co-curricular learning environments, the role of technology, cross-cultural proficiencies, global competencies in "high-skills," modern advances in pedagogy, and student success and retention.

The Conference will also explore the contribution of internationalization to the reinforcement of global "knowledge networks" and "knowledge diplomacy".

Participants: The Conference is expected to harness strategies, expertise, and resources in internationalization across the widest spectrum of the higher education community in India and abroad.

The Conference will host educationists, institution leaders, academics, and researchers from around the world. Renowned Indian policy makers, legislators, civil servants, and members of civil society organizations will participate in the discussions. Members of many international and regional organizations devoted to internationalization will join in, as will representatives of foreign embassies, including consuls and education attaché. It is relatable that delegates from organizations engaged in global academic rankings will share their views in the discussions and workshops. Vice Chancellors of institutions in India and neighboring countries and subject experts in the field of internationalization will lead the discussions. A robust network of delegates, committee members, and enthusiastic volunteers from AIU and Symbiosis will ensure smooth functioning of the scheduled programs.

Programs and Format: The Conference will provide an engaging forum to widen the attendees' knowledge base and revitalize networking opportunities with peers. The organizing committee is responsible for conducting the many programs of the two-day Conference, which will be preceded by a Curtain Raiser to the conference on 8th April; a Round Table Discussion on 'Building World Class Universities' especially for the vice chancellors, senior faculty/administrators and representatives from educational agencies and government departments.

Day One on 9th April will offer an inaugural function and two track sessions. The first session is titled "Creating an Ecosystem for Internationalization" and the second "Cross-border Higher Education".

Day Two on 10th April will comprise two track sessions titled "Internationalization at Home" and "Building Successful Partnerships".

Amidst these will be presentations on select research papers and artistic posters related to the theme of the event as well as an illuminating documentary, which will present the students' experiences and opinions on the subject.

The sessions are designed to be highly interactive. The track sessions, keynote lectures, discussions, and poster and paper presentations are all designed to present as comprehensive a collage of information and ideas as a two-day event could possibly offer.

ICSDDM-2017

ICSDDM-2017 is a premier International Conference being organized in Association with University of Mumbai by Saraswati College of Engineering during 12th -13th Jan 2017 at Kharghar, Navi Mumbai (M.S.) India. Emergence of various technologies in the modern time has become inevitable. We have to be competent enough to compete with the present and the future global market which is dynamic in nature and as touched high scales of excellence. Hence, a conference on Sustainable Development in Design & Manufacturing will result in an improved awareness about the implications of every emerging technology. The conference will be focusing on all the latest concepts in the field of Design & Manufacturing. ICSDDM-2017 is a true testimony of the fact that every emerging technology today will give way to a better tomorrow.

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Unveiling of Conference Proceeding ICSDDM 2017

The conference will provide an exceptional platform to the researchers to meet and discuss the practical methods of solving intriguing problems with people who are actively involved in these fields. The conference also aims at encouraging the faculty for engaging in more and more research in particular and creating an environment promoting research in every field of academics. There are different tracks of Mechanical Engineering which includes Advanced Manufacturing Process, Material Science and Metallurgy, Sustainable Management, Production Management and Operation Research etc. In Automobile Engineering we have tracks like. Fuel Economy, Emissions and Environmental Implications, Advanced Materials and Alternative Fuels and Vehicles for Disabled Persons etc. and in Civil engineering we have Green Building Materials and Technologies, Sustainable Resources and Materials and Innovation, Sustainable Infrastructure Development and Planning.

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GJEIS is also associated with International DOI Foundation (IDF) USA. GJEIS is also concomitant of Publisher International Linking Association, Inc (PILA) a not-for-profit membership organization, USA.

Type of Articles

We are soliciting different types of article which mainly focused on research issues in the EIS and IT related areas.

1. **Empirical Research Papers (ERP)** report on completed EIS research that complies with rigorous scientific standards. ERP present original results of completed research studies with the aim of obtaining feedback from fellow researchers. [Limit 16 Pages]

2. **Theme Based Papers (TBP)** are short papers that present the design and preliminary results of ongoing EIS research studies with an endeavor of obtaining early feedback and further guidance from experts and peers. TBP will be evaluated using the same academic standards as regular research papers (except for completeness requirements). [Limit 12 Pages]

3. **Case Study Based Papers (CSBP)** describes real-life experiences with EIS that authors wish to share with fellow practitioners and EIS researchers. They focus on problems and solutions in specific contexts. Their aim may be to help other practitioners facing similar problems or to solicit help and possible solutions from other practitioners (or EIS researchers). [Limit 10 Pages]

4. **View Point (VP)** is a situation for which something is pragmatic or considered as a point of view. The purpose of VP is to share different views about the IT related products and what individual think about that. [Limit 8 Pages]

5. **Research Thought (RT)** can refer to the opinion or arrangement of research ideas that effect from thinking, the act of producing thoughts on diverse interdisciplinary collaborative research areas or tools with which researcher can formulate it's research paper, choose a method for undertaking a study, write up for findings and discuss the outcomes in a discussion section. In this head author can throw a light on various research tools which can be helpful in formulating a research paper. [Limit 5 Pages]

6. **Student Research Initiatives (SRI)** is a research initiative by a grass-root researcher and technocrats. This head facilitate students/learners to pursue independent academic and imaginative effort and engage in research under the supervision of a faculty mentor with an intention to heighten student research as a means of collaborative learning, critical thinking and the establishment of knowledge. [Limit 12 Pages]

7. **Dissertation Snapshot (DS)** is an excerpt from a researcher's own thesis or dissertation which had been previously published or submitted in the form of research project or its own doctoral work. The rationale is to raise the curtain on an application and thought used by researcher in a brief manner with an intention to promote the future researchers to sequel their thoughts. [Limit 10 Pages]

8. **Questionnaire Format (QF)** A new philosophy called "Questionnaire Format" had been introduced, in which we are going to publish distinguish questionnaires that navigates the usefulness of it in building research and how to communicate with the respondents . The rationale behind introducing this QF is to give a glimpse about the structure and the pedagogy. QF on the other hand provides a niche to grass-root researcher about their various thoughts related to preliminary research and facilitate them in linking with a respective research papers which the researcher had visualize or going to plan in a coming future. This is a new inventiveness under the GJEIS Academic Social Responsibility(GASR) and would be complimentary/charitable in nature. [Limit 5 Pages]

9. **Book Review (BR)** is a form of literary criticism in which a book is analyzed based on content, style, and merit. BR can be a primary source opinion piece, summary review or scholarly review. Books can be reviewed for printed periodicals, magazines and newspapers, as school work, or for book websites on the internet. A book review's length may vary from a single paragraph to a substantial essay. Such a BR may evaluate the book on the basis of personal taste. Reviewers may use the occasion of a book review for a display of learning or to promulgate their own ideas on the topic of a fiction or non-fiction work. [Limit 3 Pages]

10. **Biographical Note** of the Luminary in an Area of IS We as per our culture acknowledge in every issue a great leader, Entrepreneur, Technocrats, Academician etc., who contribute a lot to a society in an area of IS. [Limit 2 Pages]

11. **Great Enterprise Contribution to Society** in Information System Perspectives deals with those enterprises contributing a lot to the society, and considering themselves a wizard in the field of Information System, we publish their profile, with the intention that their creation/contribution would be viewed and duly appreciated by the corporate and academics, all-around the globe. The purpose behind this is to broadcast the most visually powerful, immersive and engaging rich media applications on the Web. [Limit 2 Pages]

12. **Award** is something given to a person or a group of people to identify their fineness in a definite field especially in an area of EIS, it is rather a certificate of excellence for their contribution in academia or in a corporate world. This start throws a light on an entity or a gamut of researcher who had been honored for their extra ordinary input. [Limit 2 Pages]

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