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Chief Editor
Dr. MS Dayanandaswamy
Professor, SOM, School of Management,
Presidency University, Bengaluru, Karnataka, India

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Chapter - 1

Customer Satisfaction Towards Swiggy

Dr. T.S. Edwin
Associate Professor,
School of Management,
Presidency University,
Bengaluru, Karnataka, India

Sonal Chondamma HS
MBA Student,
School of Management,
Presidency University,
Bengaluru, Karnataka, India

Abstract

The fast-food market in India is growing rapidly in India with changing habits and agile lifestyles. At the same time, Technology is diffusing rapidly into the deepest pockets of India, with cheaper data and betterment of digital infrastructure. In this context, many fast-food brick and mortar stores are increasing their digital presence in order to cope with the Technological disruption across all segments. These online retailers have been empowered by Aggregators like Swiggy who aim to better synchronize demand and supply of products, leveraging technological innovations. A major challenge encountered by these online retailers in a highly fragmented and competitive industry is to retain customers, and subsequent loss of revenue and market share. Customer Satisfaction has been dubbed as an antecedent to Customer Loyalty in several studies and is a potential solution to retaining customers in the face of numerous alternatives and low switching costs. The study at hand aims to bring out the factors influencing Customer Satisfaction in the tech enabled Indian Fast-Food industry, through an exploratory analysis via a structured questionnaire. The results have isolated five factors can assist Service marketeers to better formulate online retailing strategies, particularly catering to Fast food customers. These factors have been named as “Quality”, “Customer service”, “Price”, “Delivery” and “Time” with “Quality” being the most significant.

Keywords: Customer Satisfaction, Exploratory Factor Analysis, Fast-food, Online Food Delivery

Introduction

Customer satisfaction is a term frequently used in marketing. It is a measure of how products and services supplied by a company meet or surpass customer expectation. Customer satisfaction is defined as 'the number of customers, or percentage of total customers, whose reported experience with a firm, its products, and its services exceeds specified satisfaction goals. In researching satisfaction, firms generally ask customer whether their product or service has met or exceeded expectations. Thus, expectations are a key factor behind satisfaction. When customers have high expectations and the reality falls short, they will be disappointed and will likely rate their experience as less than satisfying.

Online food ordering and delivery is a new type of business model in the current era of e-commerce and that leads to the start-ups of several online businesses. Online food ordering and delivery plays an important role in consumers, entrepreneurs, investors etc. Online food ordering and delivery is very successful because it bridges the gap between restaurants and consumers.

The online ordering system can be defined as a simple and convenient way for customers to purchase food online, without having to go to the restaurant. The system is enabled by the internet that connects the restaurants or the food company on one hand, and the customer on other hand. Therefore, as per this system the customer visits the restaurant's app or website, browses through the various food items, combos and cuisines available there and those ahead and selects and purchases the items he or she needs. These items will be then be delivered to the customer at his or her doorstep at the time they choose by a delivery person. Payments for such online orders can be made through debit cards, credit cards, cash or card on delivery or even through digital wallets.

Importance of the Study

Generally, people consume food from hotels which takes a lot of time for its delivery. The time factor will be more in case of people going to restaurants and buy foods and cost will also be more. This study is conducted to study the consumer perception towards online food ordering Swiggy, how it bridges the gap between the consumer and the hotels. The factors influencing the consumers to buy through food ordering application Swiggy is also identified in the study and the satisfaction derived out of the food ordering applications Swiggy is also examined.

Industrial Profile

Ordering food online with the swipe of a finger has become nothing less than a cakewalk for most of us. There are a number of applications that are essentially designed to ease people's lives, especially when most of the people live away from home trying to make a living on their own. And no matter how healthy cooking own meals would be, it is not always possible to do so, given the hectic lives. The First Pizza Delivery Was Way Back In 1889.

Customers can have easy access to competitive service providers at competitive prices and at the same time they can also receive input from their peers through social media, which helps influence their ultimate purchase decision. With a population of over 1.2billion, India is undeniably one of the biggest consumer markets in the world today. 50% of this population fall under the age of 25, making India one of the countries with the youngest population in the world. Furthermore, it has been predicted that by the year 2025 the number of middle-class Indians will touch 550 million. Moreover, e-commerce has been expected to grow from US $2.9 billion in 2013 to a mammoth US $100 billion by 2020, thereby making it the fastest growing e-commerce market in the world.

Importance of the Study

Generally, people consume food from hotels which takes a lot of time for its delivery. The time factor will be more in case of people going to restaurants and buy foods and cost will also be more. This study is conducted to study the consumer perception towards online food ordering Swiggy, how it bridges the gap between the consumer and the hotels. The factors influencing the consumers to buy through food ordering application Swiggy is also identified in the study and the satisfaction derived out of the food ordering applications Swiggy is also examined.

Statement of the Problem

The problem is undertaking for the study of consumer satisfaction towards online food ordering. The online food ordering services is provided to the customers from websites and the applications the online food ordering is can easily place the orders and track their orders. This system provides a feedback system which user can rate for the order and it can recommend food, hotels based on the ratings they can find the best restaurant it improves along with the quality. The payment is can be done through cash on delivery or credit card/debit card. For the ordering of foods, the customers have to maintain the account in the particular applications. The purpose of this study is to measure the expectation & satisfaction of customers regarding Swiggy food delivery

application among college students. This study also analyses the factors that attract consumers towards Swiggy.

Scope of Study

Scope of the study is limited towards commerce students who have experienced such online food delivery services through Swiggy app. The study is basically conducted to know how consumers perceive the online food delivery services. The expectation and satisfaction of consumers may vary under different circumstances. From this study, we can have a better understanding of the Online Food Delivery Service Market. Therefore, these findings may help the service providers to work upon on these variables to fill up the gaps in the mind-set of consumers

Research Objectives

1. To measure the source of awareness among consumer towards choice of Swiggy.
2. To find out the factors influencing the consumer towards Swiggy.
3. To know the expectation and satisfaction level of respondents towards Swiggy.

Literature Review

1. Bhavya saini (2016), "Consumer preference and attitude regarding online food products" the study emphasized that using the internet in seeking food service information was a common practice among people living in India and online interpersonal influence took a fundamental apart. A high percentage of consumers were unconcerned about accurate evidence regarding food safety in selecting food products on the internet. The conclusion of our findings produces practical pieces of advice to consumers buying online food, to food retailers selling food over the internet and to the government of India to implement appropriate legislation regarding online food product information. Among all these factors customers usually expect three website merits to assist their online encounters that are system quality, information quality, and service quality.
2. Sumathy (2017), "A study on prospective concernment towards food adjure app" the online food adjure app system will be helpful for the hotels and restaurants to increase the scope of the business by helping users to give order through online. This study was to find the awareness level and satisfaction derived by the consumer and also to find which factor influence customers to buy food through online

from food adjure app. Most of the respondents disagree to the fact that online website charges high delivery fees. Almost all users feel safe paying online. The service rendered by the food adjure app is the major factor behind its success.

3. Leong Wai Hong (2016), the technological advancements in many industries have changed the business model to grow. Efficient system can help improve the productivity and profitability of a restaurant. The use of online food delivery system is believed that it can lead the restaurant's business grow from time to time and will help the restaurants to facilitate major business online.
4. Kumaran. M. (2017), has conducted a study on "perception towards online shopping an empirical study with respect to Indian buyers". This research deals with E- marketing researches concerning the factors which affects consumer perception towards online purchasing experiences, this research dealt with the perceived risks, website role, domain specific innovativeness, subjective norms, and attitude perceived usefulness, perceived ease of use, attitude, online shopping intention and online shopping behavior. There are many reasons for people preferring online shopping but the major reason for a consumer backing out from online shopping is the security issues but the industry has given little concern to this issue.
5. Jyotishman Das (2018), the doorstep delivery is the most highly ranked factor of influencing the consumers to use the food ordering applications. The consumers are also often influenced by discounts and cash backs they enjoy. On comparing the factors the most preferred service provider came out to be Zomato followed by Swiggy.

Research Design

Nature of Study

The study on customer satisfaction of Swiggy among college students is descriptive cum analytical in nature.

Nature of Data

The study is based on both primary and secondary data.

Sources of Data

Primary Data: To study the customer satisfaction on Swiggy a questionnaire was prepared and the data was collected from the commerce students who are using Swiggy application.

Secondary Data: The secondary data was collected with the help of internet search, and online articles.

Sample Design

The research was carried out in various phases that constituted an approach of working from whole to part. It included several phases which tried to deeper into users liking and develop a thorough understanding of what the consumer looks forward while ordering food online. For the study a sample of 50 respondents were chosen randomly. The sample design is used in the study is descriptive research design.

Sample Size

The primary data is collected form 50 respondents from order food through online.

Sampling Technique

Convenience sampling is used to collect the data.

Tools for Analysis

Statistical tools used for the analysis are mean average, percentage, table & graph.

Findings

The expectation and satisfaction of Swiggy customers on product price. From the table it is clear that the average expectation is 2.56 and average satisfaction is 3.68. Therefore, satisfaction on price is higher that expectation on price. The expectation and satisfaction of Swiggy application. From the table it is clear that the average of expectation is 2.8 and average of satisfaction is 3.82. Therefore, the satisfaction on application is higher than the expectation on application. The expectation and satisfaction of food quality provided by Swiggy. From the above table it is clear that the average expectation on food quality is 2.92 and the average satisfaction on food quality is 3.76. The satisfaction on food quality is higher than expectation on food quality. The expectation and satisfaction of food packaging. From the table it is clear that the average expectation on packaging is 3.02 and average satisfaction is 3.8. Therefore, satisfaction on packaging of food is higher than expectation of the respondents. The expectation and satisfaction of the respondents towards responsiveness of Swiggy. From the table we can understand that the average expectation on responsiveness is 2.72 and average satisfaction is 3.58. Therefore, the satisfaction on responsiveness is higher than the expectations of the respondents. The satisfaction comparison of various factors of Swiggy.

From the table it is clear that average of satisfaction on delivery speed is 3.9, it is higher than all the other factors. Therefore, respondents are having more satisfaction on the delivery speed of Swiggy.

Results and Discussion

Following Are the Findings That We Obtained From the Study

- 54% of respondents are aged between 21-22.
- 50% of the respondents are male and 50% of them are female.
- 86% of respondents are degree students.
- Majority of the respondents i.e., 74% order food online on monthly basis.
- 72% respondents got to know about Swiggy from online advertisements.
- 40% of respondents have been using Swiggy for a period of less than 1 year.
- 50% of the respondents use Swiggy considering its special offer.
- When compared with services offered by other companies 34% of respondents feel that Swiggy is better than other applications.
- More than half of the respondents i.e., 62% says that it is easy to navigate through website.
- Average expectation on price is 2.56 and average satisfaction on price is 3.68, respondents are satisfied with the price of product.
- Satisfaction level of respondents towards application i.e., 3.82 of Swiggy is more than their expectations on application i.e., 2.8 before using it.
- The average expectation on food quality is 2.92 and average satisfaction is 3.76 therefore the satisfaction of respondents on food quality is higher than their expectation.
- The satisfaction level of respondents on packaging of food i.e. 3.8 provided by Swiggy is higher than the expectation i.e. 3.02 they had before using it.
- Average expectation on responsiveness of Swiggy is 2.72 and average satisfaction is 3.58, the satisfaction on responsiveness is more than expectations.
- The respondents are satisfied on delivery speed of Swiggy. Average expectation of respondents about delivery speed of Swiggy is 2.82

and average satisfaction is 3.9, the satisfaction is higher than expectations.

- While considering the overall satisfaction of respondents, average satisfaction on delivery speed of Swiggy is higher which is 3.9.
- It is found that 42% of respondents have faced trouble in dealing with Swiggy and 58% of respondents have not faced any problem.
- Most of the respondents i.e., 80% will recommend Swiggy's services to others.

Conclusion

Swiggy is a perfect example of a robust start-up. The brand started with delivering food in one city and now spreading across India. The food-delivery giant is also diversifying its logistics business with emergency items like groceries and stationeries. It has been a unique blend of business strategies, marketing strategies and social media strategies which has transformed the business in just 5 years of its inception.

Applications for the food supply have now become a major sensation in India. Numerous food delivery applications in India can be downloaded from the ease of homes on smart phones to order food on the go. By conducting the above research, we came to know that the food apps are successful in capturing a market in Indian economy as almost every person uses it. These apps also help to achieve digitalization as the most preferred payment method is Paytm. These apps are easy to use and satisfy the consumer needs by providing quality services to them. Technology is affecting the business in almost every sphere. The gap between customer's satisfaction and their fulfilment is being reduced with the help of new technologies. These apps also help achieve digitalization, because Paytm, Google Pay is the preferred form of payment. These applications are easy to use and meet the needs of customers by providing them with quality services for them.

The study helped in identifying the factors which influenced the customers for choosing Swiggy. On analyzing the customer satisfaction on Swiggy, it can be concluded that the company has to focus on building positive image regarding the product on customer's mind. Customer's expectation about Swiggy was surpassed and most of the customers are satisfied in every means. The customers who had several expectations before using Swiggy had more satisfaction after making purchases. Comparing with other variables customers are more satisfied on the delivery speed of Swiggy. The company should focus on providing food items in considerable quality and quantity, it should also focus in undertaking more promotional activities through more

mediums finally, and we can conclude that many customers are satisfied with Swiggy.

Suggestions

Company should try to reach to people of other age groups. Company should take necessary steps to stimulate customers in repurchasing on a frequent basis. Swiggy should focus more on other promotional activities such as television advertisements. The Company should focus on giving better quality product as most customers were very brand loyal and were generally satisfied with the product. The company should try to be competitive than other companies and try to establish a strong position in the market. Food app should improve their payment security so that consumers don't hesitate while making payment online. They should provide more offers as customers are mainly using these apps to avail offers. They should increase their reach to local vendors because consumers prefer it more. Sometimes tracking facilities is poor. They have to update their websites according to the current trend for tracking the order.

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Chapter - 2

Critical Analysis of the Unprecedented Growth of Ed-Tech Companies in Education Sector

Parvathy S
School of Management, Presidency University,
Bengaluru, Karnataka, India

Abstract

The education sector in India has seen an unprecedented growth in the past decade with the emergence of new age Ed Tech companies coming up with new approach and tools of imparting education in schools and higher education institutes. These companies have revolutionized the education system by slowly revamping the traditional approach of imparting education by proper use of ICT.

This paper attempts to find the reason why ed-tech companies are having exponential growth and how it's impacting the education sector in the country.

Keywords: Ed-Tech, ICT

Introduction

The mode of education has been changed over the years. There are many people who prefers to study online rather than going to the schools or colleges. Even though, it has its own merits and benefits. The introduction of Information and Communication Technology was a breakthrough for the education sector. It created many changes in the field and also made the process of education easier. The students have received an opportunity to learn more about the changing world. It also assists them to get used to the technology which they have to use every day when they will start their career. Moreover, many ed-tech companies have been introduced in this field to support the people to get education in any university with extra.

Opportunities and Challenges: There are many opportunities which the education sector has received after the introduction of ICT with some barriers also. ICT prepared the schools to give the basic knowledge to the students about the computers which assist them in the next step of education. It provided more job opportunities to the faculties. Exchange the learning

experience with other which encouraged them to learn more and dream big. Developing self-learning habits with the help of remote devices. Both students and teachers get the opportunity to learn something new every day while exploring ICT with accessibility being high. It increases leisure time by consuming lesser time to complete the work. Higher quality of education has led the students to find new ways of interaction.

The various challenges in implementing ICT are affordability of the computer, availability of electricity, cost of education, unavailability of qualified teachers and instructors who are appropriate to make adequate use of the ICTs. The application of modern and scientific teaching-learning methods and instructional strategies in the educational system is at the heart of innovation and educational technology. The employment of technologies has become increasingly important in today's world. Instructors and students are utilizing the internet on a large scale to generate material on a variety of topics and to supplement their learning. Furthermore, kids use computers to complete their homework and projects. Individuals can become well-equipped with technology by putting in a lot of practice time. Charts, maps, models, textbooks, and other reading materials are some of the additional inventive ways employed in the teaching-learning process. Instructors are implementing several types of instructional strategies that are required to supplement student learning by utilizing these technology and materials. Giving Power Point presentations, reading, and providing explanations, as well as presenting explanations through the use of charts, models, and maps, are all examples of instructional tactics. Instructional practises can be transformed with the use of innovation and educational technology.

The Major Players in Ed-Tech Are: Byjus, Vedanta, Udemy, Simply learn, Sunstone Eduversity, Upgrade etc. There other platforms like SWAYAM, NPTEL, Course era, MOOCS etc. That promotes online learning in variety of domains and also offer recognized certifications.

This study aims to examine the impact of Information and communication Technologies on education in India. Furthermore, this study will investigate, how technology can improve the education sector while adapting the changes and how the edu tech companies are impacting the traditional approach of education.

Edu tech are thinking about creating interactive apps which will help students understand concepts in a more interactive way. The concept here is to make education easy and fun for a generation which spends most of their time using technology. It will promote a higher-level thinking which will keep

on improvising. Interactive course makes students to complete a degree course in a way such that the knowledge will be useful.

Survey of Existing Literature

Students' learning styles have shifted as a result of technological advancements, as has their interaction with academics for assistance and inquiries. Changing not only students' learning methods, but also teachers' teaching methods. This literature study discusses the evolution of educational technology, as well as the major events that have influenced students' learning styles. It gives data on how much time pupils spend on technology and how much progress they make. It identifies both positive and bad aspects of the topic, as well as how teachers are receiving support for this technology.

In the year 2009 ZA Shaikh published a paper on “Usage, acceptance, adoption, and diffusion of information & communication technologies in higher education: a measurement of critical factors." The creator says that, to appropriately integrate information and communication technologies (ICTs) with Pakistan's higher educational institutes (HEIs), aspects relating to their use, acceptance, adoption, and diffusion must be assessed using appropriate statistical tests prior to their implementation on the ground.

In the year 2002 C Kenny published a paper on “Information and communication technologies for direct poverty alleviation: costs and benefits." The creator says that, in poor nations, information and communication technologies (ICTs) are significant tools for empowerment and revenue development. However, the cost-effectiveness of various ICTs varies across industrialized and developing countries.

In the year 2021 RES Bravo and MR Gámez published a paper on “Information and communication technologies, their impact on the teaching-learning process." The creator says that, Humans can develop their regular activities in less time thanks to information and communication technologies, and teachers can engage in creative educational activities. The goal of this study is to examine the technological instruments used by the "Aurelio Salazar" Educational Unit and their impact on the teaching-learning process. The qualitative technique was used to investigate the depths of the teaching process, the inductive-deductive method was used to derive the behaviour of this methodology and its prevalence in education, and a bibliographic review was conducted.

In the year 2019 SN Allayarova published a paper on “Implementation of Modern Information Communication Technologies (ICT) in Higher Education Sector: International Experience and The Example of." The creator

says that, Information and communication technology (ICT) is a significant instrument for higher education institutions to deliver high-quality education. A number 23 of countries that recognise the full benefits of ICT have already implemented and developed it in the higher education sector, however Uzbekistan may face certain hurdles in this regard. The goal of this study is to add to the expanding body of evidence on the use and acceptability of ICT in Uzbekistan's higher education institutions.

Many studies were conducted in various domains like medicine and sports that highlighted the importance of ICT and its impact on education sector both at schooling and higher education level.

Research Methodology

Objectives

1. To study the process of supply chain network in the agricultural sector.
2. To understand the various preserving techniques of agricultural products.
3. To identify the factors that influences the warehouse management of agricultural products.
4. To analyse the key contributing factors in the warehouse management.

Methodology

For the purpose of this research work, data will be collected from farmers in and around Shivakote and also the mediators operating in and around the village who are operating with the warehouse agencies. Primary data for this work will be collected by means of interview with the help of a questionnaire. Along with the primary data, secondary data will be used taken from various magazines, journals, reports from government.

Scope of Study

Data source : Primary and Secondary

Sampling Technique : Simple random sampling

Research instrument : Survey conducted through questionnaires

Findings

- More than 50% of the respondents opined that shelf life of the product is 3-6 months

- Maximum respondents around 80% were of the opinion that they can store their products in warehouses beyond its shelf life.
- 70% of respondents said that Cost variation by delay in product depends upon the demand.
- 80% of respondents agreed that warehouse can be managed for storing during peak times with regular supply
- Nearly half the farmers said that they can sell to both to dealers and customers if warehouses are not available.
- Most of the farmers opined that group selling is not practical and economical.
- The respondents agreed the old stock can be replaced by new arrivals depending on the demand of the product.
- Almost 70% of the respondents said the warehouse charges are yearly while few said that it depends on the type of product.
- Banks support and agree to support financially for warehouse development
- Warehouses do not make money except during season time this was observed by most of the respondents.
- Increase in number of warehouses will increase profitability was the response from many.

Conclusion

It can be concluded that warehousing of agricultural products is a big challenge in the country and is dependent on all the stakeholders in the supply chain. The infrastructure for warehouses has to be enhanced in order to avoid wastages in the agricultural produce. The communication between stakeholders should improve in order to reduce cost and expedite delivery.

Suggestions for Future Research

The research work can be conducted on similar lines in other places in the country as the dynamics of supply chain changes as per the infrastructure available at different. After analysing the problems encountered in the study a model can be designed to overcome the challenges in terms cost and delivery.

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Chapter - 3

A Study on Impact of Online Food delivery app on Restaurant Business

Sandaboina Ganesh
Student, Presidency University,
Bengaluru, Karnataka, India

Saptarshi Mukherjee
Prof., Presidency University,
Bengaluru, Karnataka, India

Abstract

With online ordering on board you will enrichen your customer experience by making the process of 'placing orders' a lot easier. It will show that you value your customer's time. Online ordering will guarantee a 'level up' to your web presence. And a good web presence will make you stand out in the search engine rankings and bring more customers to you. Online ordering will boost your productivity by eliminating the inefficient process of taking orders. It will help you to plan and implement an adaptive marketing campaign. Utilizing the latest online ordering technology for your restaurant will also help you to tap into a massive customer base which is tech-savvy and believes in 'online way'.

The customer's comfort is simply the primary facet good thing about such, whereas on the second facet these system also are helpful for the expansion of eating place and food provide trade, as by the utilization of digital food ordering system a eating place owner are ready to attract the users attention by permitting them see the whole food menu in conjunction with dish name, image, specialty, and price. Integration a web food ordering system isn't any doubt are the simplest, cheap and helpful call for a eating place business owner. With constant deluge of experts in urban areas and fast urbanization of Indian scene, the food delivery and eatery portion is currently flourishing at a rankling pace. Adding to this situation is an expanding number of cell phones and food delivery applications. Food delivery applications have now turned into a major hit with well-informed people crosswise over India. There are a few food delivery applications in India that one can download on advanced cells to arrange food in a hurry and from the solace of homes. The changing

urban way of life of the normal Indian is sufficiently emotional to be ideal for the food-on-the– go and fast home delivery models to develop at higher rates. The regularly expanding populace swarmed metro urban communities and longer travel times are drivers for the helpful, prepared to eat and less expensive alternatives of having food and foodstuffs conveyed at your doorstep. Organizations that know about the colossal potential for development may wander straight in, yet just the fittest will endure.

Keywords: Online sales, Restaurant business

Introduction

There is limited empirical evidence on the impact of adding an online sales channel to a traditional industry from the firms' perspective. In the newspaper industry, the introduction of online articles caused significant substitution effects that greatly reduced the readership of print media (Gentzkow 2007).

Grocery store sales are only moderately crowded-out with the introduction of an online channel and their overall revenues increase (Pozzi 2012; Relihan 2017).

Serhat Murat Alagoz & Haluk Hekimoglu (2012), opined that e-commerce is dynamically growing worldwide, the food industry is also indicating an increased growth. They have suggested the Technology Acceptance Model (TAM) as a base to study the acceptance of online food ordering apps. Their analysis of data stated that the attitude towards online food ordering is due to the ease and usefulness of online food ordering process and also vary according to their innovativeness against information technology, their trust in e commerce websites and few external influence

Ashoutosh bhargve (2013) said that Foodpanda an online food ordering apps has been launched in the Indian market since May 2012. Foodpanda first major move was acquisition of TastyKhana, which was started in Pune in year 2007.With acquisition of TastyKhana and JUST EAT, it is now available in over 200 cities and delivery partner with over 12,000 restaurants. JUST EAT which was launched in Denmark in 2001 and was listed publicly on the London Stock Exchange is also mentioned. Their Indian venture was come as Hungry Bangalore in 2006. It was reintroduced in 2011 when JUST EAT acquired a majority share in the business. Today, the company partners with over 2,000 restaurants.

H.S. Sethu & Bhavya Saini (2016), their idea was to analyze the student's perception, behavior and satisfaction of online food ordering and delivery

applications. Their study shows that online food ordering apps secure their time due to easily availability. It is also found that visibility of their favourite food at any point of time and always access to internet, free data are the main reasons for using the apps.

According to Sheryl E. Kimes (2011), his study found that perceived control and convenience associated with the online food ordering services were important for both users and non-users. Nonusers need more personal attention and also had high uncertainty towards use of early technologies

In fact, it is generally found that including an online sales channel provides significant increases in sales, inventory, and return on investments, while costs decrease in a sample of more than one hundred publicly traded companies (Xia and Zhang 2010)

Recent studies have described a "retail apocalypse" in which e-commerce has forced brickand-mortar retail establishments without online channels to shut down across the nation. However, physical stores are not quite finished. The "bricks-and-clicks" hybrid model has become more and more popular—and this trend has not been limited to just retail stores (Horta¸csu and Syverson 2015)

This study seeks to quantify potential crowding-out effects and market expansions that have occurred due to the entry of online food delivery services and subsequent hybridization of restaurants. "Crowding-out" refers to sales that usually occur in brick-and-mortar stores that are now happening via other channels. Market expansions refer to new sales that 5A thorough review of studies on e-commerce can be found in Lieber and Syverson (2012). 7 are generated by creating an online channel for purchases. Although opening new online channels could potentially increase restaurant revenues and cause overall market expansion, new channels also allow for cannibalization of offline sales, i.e. crowding-out. Firms face a similar trade-off when introducing new products or opening a new store (Shaked and Sutton 1990; Holmes 2011; Mitsukuma 2012). Consumers that would typically purchase meals in-person are now ordering take-out with online food delivery services

Bhavna Singh (2015) said that Food panda has been present in the Indian market since May 2012. Food panda first major move was acquisition of Tasty Hana, which was launched in the city of Pune in 2007. Together with Tasty Hana and JUST EAT, it is now present in over 200 cities and partners with over 12,000 restaurants. She also talked about JUST EAT was launched in Denmark in 2001 and was traded publicly on the London Stock Exchange. Their Indian business was launched as Hungry Bangalore in 2006. It was

renamed in 2011 when JUST EAT acquired a majority share in the business. Today, the company partners with over 2,000 restaurants.

Objectives

1. To know the impact of food delivery start-ups like Zomato and swiggy on restaurant business
2. To know the strategies of food delivery app Zomato, swiggy, food panda and uber eats.
3. To analyze the influencing factors which help the consumers to choose online food delivery services

Questionnaire Developed

We had 15 Questionnaire which is prepared through Google Form and has forwarded to public restaurants managers and works, swiggy, Zomato works and customers via thought emails and what's up

Data Collection

I collected a nearly 60 respondents has been taken for the study.

Face to Face interviews of the restaurant employees and swiggy and Zomato employees were taken on the benefits that they are seeking from the restaurant employees and swiggy and Zomato employees and their opinion towards benefits provided. This method has a lot of scope in data collection.

This interaction with employees has been carried out when they were free to respond and received a lot information. The employees were honest and are comfortable in answering the questions and have shown enough interest in giving additional information.

Scope of the Study

Consumers have specific need and expectations with respect to their food. The study is conducted to know the perceptions of customers regarding electronic food ordering among the customers (students) of Chennai city. From this study, we can have a better and clear understanding of the online food delivery portals. We will know about the preference of the consumers whether they prefer Swiggy or Zomato and will get to know the influencing factors which make the customers prefer a particular app. Also we will get to know the satisfaction level of the customers in terms of price, quality etc. Therefore the findings will help the service providers to improve and to know about customer's preference and to fill up the gaps.

Analysis

Table 4.1: AGE Groups

Age	Persons
19 To 24	34
25 To 29	3
30 To 35	8

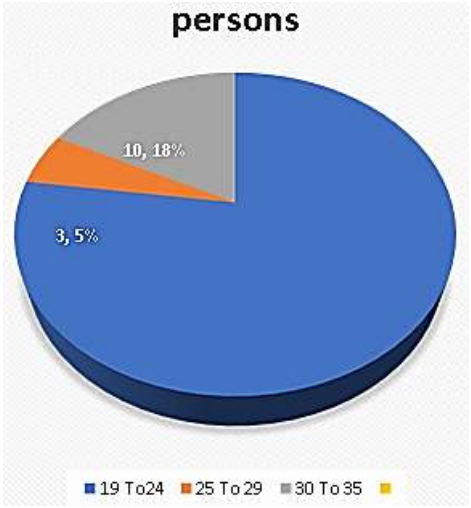

Fig 4.1: Pic chart showing percentage of different age groups

Researcher found out through result analysis of Online Food delivery app on Restaurant Business between the age group 19 to 24 years. People in the age group 19 to 24 mostly prefer interested in these, and second place of age is 30 to 35 mostly go to direct restaurant to eat the food Coming to 25 to 29 in these age groups their interest in both side offline restaurant and online delivery food.

Occupation

Table 4.2.

Occupation	No of persons
Students	27
Business	14
Employees	5

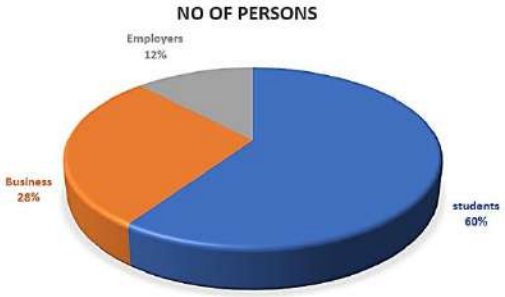

Fig 4.2: Pic chart showing of different occupation

In this collected date of responders, the responders are different occupations majorly involved students are 60%and doing businesspersons are 28% and employees are 12%.

After the Introduce of the Food Delivery App What was its Impact on the in House Sales?

Table 4.3.

Options	Responses
Increases	33
Decreases	13

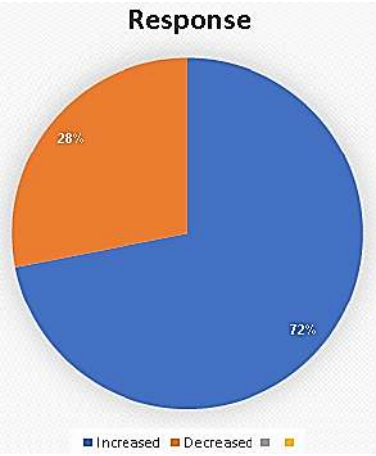

Fig 4.3: Percentage of people showing their choice of preference

According to the respondent's is a 72% maximum replied the restaurants of sales are increased via introduce of the delivery app.

Another 28% of responders is said restaurants of sales are decreased though introduce of the delivery app.

Why are Restaurants' Profit Margins So Low?

Table 4.4.

Options	Responses
Online food delivery	29
Time consuming	22
Noy interest move to restaurant	6

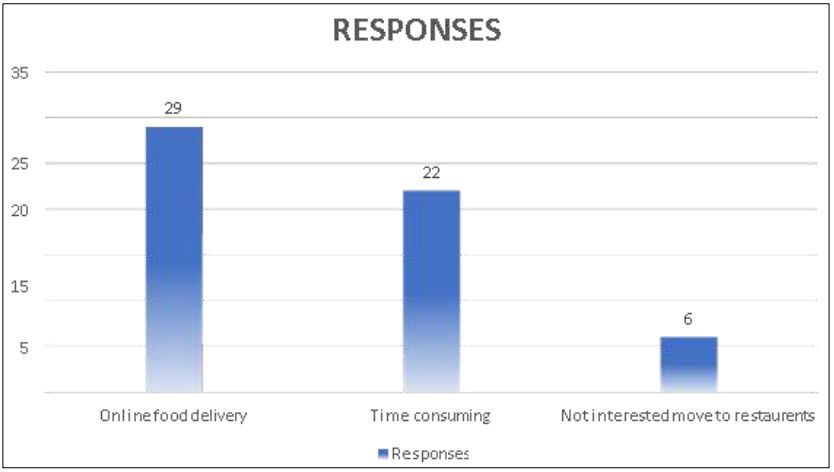

Fig 4.4: Percentage of people showing their choice of preference

According to the maximum (29) of the Responses their preferring Online food delivery so that is getting low margins or profit which does not link to with online delivery app.

And next second place of the responses (22) is when going customer in to direct restaurant, the will come late this is one of the reason getting low margins or profit of restaurants and some of not interested to go restaurants

Most of Restaurant are linked with Food delivery app?

Table 4.5.

Opinions	Responses
Yes	37
No	0
May be	9

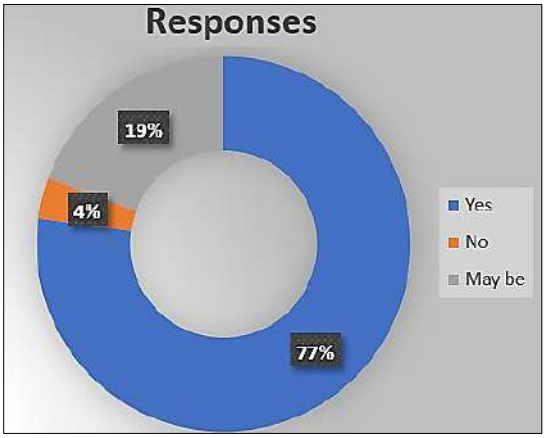

Fig 4.5: Percentage of people showing their choice of preference

Maximum 0of 89% respondents replied that the Restaurants are linked with online delivery apps like swiggy, Zomato.

Some respondents (20%) relied on may be linked or some restaurants are not linked and may be is (4%).

Which Method do you prefer to Order the Food?

Table 4.6.

	Responses
Online orders	18
Go to Restaurant	6
Both	22

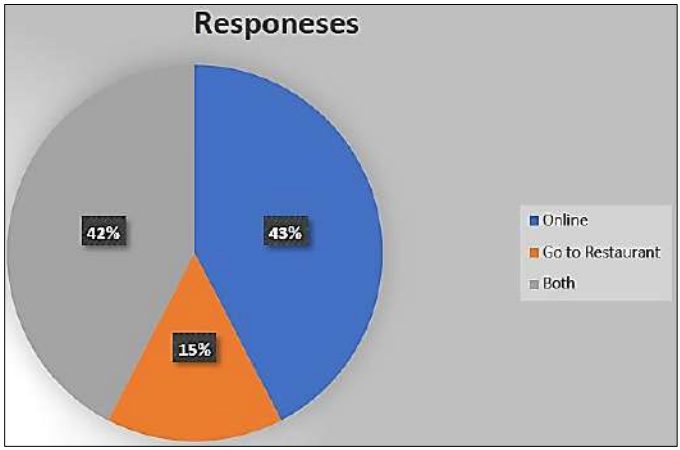

Fig 4.6: Percentage of people showing their choice of preference

According to the maximum respondents of 42% preferring both online food and offline direct restaurants foods. And 43% of respondents chosen to go online food ordering and only 15% of respondents chosen direct go to restaurants.

In your opinion which will take less for food?

Table 4.7.

Options	Responses
Food delivery App	29
Food Restaurants direct delivery	19

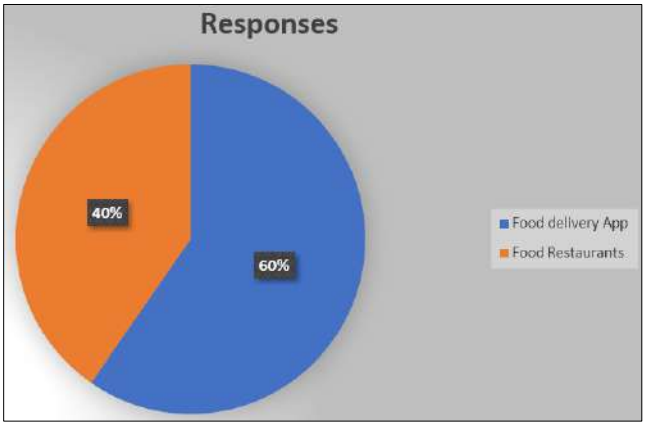

Fig 4.7: Percentage of people showing their choice of preference

Most of respondent (60%) replied that food order via food delivery app coming to in our responses.

Because of food delivery app the food tack come in different restaurants in the show which restaurants.

And another some responses (40%) replied to go through direct food restaurant provide delivery.

Have you ever used any Online Food Delivery App/Services?

Table 4.8.

Options	Responses
Yes	43
No	5

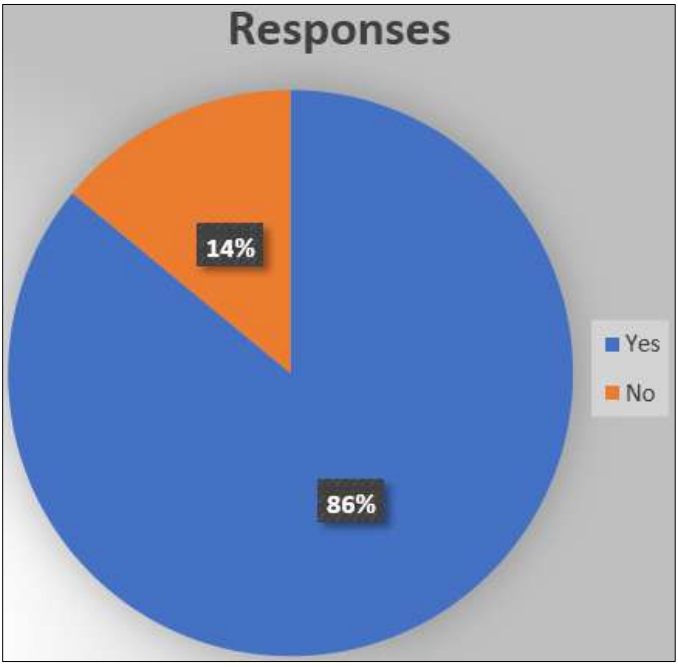

Fig 4.8: Percentage of people showing their choice of preference

According maximum responded (86%)replied that there are using food delivery apps to order food However there where only few(14%) who don't use online food order I think in them city's don't have online food delivery option, However there were only replied No very less numbers when compere to yes.

The important factor you consider most in choosing online delivery/service?

Table 4.9.

Options	Responses
we order food from online to save our time	24
To minimize transportation cost	14
At a time, order food from different restaurants	9
Cash less payment	2

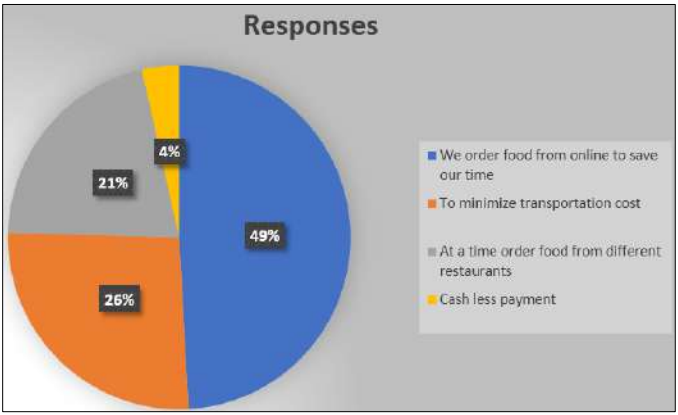

Fig 4.9: Percentage of people showing their choice of preference

According to most of respondents (49%) relied "we order from online to save our time "and next option most of respondents (26%) is to minimize transportation cost and at a time order food (21%) from different restaurant this two nearly get some responses.

Due to Food Delivery app the sales are?

Table 4.10.

Options	Responses
Increased	40
Decreased	2
May be not	7

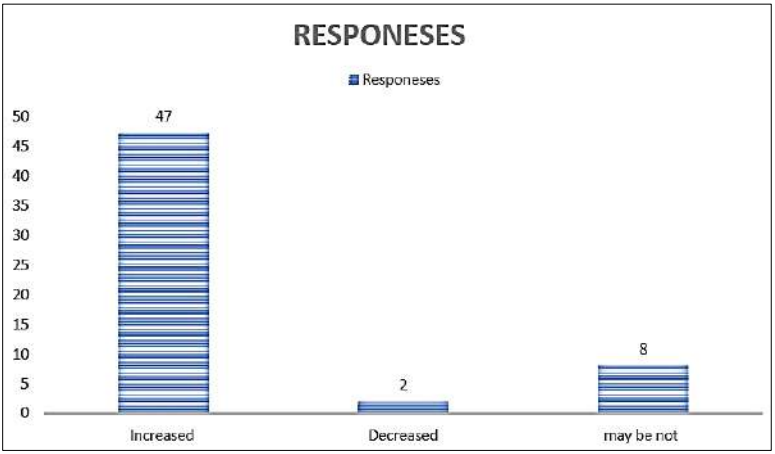

Fig 4.10: Percentage of people showing their choice of preference

Accounting Maximum respondents replied when restaurant linked with food delivery app the food sales are increased, however, there were only few relied decreased and some responses are may be increased or not increased food sales.

Which meal you typically order food online or direct Restaurant?

Table 4.11.

Options	Responses
Breakfast	4
Lunch	21
Snacks	8
Dinner	16

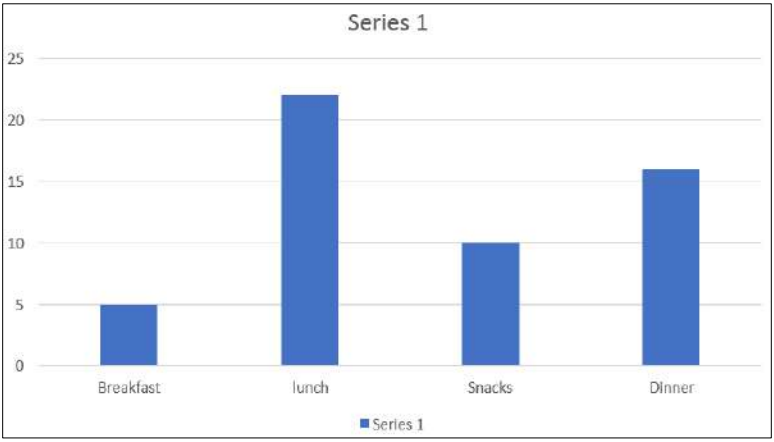

Fig 4.11: Percentage of people showing their choice of preference

Most of the respondents replied that is mostly eat in lunch time and its both offline direct restaurant and online ordering.

And after that mainly is a dinner, I think these is like birthday party and some occasion mainly night times However, there were other two options is only few breakfast and snacks.

Which online Food delivery company do you prefer?

Table 4.12.

Options	Response
Zomato	32
Swiggy	15
Uber eats	1

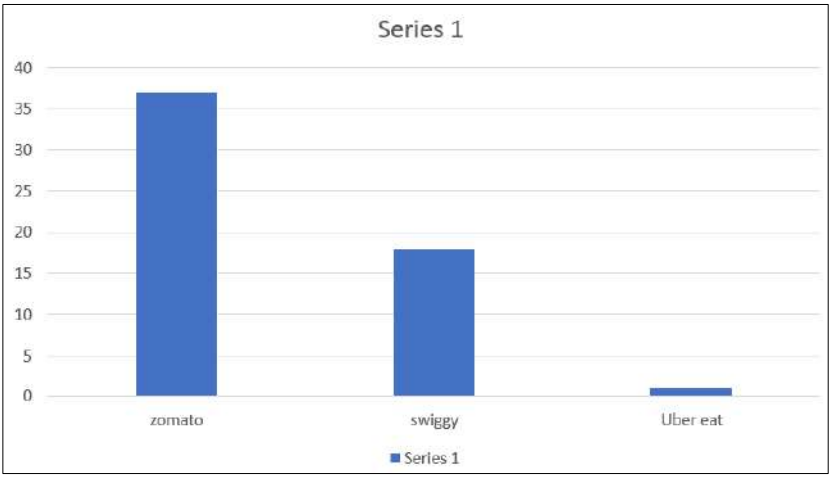

Fig 4.12: Percentage of people showing their choice of preference

According to maximum respondents replied are food ordering in Zomato, it is number one place India, and next it is second place is swiggy compere to Zomato comes to swiggy it second according to my respondents and last is uber eats it very few only.

Findings

The online ordering software will receive the orders from the customers and directly relay it to the kitchen staff.

Your business needs to maintain a competent presence at various search engines and social media platforms.

And during rush-hour/lunchtime, you don't have to place a staff dedicated to receiving orders at the counter. By using online ordering, you can shorten the queues at the counter, easily.

A good online ordering system will have an inbuilt analytics platform that will help you to track this data and channel it to sell better.

When customers order online, there are fewer distractions. They don't have to decide quickly on the items as there is no-one waiting to take the order.

Usually, there is no pressure to order. Hence, your customers spend more time on the menu. And, this is good for your business.

When the ordering process is easy, it increases the likelihood that the customer will complete their order. People want fast, immediate service which is why the user experience is critical when someone is ready to make a purchase.

Customers appreciate not having to sit in their car or the restaurant to wait for their food. Online ordering can streamline your systems in the kitchen. When customers send their orders online, it decreases the amount of time staff members need to spend on the phone. Instead, the team can complete the steps such as cooking the food, packaging it, and delivering it necessary to ensure that every meal is ready for your customers on time.

Customers want to know specifics about their food options, which is why it's smart to list details and descriptions in the online ordering system. Not only does an online menu provide more information about food options, but it allows customers to take the time they need to browse the menu.

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Chapter - 4

A Study on Entry of Jio and It's Marketing in Telecom Industry

Shayan Baruah
School of Commerce, Presidency University,
Bengaluru, Karnataka, India

Dr. Varsha PS
School of Commerce, Presidency University,
Bengaluru, Karnataka, India

Abstract

This study aims to know about Reliance Jio Info comm Ltd, also known as Jio, is an Indian mobile network operator that went live on the market on September 5, 2016. The introduction of Jio, which is owned by Reliance Industries, revolutionised the telecommunications industry. Based on research and studies undertaken in these domains, the success story of this new entrant and the management concepts implemented by the organisation were analysed in this project. The organisational structure, planning and marketing strategy, staffing and recruitment, SWOT analysis, PEST analysis, promotional strategy, the impact of the Jio launch, Government policies, controversies surrounding Reliance Jio, its ventures, collaborations, and future projects were also examined in depth.

Keywords: Jio, market penetration, telecom, market strategy, new entrants

1. Introduction

In the current environment, the competition among enterprises operating in India's telecom industry has become extremely severe, making it difficult for businesses to survive in the marketplace. India is currently recognised as having the second largest and most promising communication sector in the world (Middlemiss, 2017). The tremendous expansion and development of the Indian telecommunications industry can be attributed in large part to the industry's 1.19 billion subscribers. Over the past decade, the nation has witnessed dramatic growth and change in the telecom industry, and the telecom industry has contributed significantly to India's GDP growth. In addition, strong customer demand is a vital aspect contributing to the long-term growth and sustainability of the Indian telecommunications business.

This study focuses on Reliance Jio Infocomm Limited, also known as Reliance Jio, whose presence has resulted in the transformation of the entire country's telecommunications business. Reliance Jio is seen as a game-changer in the entire market, and its entry has had a negative impact on the sales, profitability, market share, and user base of the incumbent market participants, including Airtel, Idea, Vodafone, and BSNL. Reliance Jio's services are unique and highly satisfying, and the company has adopted a low-cost pricing plan. Currently, the greatest obstacle for businesses is the difficulty of enhancing business efficiency and employee productivity. The primary reason for this is the existence of disparate systems for managing various business processes, which results in data duplication and reduces overall efficiency.

2. Literature Review

According to Purkayastha, Kumar, and Lu (2017), with 1.19 billion users, the Indian telecommunications industry is the second largest in the world. In addition, the industry has emerged as one of the most promising and quickly expanding sectors in the nation. On the other hand, according to Panda & Shastri (2016), India is the fourth largest application economy in the world. The rapid expansion of the Indian telecommunications industry can be attributed to two key factors. The first and most important factor or explanation is the rising demand of the country's consumers. Customers on the Indian market are currently anticipating a telecom service provider who can offer services such as fast internet connectivity and an efficient mobile network at prices that are both affordable and practical.

However, Panigrahi (2017) has argued that the increasing competition has compelled existing market players to provide high-quality services at low prices in order to survive in the market. The policies and regulations of the Indian government have also played a significant role in accelerating the growth of the Indian telecommunications industry or sector. It has been determined that the policies have resulted in industry-wide reform, as businesses were encouraged to improve their services in the best and most effective ways possible.

According to Curwen and Whalley (2018), Reliance Jio's entry into the Indian telecom industry in 2016 resulted in strong competition and a substantial threat to the business models of established competitors. The unique nature of the services provided by Reliance Jio attracted both new and existing users of competitors such as Idea, Vodafone, BSNL, Airtel, and others in the telecom industry. Reliance Jio's business approach emphasised the

provision of high-speed and inexpensive 4G data, and this strategy has enabled the company to effectively penetrate the Indian market. The revolutionary rate arrangements proposed by Reliance Jio initially appeared implausible.

3. Research Methodology

The study used descriptive research design. Simple random procedure is used to collect the data.

Sample Size: A sample of 100 respondents are taken to undergo the survey.

4. Need of the Study

Prior to the introduction of Reliance Jio, telecom companies charged a premium for access to high-speed internet data. Reliance Jio introduced a new trend by offering high-speed internet data at affordable costs. With the goal of being their clients' "first call," Reliance Jio is working extremely hard to achieve this. Customers stated that they previously paid a premium for 2G and 3G internet services, but Reliance Jio has made 4G services available at a pricing lower than 2G, a revolutionary development in India.

5. Objective of the Study

1. To gain an overview of the present situation of the Indian Telecom Industry
2. To identify key attributes in the business model of Reliance Jio
3. To define the ways in which reliance Jio has affected other players in the telecom industry of India
4. To assess the key ways in which Reliance Jio has dominated the entire telecom industry
5. To recommend ways through which Reliance Jio can become leader in the Indian Telecom sector

6. Method of Survey

Structured questionnaire created in google form and collected the data

7. Research Approach

Percentage analysis was used to analyse data obtained. Descriptive analysis was used to interpret results.

8. Data Analysis

The comprehensive analysis conducted has confirmed that the Indian

telecom industry has become highly competitive, with a large number of market participants. Different businesses are implementing various strategies to retain clients and meet their demands in the most comprehensive manner. Primary and secondary research indicates that the presence of a high level of competition in the market has greatly benefited customers, as they are now able to obtain a wide variety of services from telecom companies, which in turn contributes significantly to meeting their needs in the most optimal manner. According to an analysis of the collected data, Reliance Jio's entry into the Indian telecom business has resulted in a digital transformation of the sector. Seventy percent of the 10 responders strongly agree with this statement, while the remaining thirty percent agree. The responders have further indicated that the voice call and mobile data services of Reliance Jio are technologically improved and upgraded. Respondents also indicated that, as a result of Jio's introduction into the market, other network providers were compelled to implement modern and upgraded technology in their services and entire business plan. This has contributed to the digital or technological transformation of the whole Indian telecom business. To remain competitive and retain their customer base, the other network providers in the country have aggressively implemented cutting-edge technologies. However, respondents have also stated that the ultimate beneficiaries of this digital revolution of the country's technical sector are the end consumers.

9. Findings, Suggestions & Limitations

With the assistance of Reliance Jio, the digital transformation has been carried out in an appropriate manner, according to the findings of primary research. Some of the company's core services, upon which its business model is based, are highly advanced, such as the mobile data, particularly 4G, and the voice call, which contributes significantly to the target market's happiness. In addition, Reliance's entry into the telecommunications industry has altered the industry's landscape, and the company's primary objective is to increase customer happiness by providing the best services to its target market.

The major suggestions of the research are more emphasis must be placed on the development of advanced services since, as a result of modernization, it is essential for telecommunications companies to provide customers with convenient advanced services, which may also boost the performance of the brand. Companies must determine on a regular basis what approaches they might implement to provide better services. Research and development must be the firm's primary priority, as it is a critical area where appropriate research may greatly aid in the launch of new services and, in turn, become one of the primary reasons for the firm's market success. This will directly contribute a

great deal to boosting client satisfaction and can also be of great assistance in acquiring a competitive advantage. In the entire telecom sector, customer retention is of the utmost importance, and Reliance should prioritise this issue in every way imaginable. The corporation is expected to employ any strategy that facilitates the retention of clients. This can be accomplished by providing discounts or other forms of appealing services. This can be quite helpful in influencing the purchase behaviour of the target market, and it can also provide many benefits for the organisation. Competitor analysis is vital since it reveals the strategies and activities of Reliance Jio's competitors, hence revealing the company's current market performance. Continuous competition analysis can be undertaken, allowing Reliance to determine how its services compare well to those of other telecom providers operating on the Indian market. More marketing and promotion-related efforts are required in rural areas since customers anticipate inexpensive telecom services. By doing so, Reliance Jio will be able to attract consumers living in rural areas and, in turn, would be able to give the firm with the strongest competitive edge imaginable.

Research limitations can be described as the characteristics or aspects that hinder a researcher's ability to conduct the study in the most optimal manner. Considered to be the most major and significant limitations of this study are time and resources. It can be claimed that the researcher will have limited time and resources available for analysing and identifying the total impact of Jio on the Indian telecom market. In addition, the researcher will be responsible for ensuring that the highest quality study is conducted within the allotted time and resources. The researcher will face hurdles in areas such as data collecting, analysis, and interpretation due to a lack of financial resources. In addition, the limited availability of literature on the Indian telecommunications market and the business model of Reliance Jio would be a key limitation of this study. Effective plans and strategies must be devised by the researcher in order to overcome the mentioned limitations and achieve the purpose and objectives of the present investigation.

10. Conclusion

As a result of research, it has been shown that a variety of factors have negatively impacted corporate performance. The prevalence of intense market competition is one of the company's greatest challenges. The industry's degree of competition is increasing at an accelerated rate, making it harder for enterprises to survive in the market. Therefore, one of the best strategies that Reliance Jio has implemented in the market is the adoption of a unique business model through which the business position is handled, which has contributed greatly to the company's ability to easily survive in the market.

Therefore, it is evident from the entire analysis that Reliance Jio offers a unique and modern type of services in the market, and that the bulk of users are turning towards this brand.

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Chapter - 5

Solar Energy System in India

Roshan Kumar Jaiswal
BBA Student, School of Commerce, Presidency University,
Bengaluru, Karnataka, India

Dr. Mounica Vallabhaneni
Assistant Professor, School of Commerce,
Presidency University, Bengaluru, Karnataka, India

1. Introduction

Conventional energy sources like coal, oil, natural gas, etc., are limited in quantity, and if these continue to be depleted at the present rate, these will be exhausted in the coming decades. Energy demand is resulting in the creation of fossil fuel-based power plants leading to substantial greenhouse gas emissions having an adverse impact on global warming and climate change.

Solar energy offers a clean, climate-friendly, abundant and inexhaustible energy resource to mankind. The costs of solar energy have been falling rapidly and are entering new areas of competitiveness. Solar Thermal Electricity (STE) and Solar Photo Voltaic Electricity (SPV) are becoming competitive against conventional electricity generation in tropical countries. Rooftop SPV in tropical countries can compete with high retail electricity prices. Solar Power installations worldwide are growing rapidly with nearly 18-20 Giga Watt (GW) expected to be installed in 2012.

Global Solar Scenario

The Global solar market is expected to have an installed capacity of 227 Gigawatts (GW) by 2016. Global solar installations, meanwhile, are expected to reach 46.8 GW per annum in 2016, up from 19.8 GW in 2011, with a Compounded Annual Growth Rate (CAGR) of 18.7 percent during the same period.

Experience of Solar Energy in India

India has high solar insolation. India being a tropical country receives adequate solar radiation for 300 days, amounting to 3,000 hours of sunshine equivalent to over 5,000 trillion kWh. Almost all the regions receive 4-7 kWh of solar radiation per sq. metre with about 2,300 – 3,200 sunshine hours/year, depending upon the location.

In July 2009, the Government of India unveiled a plan to produce 22 GW of solar power by 2020 under the Jawaharlal Nehru National Solar Mission (JNNSM). Solar Energy is undergoing a silent revolution in India. The falling prices of Solar panels are on the verge of coincidence with the growing cost of grid power in India.

Technology Cost

The installed capacity of solar power has grown at a rate of 40 percent per year over the last decade. As the industry has grown, the prices have seen cost reductions of 22 percent for each doubling of cumulative capacity over the last few decades.

Advantages of Solar Power

Solar Energy Provides the Best Viable Solution to Ensure Long Term Energy Sustainability with the Following Advantages

- Abundant, constant and perennial source, predictable
- Solar resource is much more evenly distributed across the State
- Low gestation period
- Available during the day time, helping in peak demand
- Can be generated at the point of consumption
- Reduced Transmission & Distribution losses
- No fuel cost
- Clean & green power i.e., no emission of CO_2, Sox, Nox etc.,
- Much firmer and complements Wind Energy.

In case of Solar Photo Voltaic (SPV) technology, the plant can be established from few kW to 100s of MW and it is also easily scalable. If SPV plants are established very near to Industrial Estates, the power produced can well be utilized at the same location drastically reducing T&D losses. Huge investment needed for transmission infrastructure could also be prevented. Solar Thermal Power Generation has an additional advantage of storing of heat energy, which can be used to produce electricity during non-sunny hours.

2. Solar Technologies

Solar Photovoltaic

Solar photovoltaic (SPV) cells convert solar radiation (sunlight) into electricity. A solar cell is a semi- conducting device made of Silicon materials, which, when exposed to sunlight, generates electricity. Solar cells are

connected in series and parallel combinations to form modules that provide the required power. PV modules are manufactured by assembling the solar cells after stringing, tabbing and providing other interconnections.

Solar Energy in Tamilnadu

Tamil Nadu has reasonably high solar insolation (5.6-6.0 kWh/sq. m) with around 300 clear sunny days in a year. Southern Tamil Nadu is considered to be one of the most suitable regions in the country for the development of solar power projects. With substantial solar insolation in the State, the strong commitment of the State Government and rapidly declining Solar Power costs, there are remarkable opportunities in the solar energy domain. This will enhance energy security, making Tamil Nadu the global reference in the solar energy sector.

As on 30.9.2012, India has a total installed capacity of 2,07,876 MW, out of which 20,162 MW is derived from Renewable Energy sources viz., Wind, Biomass, Solar etc. Knowing the importance of promoting solar power, the Government of India has launched the Jawaharlal Nehru National Solar Mission (JNNSM) under the National Action Plan for Climate Change (NAPCC). The goal of the Mission is to provide tariff subsidies to increase scale and drive down costs to grid parity for achieving a target of 22,000 MW by 2022 in a phased manner. India has also fixed a self-imposed renewable energy obligation with a separate solar energy obligation.

Vision of the Government of Tamilnadu

The Honorable Chief Minister Selvi J Jayalalithaa has a vision of developing Tamil Nadu as a world leader in Solar Energy by establishing 3000 MW by 2015. Tamil Nadu is committed to leading the country by generating 3000 MW of Solar Power by 2015 through a policy conducive to promoting solar energy in the State. This Government headed by the Humble Chief Minister Selvi J Jayalalithaa, intends to make Solar Energy a people's movement just as it did earlier in the case of Rain Water Harvesting.

Policy

This policy will be known as the - Tamil Nadu Solar Energy Policy - 2012‖. The Government of Tamil Nadu will undertake a review of this Policy as and when required in view of any technological breakthrough or any changes taking place in the policy at the National level.

Objectives

- To achieve energy security.

- To reduce carbon emissions.
- To project Tamil Nadu as a Solar Hub.
- To generate 3000 MW of Solar Energy by 2015.
- To achieve grid parity by 2015.
- To encourage indigenous solar manufacturing facilities in the State.
- To promote R&D in the solar energy sector and hybrid systems.
- To create skilled man power and employment in a new industry.

Target for Promotion of Solar Energy in the State

It is proposed to generate 3000 MW of Solar Energy by 2015.

Shortages and Constraints in Fossil Fuel

Out of the Nation's installed capacity of 2,07,876 MW, the contribution of Thermal (coal/oil/gas) based power is around 67% causing huge emission of Green House Gases, thus making renewable sources of energy one of the critical sources of power in the future.

- Coal production in India is falling short of projection and there is a need to import a quantity much larger than what was planned for earlier. Further, the price of imported coal has been hiked by 1.5 times over the last couple of years, causing concern with regard to the viability of operation of many thermal power stations. The major supplier Coal India Limited is already facing massive problems in providing coal for the existing plants.
- 55% of India's Coal Supplies to thermal power plants have been affected due to the recent regulatory changes made in Indonesia and Australia. In order to bridge the gap between demand and supply, taking into account the availability of fossil fuels, it is necessary to concentrate on renewable energy such as solar energy.

3. Renewable Energy Installations In Tamil Nadu

Tamil Nadu Leads the Country in Terms of Renewable Energy Installations

Tamil Nadu is the pioneer State in harnessing wind energy and remains at the No.1 position in the country. At present 40% of the country's installed wind energy capacity is contributed by Tamil Nadu. The erection of wind electric generators started during 1986 and gained momentum during the early 90's and again achieved huge growth during the years 2001-2006, during the tenure of the Tamilnadu Government headed by Selvi. J. Jayalalithaa as on

31.3.2012, the installed capacity of wind power has grown to 6,970 MW and an addition of 6000 MW is anticipated during the 12th Five Year Plan (2012-2017). This is due to the availability of high wind potential in Tamil Nadu as well as the conducive policies of the State Government. The contribution of energy from wind alone to the State grid during 2011-2012 is 9763 MU, which is around 12.6% of the total energy consumed by the State. Similarly, Tamil Nadu is a pioneer in establishing projects in the following Renewable Energy sectors also:

1. Biogases based co-generation in sugar mills
2. Biomass based power projects
3. Biomass based gasification projects
4. Bio-methanation projects from Industrial / Poultry / Sago waste.

Biomass is limited by the availability of feedstock. While wind energy is seasonal and also variable on a daily basis, solar energy has better predictability and follows the sunrise to sunset pattern on a daily basis. The generation profile of solar energy can complement the Wind energy profile and help stabilize the grid. Solar energy will play a vital role in the years to come since the cost of installation is coming down drastically and grid parity is anticipated before 2015.

4. Concentrated Solar Power (CSP) Based

Solar Thermal Power Plant

Solar Thermal Power systems, also known as Concentrating Solar Power systems, use concentrated solar radiation as a high temperature energy source to produce electricity using the thermal route. CSP requires 7.5 acres to 10 acres / MW. High temperature solar energy collectors are basically of three types:

Parabolic Trough Systems

Trough solar systems use parabolic curved/ trough shaped reflectors that focus the sun's energy onto a receiver pipe running at the focus of the reflector. The concentrated energy heats a heat transfer fluid (HTF), usually oil, flowing through the pipe. This fluid is then used to generate steam which powers a turbine. In a parabolic trough system, the receiver can reach 400° C and produce steam for generating electricity.

Power Tower Systems

The solar power tower plant comprises an array of heliostats (mirrors) which concentrates the sun's rays on the top of the high tower where the solar receiver is located. The receiver collects the concentrated sun radiation and

transfers the energy to generate steam. (The reflected rays of the sun are always aimed at the receiver, where temperatures well above 1000° C can be reached). The steam drives the turbo generator thereby producing electricity.

Parabolic Dish Systems

The solar dish generates electricity by focusing the sun's rays onto a receiver, which transmits the heat energy to an engine. The engine is a sealed system filled with hydrogen, and as the gas heats and cools, its pressure rises and falls. The change in pressure drives the pistons inside the engine, producing mechanical power. The mechanical power in turn drives a generator and produces electricity. The solar dish sterling system could be well deployed for decentralized power generation. Parabolic dish systems can reach 1000° C at the receiver, and achieve the highest efficiencies for converting solar energy to electricity.

Thermal Storage Systems

A major advantage in a Solar Thermal Plant compared to SPV/other renewable energy is the thermal storage system, i.e., before using the heat to generate steam, a part of the heat can be stored for later use/ during peak hours. Solar thermal energy can be stored at high temperatures using molten salts/other materials. A part of the heat energy is stored as heat and the rest is used for generating steam to run the steam turbine. The stored heat can be used later to generate power. The collector field can be sized according to the need. Thus, thermal Energy storage systems can extend the operational time of Solar Thermal Power plants by 6-12 hours. Storing heat energy is cheaper than storing energy in any other form. By building a sufficiently large heat storage system, it is possible to generate power even when the sun is not shining.

Development of Solar Power in Tamil Nadu

With average solar incidence of 5.5 - 6 kWh/m2/day, Tamil Nadu is amongst the States with the highest solar insolation in India. To retain its leadership position, Tamil Nadu will promote setting up of solar power projects to the extent of 3000 MW over a period of 3 years, as furnished above. Tamil Nadu will actively promote the solar energy sector by prescribing a certain percentage of electricity consumption through solar energy as mandatory. This will be progressively increased.

Solar Purchase Obligation (SPO)

The State will mandate **6% SPO** (starting with 3% till December 2013 & 6% from January 2014). This mechanism will require generation of 1000 MW by 2015.

Mechanism to Generate 3000 Mw By 2015

The 3000 MW of Solar Power will be achieved through Utility Scale Projects, Rooftops, and under REC mechanism as follows:

In utility scale out of 1500 MW, 1000 MW will be funded through SPO and balance 500 MW through Generation Based Incentive (GBI) provided by the Government.

5. Promoting Solar Roof Top Systems

The Government of Tamil Nadu will promote Solar Rooftops through the following measures:

i) Domestic Rooftop GBI

All domestic consumers will be encouraged to put up roof-top solar installations. A generation-based incentive (GBI) of Rs 2 per unit for first two years, re 1 per unit for next two years, and Re 0.5 per unit for subsequent 2 years will be provided for all solar or solar-wind hybrid rooftops being installed before 31 March, 2014. A capacity addition of 50 MW is targeted under this scheme.

ii) Promoting Rooftops in Government

a) Solar Home Lighting is being installed in 3 lakh houses under the Chief Minister's Solar Powered Green House Scheme (CMSPGHS) and will be completed by 2015-2016

b) Energization of Street Lights with Solar energy. The State will be energizing 1 lakh street lights through solar energy by 2015-2016.

c) All new Government/Local Body buildings shall necessarily install solar rooftops.

d) Existing Government/Local Body buildings will be provided with solar rooftops in a phased manner.

e) All Street Lights and Water Supply installations in local bodies will be energized through solar power in a phased manner.

Promotion of Solar Water Heating Systems

i) Public Buildings

The Government of Tamil Nadu has issued amendments to the Building Rules through the following Government Orders, making the use of solar water heating systems mandatory for all designated new Houses/buildings/ Marriage halls / hotels etc.,

- G.O. Ms. No. 112, Municipal Administration and Water Supply (MA1) Dept. dated 16.8.2002.
- G.O. Ms. No. 277, Housing and Urban Development (UD 1) Dept. dated 14.11.2002.
- The State will promote Solar Water Heating systems by suitably amending the relevant Acts of Municipalities/Corporations.

ii) Industries

Installation of Solar water heating systems will be made mandatory for industries having hot water boiler/ steam boiler using fossil fuel.

Development of Solar Parks

Utility scale solar parks may comprise 250 MW in sizes of 1 to 5 MW, 600 MW in sizes of 5 to 10 MW and 650 MW of sizes above 10 MW. Solar Power projects will be developed through competitive/reverse bidding. Solar Parks with a capacity of about 50 MW each will be targeted in 24 districts.

Procurement Policy of Solar Power

Tariff Based Competitive Bidding

As solar power is expensive compared to conventional/other renewable energy, a cost-effective methodology needs to be evolved to promote solar power generation systems. Tamil Nadu will select developers through Tariff based reverse/competitive bidding. The recent experiences of Germany and Spain also prove that competitive bidding is the best way for adoption by Governments. The Government of India through NTPC Vidyut Vyapar Nigam Ltd (NVVN) also follows the competitive bidding process. Investments through Joint Ventures by State Public Sector Undertakings will also be encouraged at competitive tariffs.

Renewable Energy Certificate and Carbon Credits

Renewable Energy Certificate (REC) mechanism promotes trading of solar power to meet solar purchase obligations (SPO). All the obligated entities committed to meet SPO will necessarily have to either produce solar power (captive) or buy solar power from TANGEDCO or purchase Solar RE Certificates for an equivalent quantity through the Power Exchange from the Promoters who have tradable RE Certificates.

Under this mechanism solar power promoters are eligible to possess one tradable RE Certificate per every 1000 units of energy (1 MWh) wheeled to the Distribution utility or to any other licensee.

The promoter can trade the Certificates to the SPO consumers within the regulated price band as dictated by the market forces from time to time. All solar power producers are eligible to avail of the Clean Development Mechanism (CDM) benefits to enhance the viability of the projects.

Single Window Agency (Teda)

Various statutory clearances that are essential for the development and commissioning of Solar Energy Projects will be handled by TEDA in co-ordination with the concerned departments/agencies. Guaranteed single window clearance will be provided through TEDA in 30 days so that the plants can be commissioned in less than 12 months.

Solar Manufacturing Facilities

The Government of Tamil Nadu will promote integrated solar generation and manufacturing parks which will house the entire ecosystem for solar manufacturing including wafer, cell and module making, and Balance of System (BOS) component manufacturing. Local solar manufacturing industry (around 1000 MW/annum) will result in substantial direct and indirect job creation in the supporting sectors. Manufacturing of Solar Thermal components will also be encouraged. The Government will encourage indigenous manufacturing of solar panels and other related equipment.

Incentives to Manufacturers

Appropriate tax incentives as per the Tamil Nadu Industrial Policy will be provided to attract investors from India and abroad. Tamil Nadu will actively support the growth of local manufacturing of solar components and ancillaries. A solar manufacturing ecosystem will be created that include solar research centers, test facilities, resource assessment facilities, educational institutions, training centers, etc.

Global Industry Leaders in Solar Energy Value Chain

Global majors will be invited to invest in the creation of manufacturing facilities in Tamil Nadu, with appropriate incentives as detailed above. Tamil Nadu will position itself as the regional hub for integrated solar manufacturing and technology development.

Exclusive Solar Manufacturing Parks

Lands will be identified for development of exclusive solar manufacturing parks. The State will promote setting up of solar manufacturing industries in these exclusive solar manufacturing parks to be established in the State.

Requirements for Poly Silicon Manufacturing

A Poly Silicon capacity of 10,000 MT would be required to yield silicon wafers sufficient to produce 1000 MW.

Preference in Industrial Parks

Preference will be given for establishing Solar manufacturing industries in the SEZs /Industrial estates/Parks *viz*., SIPCOT, SIDCO and similar Government organizations.

iii) Impact of Power - Cut in Tamilnadu

People are being put to severe hardships as an unannounced 12-hour power outage for the past one week has brought normal life as well as industry to a grinding halt in Salem city and district as across the State. With TANGEDCO officials confining themselves to repeating explanations about decline in wind power and other factors, the power cut – barring Chennai, which luckily has only one hour cut – has played havoc since it is the first time the State has been facing such an unprecedented shortfall in power. Despite assurances from the government that the power situation would improve from September, it has, in fact, worsened.

No supply

- Daylight hours, between 6 a.m. and 6 p.m., have no power supply, barring two hours; while in late evenings, a mere two-hour power supply is being maintained.
- From 10 p.m. to early morning, the officials resort to two-hour power cut for every one-hour supply leaving the general public gasping for breath.
- Even the UPS cannot be charged. It is utter chaos and confusion in TANGEDCO Head Quarters, ‖ says a senior official at Erode, which works out the power cut schedule for Salem and Erode districts.
- Many feel that since the volume of power outage is huge, a rational power cut schedule could not be worked out.

'In the dark'

We are taking orders from TANGEDCO Head Quarters. They call us over phone and tell us to effect power cuts. We comply. We are as much in the dark as the common man is about the power situation. But we are facing uncomfortable questions from the people here, ‖ says the official whose office is getting flooded with calls, which many times are abusive in nature.

The home-grown industries such as silver anklet units in which more than 25,000 people are engaged; weaving that provides livelihood to two lakh people; and other small and tiny industries have closed down. Construction and other industries that depend on power for various activities too face a similar situation.

Solar Energy Power Generated in Various States in India Gujarat

Gujarat has been a leader in solar power generation and contributes 2/3rd of the 900 MW of photovoltaics in the country. The State has commissioned Asia's biggest solar park at Charanka village. The park is already generating 214 MW solar power out of its total planned capacity of 500 MW. The park has been functioning on a multi-developer and multi-beneficiaries' paradigm and has been awarded for being the most innovative and environment-friendly project by the CII.

With a view to make Gandhinagar a solar city, the State government has launched a roof-top solar power generation scheme. Under this scheme, the State plans to generate five megawatts of solar power by putting solar panels on about 50 state government buildings and on 500 private buildings. The State has also a plan to emulate this project in Rajkot, Surat, Bhavnagar and Vadodara in 2012-13.

The State plans to generate solar power by putting solar panels on the Narmada canal branches. As a part of this scheme, the State has already commissioned a one megawatt solar plant on a branch of the Narmada Canal near Chandrasan area of Anand taluka. This also helps by stopping 90,000-liter water/year of the Narmada River from evaporating.

Rajasthan

Next to Gujarat, Rajasthan is India's sunniest state, and many solar projects have been proposed. The 40 MW photovoltaic Dhirubhai Ambani Solar Park was completed in April 2012. A 250 MW compact linear Fresnel reflector (CLFR) plant is under construction, consisting of two 125 MW sections.

Maharashtra

The Shri Sai Baba Sansthan Trust has world's largest solar steam system. It was constructed at the Shirdi shrine at an estimated cost of Rs.1.33 crore, Rs.58.4 lakh of which was paid as a subsidy by the renewable energy ministry. The system is used to cook 50,000 meals per day for pilgrims visiting the shrine, resulting in annual savings of 100,000 kg of cooking gas and has been designed to generate steam for cooking even in the absence of electricity to

run the feed water pump for circulating water in the system. The project to install and commission the system was completed in seven months and the system has a design life of 25 years.

Applications

Rural Electrification

Lack of electricity infrastructure is one of the main hurdles in the development of rural India. India's grid system is considerably under-developed, with major sections of its populace still surviving off-grid. As of 2004 there are about 80,000 unelectrified villages in the country. Of these villages, 18,000 could not be electrified through extension of the conventional grid. A target for electrifying 5,000 such villages was set for the Tenth National Five-Year Plan (2002–2007). As of 2004, more than 2,700 villages and hamlets had been electrified, mainly using solar photovoltaic systems.[5] Developments in cheap solar technology are considered as a potential alternative that allows an electricity infrastructure consisting of a network of local-grid clusters with distributed electricity generation.[8] It could allow bypassing (or at least relieving) the need to install expensive, lossy, long-distance, centralized power delivery systems and yet bring cheap electricity to the masses. Projects currently planned include 3000 villages of Orissa, which will be lighted with solar power by 2014.

Solar Lamps and Lighting

By 2012, 46,00,000 solar lanterns and 861,654 solar powered home lights have been installed. These typically replace kerosene lamps and can be purchased for the cost of a few months' worth of kerosene through a small loan. The Ministry of New and Renewable Energy is offering a 30% to 40% subsidy for the cost of lanterns, home lights and small systems up to 210 Wp.20 million solar lamps are expected by 2022.

Agricultural Support

Solar PV water pumping systems are used for irrigation and drinking water. The majority of the pumps are fitted with a 200–3,000-watt motor that are powered with 1,800 Wp PV array which can deliver about 140,000 liters of water per day from a total head of 10 meters. By 30 September, 2006, a total of 7,068 solar PV water pumping systems had been installed,[8] and by March 2012, 7,771 had been installed. Solar driers are used to dry harvests before storage.

Solar Water Heaters

Bangalore has the largest deployment of rooftop solar water heaters in

India. These heaters generate an energy equivalent of 200 MW. Bangalore is also the first city in the country to put in place an incentive mechanism by providing a rebate of 50 on monthly electricity bills for residents using roof-top thermal systems. These systems are now mandatory for all new structures. Pune, another city in the western part of India, has also recently made installation of solar water heaters in new buildings mandatory.

Challenges and Opportunities

Land is a scarce resource in India and per capita land availability is low. Dedication of land area for exclusive installation of solar arrays might have to compete with other necessities that require land. The amount of land required for utility-scale solar power plants—currently approximately 1 km^2 for every 20–60 megawatts (MW) generated [8] —could pose a strain on India's available land resource. The architecture more suitable for most of India would be a highly distributed set of individual rooftop power generation systems, all connected via a local grid [8]. However, erecting such an infrastructure, which does not enjoy the economies of scale possible in mass, utility-scale, solar panel deployment, needs the market price of solar technology deployment to substantially decline, so that it attracts the individual and average family size household consumer. That might be possible in the future, because PV is projected to continue its current cost reductions for the next decades and be able to compete with fossil fuel [5].

Some noted think-tanks [5] recommend that India should adopt a policy of developing solar power as a dominant component of the renewable energy mix, since being a densely populated region in the sunny tropical belt, the subcontinent has the ideal combination of both high solar insolation and therefore a big potential consumer base density.[5] In one of the analyzed scenarios, India can make renewable resources such as solar the backbone of its economy by 2050, reining in its long-term carbon emissions without compromising its economic growth potential.

According to a 2011 report by Bridge to India and GTM Research, India is facing a perfect storm of factors that will drive solar photovoltaic (PV) adoption at a "furious pace over the next five years and beyond". The falling prices of PV panels, mostly from China but also from the U.S., have coincided with the growing cost of grid power in India. Government support and ample solar resources have also helped to increase solar adoption, but perhaps the biggest factor has been needing. India, "as a growing economy with a surging middle class, is now facing a severe electricity deficit that often runs between 10 and 13 percent of daily need" [4].

Government Support

Solar Radiation Resource Assessment stations in India

51 Solar Radiation Resource Assessment stations have been installed across India by the Ministry of New and Renewable Energy (MNRE) to monitor the availability of solar energy. Data is collected and reported to the Centre for Wind Energy Technology (C-WET), in order to create a Solar Atlas.

The government of India is promoting the use of solar energy through various strategies. In the latest budget for 2010/11, the government has announced an allocation of 10 billion (US$182 million) towards the Jawaharlal Nehru National Solar Mission and the establishment of a clean energy fund. It is an increase of 3.8 billion (US$69.2 million) from the previous budget. This new budget has also encouraged private solar companies by reducing customs duty on solar panels by 5% and exempting excise duty on solar photovoltaic panels. This is expected to reduce the cost of a roof-top solar panel installation by 15–20%. The budget also proposed a coal tax of US$1 per metric ton on domestic and imported coal used for power generation. Additionally, the government has initiated a Renewable Energy Certificate (REC) scheme, which is designed to drive investment in low-carbon energy projects.

The Ministry of New and Renewable Energy provides 70 percent subsidy on the installation cost of a solar photovoltaic power plant in North-East states and 30 percentage subsidies on other regions. The detailed outlay of the National Solar Mission highlights various targets set by the government to increase solar energy in the country's energy portfolio.

The Mysore City Corporation has decided to set up a mega solar power plant in Mysore with 50% concession from the Government of India. The Maharashtra State Power Generation Company (Mahagenco) has made plans for setting up more power plants in the state to take up total generation up to 200 MW. Reeling under an acute power crisis, the Government of Tamil Nadu has recently unveiled its new Solar Energy Policy which aims at increasing the installed solar capacity from the current approximate of 20 MW to over 3000 MW by 2015. The policy aims at fixing a 6% solar energy requirement on industries and residential buildings for which incentives in the form of tax rebates and current tariff rebates of up to Rs.1 / unit will be applicable to those who comply with the Solar Energy Policy. The policy also gives an option to those industries/buildings who do not want to install rooftop solar photo-voltaic systems to invest in the government's policy and be given the same incentives as explained above.

iv) Conclusion

Research and Development on solar technologies / solar thermal storage systems, testing facilities towards the development of solar technologies will be encouraged. Technology Demonstrations on innovative projects in association with reputed institutions will also be encouraged. To effectively implement this policy and to achieve the intended objectives, the Tamil Nadu Energy Development Agency (TEDA) will promote capacity building in the area of Solar Energy.

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Chapter - 6

Educational Setup by a Global Repute Company of Greater Noida (Uttar Pradesh): An Initiative under Corporate Social Responsibility

Unnati Jaiswal
School of Commerce, Presidency University,
Bengaluru, Karnataka, India

Dr. Annette Christinal
School of Commerce, Presidency University,
Bengaluru, Karnataka, India

Abstract

This report was carried out to divulge the main aspect of a company's social responsibility towards the society, specifically the vicinity in which they are operating. The company has an industrial unit in a village of Greater Noida (Uttar Pradesh) and has adopted the villages within 5kms of radius. The report provides an analysis and evaluation of current and prospective performance of students enrolled by the trust in a school started by them for the village students. The sample taken was of 55 students of two nearby villages. The method of analysis included questionnaires, interaction with the teachers, students, parents and the employees of the trust, along with that inspection was personally conducted to ensure no loopholes were there and its fixture if any. The findings suggest that the company has to follow some standard procedures to ensure regular attendance of these students enrolled by them. A regular check on the teachers needs to be maintained to match the educational standards expected, so as to fully ensure their responsibility towards the society. The results showed that the engagement of the students in their household chores left them with little time to attend school in case of girl students and various other factors affected the performance of the students overall.

Keywords: Corporate Social Responsibility, Impact assessment, student's performance

1. Introduction

"Social responsibility (is the) responsibility of an organisation for the

impacts of its decisions and activities on society and the environment through transparent and ethical behaviour that is consistent with sustainable development and the welfare of society; takes into account the expectations of stakeholders; is in compliance with applicable law and consistent with international norms of behaviour; and is integrated throughout the organisation." (Working definition, ISO 26000 Working Group on Social Responsibility, Sydney, February 2007). Corporate social responsibility (CSR is a strategic initiative that needs to be undertaken by every company and industrial units. It needs to be planned carefully while taking in consideration the nearby area, its requirements and what a company can provide to the community in which they are serving their business unit. CSR is mainly a contribution to the society as a whole but more explicitly for the area within which their operations undertake. It's basically a concept of giving in return for the basic utilities or resource in use from the area where it operates. Due to the expansion of businesses and global summon, it has become all the more important for establishments to put in their efforts towards serving the community. A business can only prosper when they go hand in hand with the communities they operate within. According to a study done by Hewitt & Associates, 230 workplaces with more than 100,000 employees were looked upon and found out that more the company is actively involved in environmentally and socially, the more its employees are engaged with the company. This shows that CSR is not only about contributing to the society but also towards its employees. In addition to that, "The Society of Human Resource Management" found out those companies with highly engaged employees have three times the earnings per share as compared to the companies with low employee engagement due to low sustainability programs. This also throws a light upon the fact that somewhere CSR and Human Resource Management are inter linked with each other. Both the processes involve dealing with people. This adds up to a new dimension of its own which if garnered further could result into a changing the whole scenario of CSR. In more years to come and the speed at which globalization is taking place, Corporate Social Responsibility would keep on changing and growing to meet the demands of the society at large. With active involvement of the establishments, CSR will bring a revolution in how the industries function and it will be beneficial environmentally and socially.

"We are committed to creating economic value, but we are not indifferent to how we do it… Progressive businesses are gaining competitive advantage by responding to societal signals… We prosper by helping society to prosper." (Idar Kreutzer, CEO, Storebrand, 2005).

2. CSR Policy of the Trust

The CSR initiatives of the trust have aimed at integrating the economic, social, environmental imperatives for ensuring sustainability. With growing years, there came a shift in the modus operandi of the trust into to provide education to the young ones whose parents can't afford to send their children to school or are not willing to provide them education. This also included empowerment of women and girl child.

3. Structure of the CSR Wing of the Trust

The trust involved in the research report is a community development wing of the main company and is registered under the Indian Truest Act, 1883 and forms a part of the CSR department of the company. The trust has direct involvement in nearby villages of Kakrala, Aagar, Nagla. The study of the students undertaken was from the villages of Kakrala and Aagar.

4. Objectives of the Study

4.1 To assess the impact of the enrolled students under the project of the CSR activity.

4.2 To check the viable reasons behind the increase dropout rate of the students enrolled.

4.3 To highlight the effectiveness of a CSR initiative under taken by the company.

5. Methodology

5.1 Sampling

The population in this research was students aged 9-12 years from two nearby villages who were enrolled in the school by the company.

5.2 Sampling technique

Purposive sampling technique was used for the research and the sample size taken was of 55 students.

6. Findings

6.1 It was found that the female students were more than their male counterparts. Thus, the efforts of the project could be easily seen.

6.2 The attendance was satisfactory which shows that the students were quite regular and they enjoyed coming to the school but some students who were continuously not coming to the school for a long gap were paid a visit in their village to know the reason behind their week long gap.

6.2.1 The reason at hand was that the girls were made to do the house chores as per the frame of mind of the villagers; a girl's priority is her home not education.

6.2.2 The reason behind the boys who were not present in the class was their parents believed that being from an underprivileged society our sons have to follow the footsteps of the male counterpart of the family.

6.3 To assess the performance level of the students, a quick verbal test was conducted where we found that the students were reluctant to answer the questions even though they knew the answer when asked personally. Overall the students were having less confidence to stand up and answer.

6.4 Student's performance was found out to be just average as they were not completing their home assignments. It was a feedback given by the principal as well as the teacher concern.

6.4.1 The reason found out after interacting with the students was that their parents being illiterate couldn't help them out with their studies.

6.4.2 Another reason found out was that the girls specifically had to help their mothers in the household after returning from school.

6.4.3 To assess the performance level of the students, a quick verbal test was conducted where we found that the students were reluctant to answer the questions even though they knew the answer when asked personally. Overall the students were having less confidence to stand up and answer.

6.5 The motivation factor involved was both due to the parents and instructors from the company trust for students to attend the school though the major contribution made was from the mothers who had high influence on their children.

6.6 It was found out that most of the students were able to read, write and speak though they could not match the expected literacy level in comparison to other private schools outside the village.

6.7 Some parents who were concerned about their child's education shifted them to private schools that offered better education after seeing a significant improvement in their child due to the initiative taken up by the company.

6.8 During the study it was found that the teachers were not qualified as per the guidelines of the government but the company ensured an enquiry on this matter.

6.9 The school lagged behind various parameters such as the class strength exceeded 100 students in one batch, no extracurricular activities were offered to the student which is of prime importance for the age group of 9-12 years and mid-day meal given was not consumable.

6.10 A sum of Rs 1200 being ear marked by the govt. did not reach the concerned authorities and only Rs 300 was being provided. The difference in balance figure was unaccountable.

6.11 As per the new government guidelines, the students were to be registered according to their age no matter what they were capable of understanding ie if a student is 10 years old then he/she has to be enrolled in 5^{th} class irrespective of the performance level.

6.12 The teachers justified their inability to teach them properly by making an excuse of not being able to punish the students as corporal punishment was banned by the government.

6.13 Trust provided support classes to weak students free of cost.

6.14 Trust actively conducted monthly follow ups to ensure the overall development of the students and also by arranging PTA meets.

7. Challenges Faced By The Trust

There were various challenges that occurred in the implementation of school for the children in the village. These are common issues in villages were maximum population is illiterate.

7.1 The parents were reluctant to send their children to school as they are not aware of its benefits and mainly the importance of education. The trust however with vigorous sessions with the parents was able to convince so of them. The initiative taken by the trust should be implemented on a large scale as education is a field of prime importance.

7.2 There was lack of motivation for the children to go to school as their parents were not supportive.

7.3 Another area of problem was that the parents weren't sure about the safety of their girl child as they were hesitant to let their girl child study in the same class with the boys.

7.4 Children were also involved in the household chores and everyday

school activity would require them to set aside the work they were doing before, lessening the total money earned by the family. It was noticed that the work they performed required the involvement of every family member to complete the task which would provide them a sum of Rs. 100 for a week.

8. Recommendations

8.1 They should conduct a workshop for the teachers to enhance their own skills and encourage them to develop new teaching tools.

8.2 A proper framework regarding course design should be provided to the resource centre, which is in relevance with the culture of the village community.

8.3 As per the new government guidelines, the trust should make support classes mandatory to the students who are weak in studies.

8.4 The students should be encouraged to discuss about their daily activities with their parents and siblings.

8.5 The teachers should motivate the students by providing them with some sort of non monetary appreciation.

8.6 They should form a group of the existing peer leaders who would only be in charge of the feedback and the problems concerning the students.

9. Conclusion

During the study it was found that the initiative taken by the company was definitely an uphill task to educate the future leaders of our country especially their parents about the motivation they need to provide to their children to go to school. It did make an impact and with continuous check and little more involvement, it will positively pay off in future for the betterment of the society. The trust at the same time had been very active in providing quality education. This was done in collaboration with a reputed resource centre which provided the course material for the students. CSR initiative is a duty of every enterprise and the society is its responsibility that needs to be taken care. This is the least a company can perform and its regulation should be mandatory. This will solve two things at the same time, one being the upliftment of the society and secondly, it will generate awareness for the companies to be liable to take this task at hand and put in some part of their earnings in this initiative.

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Chapter - 7

A Study on Sales Forecasting of Reliance Retail Stores Using Python

Dr. Ch. Sahyaja
Assistant Professor, School of Commerce, Presidency University,
Bengaluru, Karnataka, India
Tejas Shenoy
School of Commerce, Presidency University,
Bengaluru, Karnataka, India

Abstract

This study mainly focusses on the forecasting of sales in reliance retail stores and the sample undertaken in this study is from reliance stores and the sample data is consisting of 50 days sale from 01-jan-2021 to 20-Feb-2021 and Weekly_Sales data consist of different features such as store, Day of week, date, open, promo, state holiday and school holiday etc. And the objective of the study is "Sales Forecasting of reliance retail stores using python".

Keywords: Sales Forecasting, Reliance, Retail stores, Python

1. Introduction

Kahn (2017) highlights the importance of various visual components, such as where an image appears on a product package and the shape of that package. Investigations of packaging typically take a shape or design perspective, but Krishna, Cian, and Aydinoglu (2017) propose extending this view to determine how the different layers of a package might affect consumer shopping engagement. The packaging and product thus consists of three hierarchical levels: the inner core, which is the product itself (e.g., pill, piece of chocolate); an intermediate level that consists of the container (e.g., bottle for pills, wrapper that holds chocolate); and an outer layer, which is what is immediately evident to consumers prior to their purchase (e.g., carton that contains the bottle that contains the pill; fancy box that holds all the chocolates). These authors cite the importance of understanding the roles of these three different layers, across both a physicality dimension and a functional dimension. That is, packaging levels exert a significant influence on consumers' sensory experiences.

The second type of marketing strategy views the customer as the dominant focal unit – irrespective of the brand. Retailers that use this strategy are concerned with topics such as customer acquisition, retention, and customer lifetime value (CLV). Stated differently, such a retailer has a "customer management mind set," which has the following advantages. First, it proposes a specific customer offer that aligns with customers' past behaviour and needs, thereby fostering satisfaction and retention second, it facilitates effective resource allocation because this focus aligns the resources spent with the customers' worth. Third, as the communication with customers is largely direct (e.g., mail, email, web) and thus private, it is more difficult for competitors to interpret, understand, and copy a successful customer approach.

2. Review of Literature

According to Agrawal, N., & Smith, S. A. (1996). The International Review of Retail. In the rapidly evolving retail landscape, consumers' needs still drive their purchase decisions. Shoppers make most consumption decisions, yet newer technologies (e.g., Internet of things, robots), newer business models (e.g., subscription models), and big data/predictive analytics suggest that the shopping process is on the verge of a quantum leap into an unknown shopping realm. The result is a powerful need to understand critical retailing areas in which innovations are changing the game, so that we can better understand where the retailing field will be evolving in the future.

According to Aastrup, J., & Kotzab, H. (2010), Technological change continues to be a game changer for retailing that can simultaneously benefit consumers and retailers. For example, technology enables consumers to make more informed decisions, receive more targeted and beneficial offers, and obtain faster service.

Inman and Nikolova (2017) draw attention to how technologies can benefit both consumers and businesses, which ultimately enhance the businesses' profitability. They highlight mobile apps, scan-and-go technologies, self-checkouts, QueVision, and smart shelf technology. For example, self-check- out technology helps shoppers scan, bag, and pay for products without any need to interact with a cashier.

According to Agrawal, N., & Smith, S. A. (1996) Visual Display & Merchandise Offer Decisions Today's consumers are bombarded with merchandise and offers. The question is how to design and deliver offers that stand out. Understanding this can help retailers decide how, when, and where to display merchandise (and associated offers), according to the channel format (in store or online).

3. Research Methodology

The secondary data used in this research is generated based on the End of the Day sales of Reliance Retail stores such as Gollapudi Reliance Super store (TCE6), Bhavanipuram Reliance Smart (3209), MG road Reliance Smart Point performance.

The sample data is consisting of 50 days sale from 01-jan-2021 to 20-Feb-2021 and Weekly_Sales data consist of different features such as store, Day of week, date, open, promo, state holiday and school holiday etc.

Objective of the Study

The main objective of this study is to "To study and forecasting the sales of Reliance Retail stores by using linear regression and know the minimum sales of the day and maximum sales of the day along with weekly sales of the corresponding superstores its performance on promotional days and correlation between gross sales and discounts

Contribution of the Study

This study helps in the assessment of how individual products are profitable to the company. This study gives certainty and profitability of each product such as:

1. Manpower planning on Promotional days.
2. Forecasting the day wise sales and departments wise increasing reports and suggestions.
3. Future planning of indents and identifying fast moving products on day wise

4. Data Analysis & Interpretation

Analysis using Python

The complete analysis is processed using software python with various packages such as NUMPY, pandas, linear Regression and statistical tool such as using SPSS for linear regression model in training and testing the data and detailed output:

```
import numpy as np import pandas as pd

import matplotlib. pyplot as plt

from sklearn.model_selection import train_test_split from

sklearn.linear_model import Linear Regression from scipy.special import
```

boxcox1p

import seaborn as sns

features=pd.read_csv("C:/Users/subbarao/OneDrive/Desktop/project data/Features.csv")

store=pd.read_csv("C:/Users/subbarao/OneDrive/Desktop/project data/stores.csv")

Code for Training Data

train=pd.read_csv("C:/Users/subbarao/OneDrive/Desktop/project data/train1.csv")
test=pd.read_csv("C:/Users/subbarao/OneDrive/Desktop/project data/test.csv") features.head(10)

Interpretation

Training the data by using the store date and weekly sales train=train.groupby(['Store','Date'])['Weekly_Sales'].sum()
train=train.reset_index()

train.head(10)

Code for Merging the Data

data=pd.merge(train,features,on=['Store','Date'],how='inner')
data.head(10)

data=pd.merge(data,store,on=['Store'],how='inner') data.head(10)

Interpretation

Merging train and features data by inner join sorting the data by date. data=data.sort_values(by='Date')

data.head()

Visualization for Weekly Sales Data

sns.boxplot(x='Type',y='Weekly_Sales',data=data)
sns.countplot(x="Type", data=data)

store.head(45)

data["Weekly_Sales"].plot.hist()

sns.countplot(x="IsHoliday", data=data) data.isnull().sum()

Interpretation

index	0
Store	0
Date	0
Weekly_Sales	0
Temperature	0
MarkDown1	12
MarkDown2	12
MarkDown3	12
MarkDown4	12
MarkDown5	12
Fuel_Price	0
CPI	0
Unemployment	0
Is Holiday	0
Type	0
sale	0
dtype: int64	

4.1 Box Plot

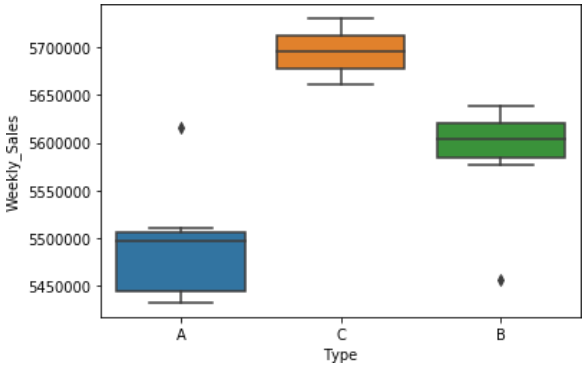

Fig 4.1: The Figure shows weekly sales of stores

Interpretation

The above Boxplot represents the weekly sales and outliers corresponding to their store (A, B, C). Store A maximum Weekly sales between 5450000 to 5500000.Store B maximum Weekly sales between 5550000 to 5650000.Store C have maximum Weekly sales between 5750000 to 5800000. The outliers are sales of promo days of store A and store C outlier is store is closed for 3 hours for sanitization purpose.

4.2 Histogram

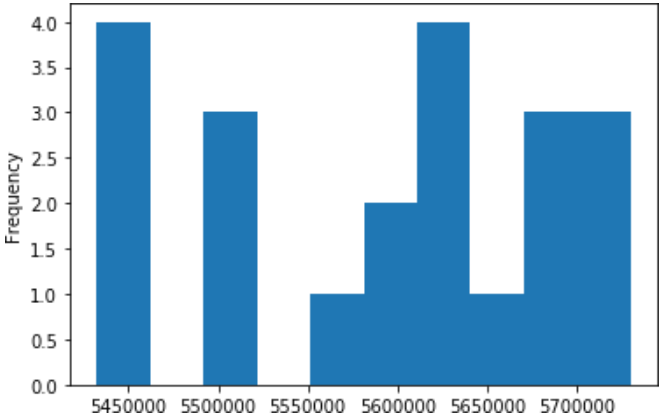

Fig 4.2: The Figure shows weekly sales and its Frequency

Interpretation

The above Bar chat indicates the Frequency of Weekly_ sales, Weekly sales around 5450000 is occurred 4 times in total 50days, Weekly sales around 5500000 is occurred 3 times in total 50days, Weekly sales around 5550000 is occurred 1 time in total 50days, Weekly sales around 5600000 is occurred 2 times in total 50days Weekly sales around 5650000 is occurred 4 times in total 50days. The maximum frequency is 4 and amount is 5450000 and 5650000. The distribution scale is 50000.

4.3 Linear Regression

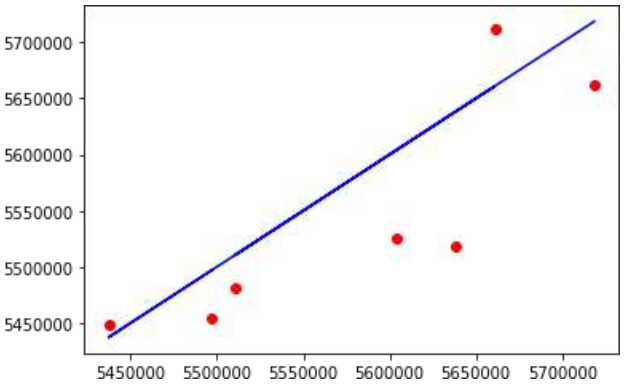

Fig 4.3: The figure shows Linear Regression of weekly sales

Interpretation

The above linear Regression indicates weekly sales data. In statistics,

linear regression is a linear approach to modelling the relationship between a scalar response and one or more explanatory variables also known as dependent and independent variables. The case of one explanatory variable is called simple linear regression; for more than one, the process is called multiple linear regression.

Root_mean_square_error=np.sqrt(np.mean(np.square(y_test-y_pred)))
print(Root_mean_square_error)

64723.04893832914

4.4 Correlation in SPSS

```
CORRELATIONS
  /VARIABLES=SALE DISCOUNT
  /PRINT=TWOTAIL NOSIG
  /MISSING=PAIRWISE.
```

Correlations

[DataSet0]

Correlations

		SALE	DISCOUNT
SALE	Pearson Correlation	1	-.108
	Sig. (2-tailed)		.599
	N	20	20
DISCOUNT	Pearson Correlation	-.108	1
	Sig. (2-tailed)	.599	
	N	20	20

```
NONPAR CORR
  /VARIABLES=SALE DISCOUNT
  /PRINT=SPEARMAN TWOTAIL NOSIG
  /MISSING=PAIRWISE.
```

Nonparametric Correlations

[DataSet0]

Fig 4.4: The figure shows correlation between sale and discount

Interpretation

The above correlation indicates there is a positive correlation between sale and discount and both are in same direction the Pearson correlation between sale vs sale is 1 and sale vs discount is 0.59. There is a positive correlation between sale and discount and both are in same direction the Pearson correlation along two tailed test between discount vs sale is .599 an and discount vs discount is 1.

4.5 Correlation

Correlations

[DataSet0]

Descriptive Statistics

	Mean	Std. Deviation	N
GROSS_SALE	5609371.094	106288.3656	24
DISCOUNT	1705743.792	178112.4708	24

Correlations

		GROSS_SALE	DISCOUNT
GROSS_SALE	Pearson Correlation	1	.130
	Sig. (2-tailed)		.544
	Sum of Squares and Cross-products	2.598E+11	56666644397
	Covariance	11297216654	2463767148
	N	24	24
DISCOUNT	Pearson Correlation	.130	1
	Sig. (2-tailed)	.544	
	Sum of Squares and Cross-products	56666644397	7.297E+11
	Covariance	2463767148	31724052247
	N	24	24

```
NONPAR CORR
  /VARIABLES=GROSS_SALE DISCOUNT
  /PRINT=SPEARMAN TWOTAIL NOSIG
  /MISSING=PAIRWISE.
```

Fig 4.5: The figure shows correlation between sale and discount

Interpretation

There is a positive correlation between sale and discount and both are in same direction the Pearson correlation along two tailed test between sale vs sale is 1 an and sale vs discount is 0.544 Sum of squares is 2,598745662355 Cross products is 5666644397.

4.6 Regression

Regression

[DataSet0]

Descriptive Statistics

	Mean	Std. Deviation	N
GROSS_SALE	5609371.094	106288.3656	24
DISCOUNT	1705743.792	178112.4708	24

Correlations

		GROSS_SALE	DISCOUNT
Pearson Correlation	GROSS_SALE	1.000	.130
	DISCOUNT	.130	1.000
Sig. (1-tailed)	GROSS_SALE	.	.272
	DISCOUNT	.272	.
N	GROSS_SALE	24	24
	DISCOUNT	24	24

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	DISCOUNT[b]	.	Enter

a. Dependent Variable: GROSS_SALE

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics		
					R Square Change	F Change	df1
1	.130[a]	.017	-.028	107752.8978	.017	.379	1

Fig 4.6: The figure shows Regression between sale and discount

Interpretation

The above figure indicates the regression and the forecasting gross sale of the company is R Square .017

F Change .379

Pearson correlation between sale and discount is 0.13

4.7 Linear Regression

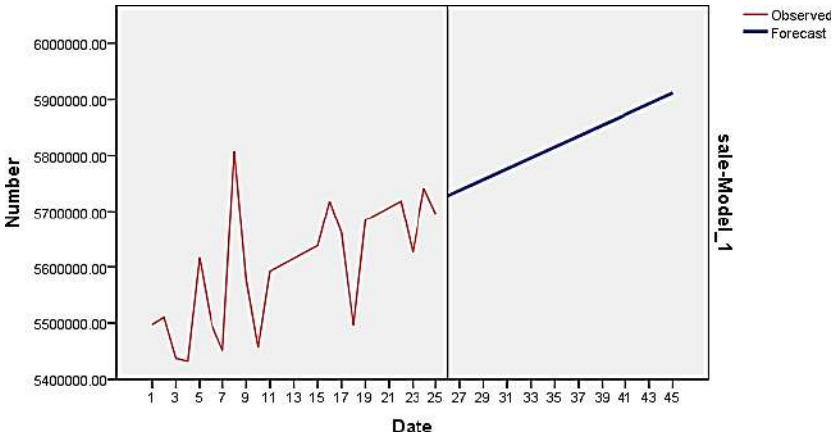

Fig 4.7: The figure shows sales forecasting for the next period of time

Interpretation

The above figure indicates the linear regression and the forecasting gross sale of the company is lies between 5700000 and 5750000. The red line indicates the observed trend in the graph and green indicates the forecast.

5. Conclusion

The Big retail players all over the world, data analytics is applied more these days at all stages of the retail process taking track of popular products that are emerging, doing forecasts of sales and future demand via predictive simulation, optimizing placements of products and offers through heat-mapping of customers and many others. With this, identifying customers who would likely be interested in certain products depending on their past purchases, finding the most suitable way to handle them via targeted marketing strategies

The innovative thinking of them to reach more and more sale is appreciable. They increased their sale network as much as possible with ultimate aim of sale and finding the customers. The study determined the final decision is not if a retailer should implement retail analytics, but which category to start with, and determine if a plan to cover all five categories as they grow their business. The study consists of with all aspects of major Reliance Retail stores sale in Vijayawada, how they are performing with corresponding to all departments in this competitive retail world has been explained.

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Chapter - 8

Turnaround Management through Internal Corporate Venturing: A Case Study of a Seafood Company

Vertika Agarwal
BBA Student, School of Commerce, Presidency University,
Bengaluru, Karnataka, India

Dr. Mounica Vallabhaneni
Assistant Professor, School of Commerce, Presidency University,
Bengaluru, Karnataka, India

Abstract

New business creation is influenced by the five industry and competitive forces proposed by Michael Porter i.e. bargaining power of customers, bargaining power of suppliers, threat of new entrants, threat of substitutes and intensity of competitive rivalry. There is a need for fostering innovation in the light of current competitive realities. Hence the key to success for any organization in the present competitive and dynamic environment is the need to adopt an entrepreneurial strategy by inducing intrapreneurial culture through internal corporate venturing and innovation. Growth of any organization is possible by effectively identifying and exploring opportunities that are market driven.

This paper attempts to highlight as to how any innovation- be it product, process, material or any other type- can be converted into a sustainable competitive advantage to build a firm standing in the arena of business. In order to conduct the research the researchers have adopted a Case Study approach. In this particular study it was observed that the turnaround of the company was based on the innovative mindset of the intrapreneurs. This is done by studying and analyzing the innovation and success of Gadre Marine Export, Mirkarwada, Ratnagiri - Maharashtra.

Keywords: Imitation crab stick, Internal Corporate Venturing, Intrapreneurship, Seafood industry, Surimi, Surimi Analogues.

1. Introduction

In a world of ever increasing global economy, the idea of corporate entrepreneurship has become a topic that leaders and managers must not only

be aware of conceptually but also understand in order to be able to strategize and position for organizational viability. As a growing competitive advantage for organizations, succeeding in corporate entrepreneurship is a necessity in today's market place. In order to succeed, the organization must set a vision that encourages growth, rewards risk taking and leverage innovation by adapting to the very changing global economy.

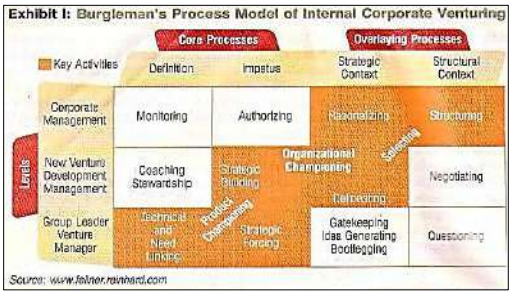
The key success to any organization in the present competitive and dynamic environment is the need to adopt an entrepreneurial strategy – seeking competitive advantage through continuous innovation by effectively identifying and exploiting opportunities in order to sustain and grow.

1.1 Intrapreneurial Base in an Organization

The notion of Intrapreneurship is typically associated with new business creation, new product development and offerings by individuals. With the onset of intensifying global competition there is an increasing need for business organizations to become more intrapreneurial to not only survive but to thrive and prosper. Hence corporate entrepreneurship has become an important paradigm in today's business environment. Corporate Entrepreneurship is a much broader concept encompassing innovation, creativity, change and regeneration within the corporate climate or entire organization. Intrapreneurship base in an organization is a concept by which corporate employees at any level of the company – identify and construct a unique business model that offers significant growth opportunities for their company.

1.2 Internal Corporate Venturing (ICV) for Sustainability

Out of the various models of successful corporate entrepreneurship, the most widely accepted one is the Burgelman"s Process model of ICV (Fig. 1)



Source: Corporate Entrepreneurship, Effective Executive, the ICFAI University Press, April 2007.

Fig 1: Burgelman's Process model of Internal Corporate Venturing

As shown in the model, while going for internal corporate venturing, the key activities of the top management include rationalizing and structuring the plan of the new venture. The key activities of middle management or the new venture development management team are strategy building and delineating for the business activities. At the functional level, the group leader or the venture manager has to establish a link between technical requirements and need of the customer and strategically forcing the idea for adoption. There is also an overlap between the top and the middle management in terms of selecting the business plan or people and between middle management and lower management where both of them can act as a product champion.

Burgelman was of the view that the motor of corporate entrepreneurship resides in the autonomous strategic initiatives of individuals at the operational levels in the organization. Therefore, organizations can build a competitive advantage by nurturing the people at the operational level.

1.3 Sustainability and Innovation

An organization can utilize innovations in all phases of its life. However, most of the innovations take place when the organizations want to increase the competitiveness in the marketplace. Such innovations are generally of two types- Product Innovation and Process Innovation- both these innovations in the long run result in being "Customer Centric" and thus result in an increasing profit (Gopal, 2007). Implementing the innovation and leveraging the same essentially calls for two broad strategies:

1. The entrepreneur himself takes the risk and steers the organization in that direction with the support of employees.
2. The entrepreneur in consultation with the functional line managers invites a product, process or structural innovation leading to successful business plan and calculated risk.

Strategically after a product has been established in the market place innovations occur when the entrepreneur desires to increase his sales which he achieves through product innovation. This strategically helps in an increase in the market penetration.

With the objective of understanding all these aspects a study was conducted with special reference to the seafood industry.

2. Rationale of the Research

The seafood industry in India is primarily an export-based industry but also an industry which gives least preference to the area of innovation. A majority of companies are driven by the owners and their mindset for quick

profits rather than emphasis on growth through innovation. Hence there is practically no evidence of the concept of ICV being applied. This study is an effort to explore the application of the ICV model in the seafood industry in India and its success or otherwise.

3. Objective of the Research

It has been seen that the seafood industry has great potential for economic contribution by innovation of product or process. But no adequate study has been undertaken till now to understand the importance of innovation in product or process in the seafood industry.

The Objective of the Study Was

1. To understand the strategic benefits of Internal Corporate Venturing and innovation.
2. To study the key strategy of the management of Gadre Marine Export for rejuvenation.
3. To highlight the role of intrapreneurial innovation in successful Internal Corporate Venturing w.r.t. Gadre Marine Export.
4. To present the findings of the case study to encourage Indian seafood exporters to leverage innovations for successful intrapreneurial skill sets.

4. Research Methodology

An in-depth desk research through secondary data was conducted to understand the various aspects that are involved in the success of corporate entrepreneurship through innovation. Secondary data was also used to acquire an overview of the Indian seafood industry. Several reference books, MPEDA (Marine Products Export Development Authority of India) Journal, FAO Yearbook of fisheries Statistics, project reports of Surimi and Surimi Analogues (by Gadre Marine Exports) were referred to. In addition, several newspaper articles as well as websites were searched.

Field research comprised of detailed discussions by the authors with knowledgeable persons in the seafood Industry. A questionnaire was used for the discussion but this had to be discarded as exploratory research had to be undertaken.

Later A Pointer Method Had To Be Adopted To Get A Better Perspective Of The Industry And Its Drivers. The Main Pointers Used Were:

- Factors which drive the seafood industry
- Problems faced by seafood exporters with special focus on Gadre

Marine Exports

- Innovations used by the seafood exporters
- Strategic Leveraging of innovation

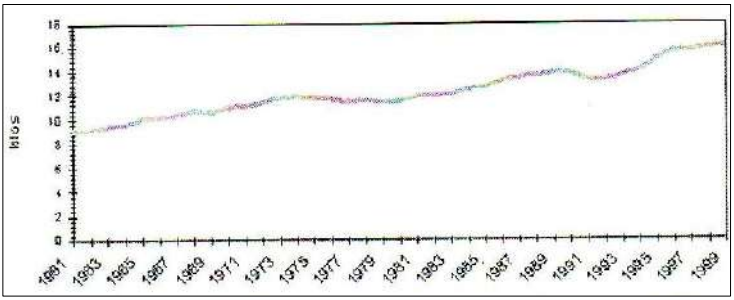
A total of 50 knowledgeable persons were contacted. These comprised of:

15 persons from MPEDA (Marine Products Export Development Authority of India) 5 seafood exporters (Allana, FourStar, Chirag, CastleRock, Naik Seafood Exporters) 25 fisheries technologists from Gadre Marine Exports 10 persons who are importers of seafood products from Gadre Marine Exports.

5. Status of Seafood Exporters in India

5.1 Steady Growing World Demand for Seafood

Year after year, since the end of World War II, human beings all over the world have increased their consumption of seafood. The production of seafood has grown from 19 million tons in 1950 to 39 million tons in 1961 and to 130 million tons in 2001. It represents a continuous increase at a yearly rate of 3.84 percent in average.



Source: FAO year book of Fishery Statistics, 2000-2001

Fig 1: Evolution of world yearly per capita consumption

India is the third largest fish-producing nation in the world, exporting to 73 countries. It has the potential to grow further in view of the growing demand in trading blocs such as the European Union, United States, Canada and Middle East.

There has been huge transformation in the Indian seafood industry over the last few years many of which have not been highlighted or marketed in the international arena. In 1997 the EU banned Indian seafood, citing lack of hygienic and phytosanitary measures in the industry, this was a landmark as thereon India has come a very long way.

The challenge was on and India spearheaded quality control and HACCP was put into place. Today we have excellent facilities, competitive labor and our infrastructure is catching up fast.

Buffeted by the US anti-dumping duty, Indian shrimp export is in a major revamp mode. Most of the top and middle level companies are going in for value added products to also create a niche in the global market and control cost effectiveness.

Export during 2011-12 compared to 2010-12

Export details	April–March 2011-12	April–March 2010-11	Growth %
Quantity Tones	855737	813091	5.24
Value Rs.crore	16477	12901	27.72
US$ Million	3484	2856	21.95

Source: www.seai.in/files/.../export%20performance%202011-12.pdf

Table 1: Overall export of Marine products

5.2 Main Drivers for the Seafood Industry

As per the discussions held with the various respondents and an analysis of the information collected by the authors, the following drivers (Strategic/Critical Factors) for the seafood industry were highlighted:

- The quantum of the „catch"
- Quality as per EU standards
- Marketing and Promotion
- Technology
- Customer Relationship Management

6. Gadre Marine Exporters: Innovators of Value-added Product – "Surimi and Surimi Analog Products"

Gadre Marine Processing Unit, Mirkarwada, Ratnagiri, was started in 1978 under the proprietorship of Shri Deepak P. Gadre. Initially the unit was processing prawns to export the same to Japan and various countries. The same was done from 1978 to 1993 but it did not prove to be economically successful and financially viable as was conceived originally.

The unit had to face acute financial crisis and to recover it had no other alternative but to search for alternative methods in the same line of verticals. During this decline phase the entrepreneur along with his technical team looked for innovative methods to rejuvenate the existing business. The entrepreneur along with his team directed their attention to use materials

which were available at lower cost and started exporting frozen fish namely Ribbon fish and Dhoma which were hitherto considered to be waste in India to S.Korea, Hongkong and Chin.

The curiosity of this export process turned the entire organization to intrapreneurship which further led to bring in the product and process innovation of "Surimi" -fish paste. In 1992-93 the entrepreneur visited South Korea to have a close look at the process and equipment required for manufacturing Surimi. In 1994 the first India Surimi production unit was set and GME dominated the market as Surimi manufacturers. There was a monopoly by them as suppliers from Indian market globally till 2000 after which there were followers for the innovation like HLL.

Surimi was produced basically by using fish varieties which were not normally eaten in India and which were thrown back into the sea as thrash. The innovation further continued where other marine exporters were thinking of investing in Surimi plant GME further geared up to meet fresh challenges for value addition by manufacturing Imitation crab – sticks from Surimi which had great market in USA and Europe. Constant up gradation and innovation has helped GME to obtain the status of 100% EOU with export house status from government. It also has the certification of HACCP & EU. Exports have been growing at a faster rate than the production. Table I gives the year wise turnover of the Unit and the Combined Annual Growth Rate.

Table 2: The year wise turnover of the Unit

Sr. No.	Financial year	Production Quantity in MT.	Export Turnover F.O.B. Rs. in Lacs.
1	1993-1994	91.32	21.05
2	1994-1995	2782.61	938.46
3	1995-1996	3890.00	1570.77
4	1996-1997	5349.38	2015.76
5	1997-1998	4647.54	2221.81
6	1998-1999	3663.54	1833.04
7	1999-2000	5826.74	3526.38
8	2000-2001	8691.04	5325.54
9	2001-2002	10248.16	5966.01
10	2002-2003	12489.35	9077.45
11	2003-2004	11576.70	6590.59
12	2004-2005	13463.73	8531.37
13	2005-2006	13031.90	7694.05
14	2006-2007	13673.26	8137.22
	CAGR	47%	57%

Source: Industry Sources

7. Analysis and Findings

A detailed analysis of the strategies used by Gadre Marine Exports helps in revealing the following three Phases of Innovation in the Company.

7.1 Innovation: Phase I

- A careful analysis of all the situational factors by the company officials lead to the realization that Ribbon fish and Dhoma which were considered as waste fish in India and thrown back into sea had a vast potential in the Global market. This was never tapped by any Indian Seafood exporter earlier.
- These fishes were bought at very low price as they did not have any market in India.
- They were sold at cost benefit price to S.Korea, Hongkong, China and other countries.

7.2 Innovation: Phase II

Success in the export of Ribbion fish and Dhoma by the entire production unit lead to the path way of innovative product and process. This led to the innovative idea of using the minced meat of thrash fish like-Dhoma, ribbon fish, lizard fish, Rani, etc. to prepare a delicacy product known as "Surimi" (a Japanese term for purified fish i.e., skinless, bonless, fatless) is manufactured from fish and used for making various Surimi Products.

- The entire unit was involved in study of the new product, process, equipment and training required for the venture.
- 1994: the first surimi plant was set up in India
- Gadre Marine Exports became the first Indian Exporters in the global market.
- The product "Surimi" product was exported to S.Korea, Japan, Australia, Taiwan, European countries and USA market
- The company applied for and achieved the Status of 100% EOU, Certification of HACCP &EU
- Gadre Marine Exporters had the Monopoly as suppliers for Surimi from Indian market till 2000.

7.3 Innovation: Phase III

Further innovation was Creating Surimi analogues. Surimi Analog Products are manufactured in various flavors and varieties from Surimi and other eatables and consumed mainly as salad.

- "Imitation crab sticks "is one of the most popular products and hence the highest revenue generator for the company.
- GME became the first Indian entrant in the global market for exporting Surimi Analogs in 2001.
- When competitors were working on Surimi, Gadre Marine Exports worked on the analogues.

8. Learnings

A detailed analysis of the three Phases of innovations and the discussions with the respondents indicated the following strategic factors for bringing about continuous innovations leading to competitive advantage and enhancement in the core competencies of the business:

1. Identifying and serving customers in a way that is distinct from competitors.
2. Ability to exploit business opportunity when it arises.
3. Right attitude of entrepreneur and the organizational employees.
4. Loyalty of Key Employees who see benefit in long term commitment of the business.
5. Lower cost of capital: Reinvestment of profits back into the business.
6. Keeping strategies well-guarded.
7. Flexibility to leverage innovation.
8. Customer service which are closely tied.

Through innovation as a strategic tool there were positive outcomes at several stages and GME created successful corporate environment and growth in business:

- Total turnaround in the business where the ROI increased every year.
- Cost effective operation, as very low-cost fish which were considered as thrash were utilized for creating a new product.
- Delivering the product in the individual brand name in the global market which was a very rare achievement in the seafood industry could be made possible because of very few suppliers for the surimi product in the global market.
- Setting up the first Indian Surimi plant and creating a business model for the other seafood exporters.
- Creating a niche for themselves not only in the South Asian market but also in the European and American market which is very difficult.

- As they were initiators for surimi and surimi analogues in India, they held monopoly in the export market.
- GME created new roles in the organization.
    - Technical innovators
    - Business Innovators
    - Product Champions.
- Generated huge employment opportunities in the peeling shed.
- Created value addition for fish suppliers making a strong bonding, creating a path to convert thrash fish to productive raw material.
- The organization became a business model for MPEDA (Marine Product Export Development Authority) Government of India and other Seafood exporters.

9. The Future Issues

- To manage expectations in the right way and keep the motivation towards ongoing innovation alive.
- To set of specific metrics to analyze and evaluate new businesses in their development and to decide when to abort a new initiative.
- Set quantitative and qualitative standards which are agreed by all in the organization to have hassle free operations.

10. Conclusion

From the detailed study and analysis of concepts and theories of corporate entrepreneurship and innovation relating it to the case study which has been undertaken for study it can be concluded that the primary aim of internal corporate venturing is the revival and rejuvenation of organization resulting in growth and the prime source of it as explored in the above discussion is innovation. The innovation be it product, process or any other type of innovation can be converted into a sustainable competitive advantage to make a firm standing in the arena of business. Organization leveraging innovation, avoids one major organizational conflict associated with entrepreneurship i.e., the distinction between the entrepreneur supported business and corporate entrepreneurship. Entrepreneurs can develop conducive environment of trust and by leveraging innovation they can create collective wealth for the organization as well as contribute to the growth of the country.

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Chapter - 9

Analysis of Just-In-Time Delivery with Special Reference of Online Retailer Deliveries

Venkata Vamsinath
Student, Presidency University,
Bengaluru, Karnataka, India

Saptarshi Mukherjee
Prof., Presidency University,
Bengaluru, Karnataka, India

Abstract

Online retailers are following Just-In-Time delivery process. Online shopping is becoming common in today's life. The study indicates that most of the customers have experience of online shopping. Online retailers are providing the best benefits to their customers, most of the customers are happy with the online retailers' deliveries. The online retailers are delivering right product, right place, right time, right customer, right price, right quality and right quantity to their customers with the help of JIT process. As per the study the customers are not receiving any damaged products from the online retailers. Most of the people are doing online shopping by this you can understand that how the quality of the online retailers and how they respond to their customers.

Introduction

The term 'Just-In-Time' (JIT) Delivery is an inventory management process that helps businesses more efficiently move their inventory from warehouses. JIT used for instance to describe the delivery of materials to a construction site, suggests that materials will be brought to their location for final installation and be installed immediately upon arrival without incurring any delay due to storage in a laydown or staging area. This process is historically known as the Toyota Production System or TPS and later known as lean manufacturing. Just- in-Time delivery, or JIT delivery, helps businesses maximize their output every day. Filling more orders and spending less time on mundane tasks are just a few of the ways that your business can leverage JIT to your benefit. The speed of order delivery is an increasingly

examined aspect of supply chain management, particularly with constantly expanding consumer demands for same- and next-day delivery and other features. Just-In-Time (JIT) delivery is an inventory management strategy that helps facilitate speedier order fulfilment with particular applications in raw materials orders and manufacturing. Since production for just in time delivery happens only for specific customer orders, just-in-time services are somewhat backward from normal supply chain fulfilment in the way that goods are pulled through the supply chain versus pushed through. So, the production process only begins when a customer placed an order, and inventory stock is only delivered as-needed.

E-commerce markets are growing at noticeable rates. The online market is expected to grow by 56% in 2015–2020. In 2017, retail e-commerce sales worldwide amounted to 2.3 trillion US dollars and e-retail revenues are projected to grow to 4.891 trillion US dollars in 2021.Traditional markets are only expected 2% growth during the same time. Brick and mortar retailers are struggling because of online retailer's ability to offer lower prices and higher efficiency. Many larger retailers are able to maintain a presence offline and online by linking physical and online offerings.

E-commerce allows customers to overcome geographical barriers and allows them to purchase products anytime and from anywhere. Online and traditional markets have different strategies for conducting business. Traditional retailers offer fewer assortment of products because of shelf space where, online retailers often hold no inventory but send customer orders directly to the manufacture. The pricing strategies are also different for traditional and online retailers. Traditional retailers base their prices on store traffic and the cost to keep inventory. Online retailers' base prices on the speed of delivery.

Research Design

Objectives

- To analyse the optimization of supply chain management in online retailers' deliveries through JIT

Research Design

Iris D. Tommelein1and Annie En Yi Li (1999)

JIT is a concept developed by the Japanese who created the Toyota Production System, later translated into English as the lean production system. The ultimate objective of JIT production is to supply the right materials at the right time and in the right amount at every step in the process. Toyota achieves

JIT production by implementing a pull system using 'kanban,' loosely translated from Japanese as 'cards.' Kanban are designed to prevent overproduction and ensure that parts are drawn from process to process, in reverse order. They thus implement a replenishment system designed to control production quantities. Parts are taken and replenished only when needed and in the right amount.

Marvin Hubl, Marcus Mueller, Johannes Merkert (2015)

Just-in-time deliveries are crucial for many industries. Rigid, centralized planning tends to fail, especially in dynamic environments with distributed decisions and control. Under the constraints of distributed decisions and control, auctions promise an efficient allocation of resources. However, a dedicated design of auctions for just in-time deliveries, which can be incorporated into the design of an IT artifact, is still lacking. We contribute a linear and a quadratic multi-attribute scoring rule for an automated execution by software.

John R. Grout (1994)

Just-in-time (JIT) involves eliminating waste in the linkages between a firm and its suppliers. Usually, the procedure for eliminating waste includes reducing the amount of in-bound material held by the firm, and reducing the lot size of deliveries. Lack of support, vendor related work stoppages, suppliers holding excessive inventory to ensure timely delivery are some of the problems that are reported. Combinations of two types of incentives that the buyer might offer are considered: (1) a fixed-value, all-or-nothing incentive and (2) an incentive that decreases in value as time elapses.

Fadye Saud Alfayad (2020)

The reduction of shipping cost volatility in the global supply chain. The context of this analysis relates to how cost-savings can be achieved for end-consumers and how this might be facilitated by blockchain technology. Blockchain's distributed ledger framework achieves improved inventory control, improved demand forecasting, and more efficient just-in-time productivity as factors to reduce cost-loading in the global supply chain. Blockchain more seamlessly supports contract formulation and exchange, smart contracts, remotely managed containers and cost reductions which all improve the JIT operating environment.

Chuah, Keng Hoo (2004)

A just-in-time supply pickup and delivery system manages the logistic operations between a manufacturing plant and its suppliers by controlling the

sequence, timing, and frequency of container pickups and parts deliveries, thereby coordinating internal conveyance, external conveyance, and the operation of cross-docking facilities. The system is important to just-in-time production lines that maintain small inventories. The objective of Jit is to minimize transportation costs while making frequent deliveries of parts in small quantities. Frequent deliveries that rely on less-than-truck-load (LTL) shipments would yield a high transportation cost.

Tejas Karkhanis, James E Smith, Pradip Bose (2002)

JIT is for saving energy in the entire instruction delivery subsystem. This scheme monitors and dynamically adjusts the maximum number of in-flight instructions in the processor. The maximum number is determined by monitoring processor performance and is adjusted to the lowest number that does not reduce performance significantly. When the maximum number of in-flight instructions is reached, instruction fetching is inhibited. Often this occurs well before all pipeline stages and issue window slots are full. In effect, instructions are fetched just-in-time so performance is relatively unchanged, but fewer instruction delivery resources consume energy with stalled and/or flushed instructions. Overall, the resulting scheme works better than other previously proposed, more targeted approaches.

Jin-Shan Yang, & Jason Chao-Hsien Pan (2007)

Nowadays supply chain management is a popular practice in manufacturing systems, and just-in-time (JIT) production plays a crucial role in supply chain environments. Companies are using JIT production to gain and maintain a competitive advantage. The characteristics of JIT systems are consistent high quality, small lot sizes, frequent delivery, short lead time, and close supplier ties. This paper presents an integrated inventory model to minimize the sum of the ordering/setup cost, holding cost, quality improvement investment and crashing cost by simultaneously optimizing the order quantity, lead time, process quality and number of deliveries while the probability distribution of the lead time demand is normal.

Charles R.O' Neal (1989)

An increasing number of manufacturing firms are developing and implementing just- in-time (JIT) systems. A unique feature of a JIT system is the new partnership philosophy of the buyer-seller organizations, which is essential to its successful implementation. This article is based on the results of an empirical study of OEM adopters of the JIT concept. It demonstrates the dramatic effect of the system on traditional buyer-seller practices, measures the performance results to date, and points up the key role of purchasing and materials management in developing successful buyer-seller JIT linkages.

Bingtao Quan, Sujian Li, Band Kuo-Jui Wu

The coordinated development of companies and ecological protection are possible only with increasing environmental awareness. Therefore, this study aims to investigate how companies can achieve sustainable development. It is found that the scientific implementation of the vehicle scheduling problem (VSP) for just-in-time (JIT) delivery in the raw material procurement. He models expands the applicability of JIT to all value- added activities, exploring all value-added activities in different spatial and temporal dimensions to achieve the optimal combination of company cost, environmental effects, and weather dimensions.

Pablo Biswas, Bhaba Sarker (2020)

Generally, Just-in-time (JIT) production systems have zero inventory systems and no buffer. In 1992, Golhar and Sarkers' observation stated that participation in JIT delivery system is economically disadvantageous for suppliers. For the last few decades, just- in-time (JIT) philosophy has played an important role in supply chain systems such as the manufacturing sectors. The successful implementations of JIT phenomena are frequent shipment of high-quality parts to the buyers and ordering raw materials in small batches whenever required to process finished products.

Rosemary R. Fullerton, Cheryl S. Mc Watters (2001)

The intense competition in the current marketplace has forced firms to re-examine their methods of doing business. JIT implementation improves performance through lower inventory levels, reduced quality costs, and greater customer responsiveness. This study indicates that JIT is a vital manufacturing strategy to build and sustain competitive advantage. JIT looks beyond the short run to the long-term optimization of the entire production/distribution network. Successful JIT implementation should accomplish improve quality and control the timeliness of the production and delivery of products.

Statement of the Problem

Whether the online retailers are delivering the product on time or not is there any issues with the quality of the online retailers. Online retailers are delivering right product or not what customers ordered. If they delivery wrong product how they respond is there any issues with refund processes is it is taking more time. In delivery time are u receiving any damaged products.

Scope of Study

Just-in-time delivery is a feature that can significantly optimize order fulfilment logistics for online retailers, improving efficiencies and managing

costs to make operations more profitable. It's a way to up your game, getting orders to customers more quickly and with greater accuracy. Just-In-Time delivery helps businesses to move their inventory efficiently from warehouses. Just -In-Time delivery make inventory level zero it will reduce cost associated with storage at the same time manufacturing time also. JIT delivery will make continuous quality improvement and improve productivity.

Questionnaire Design

We had design 17 questionnaire which is prepared through Google forms and has been forwarded through Emails and WhatsApp to online retailers' customers.

Method of Data Collection

Primary Data Collection: I had collected primary data through online surveys with the help of Google form. Primary data is a type of data that is collected by researchers directly from main sources through interviews, surveys, experiments, etc. Primary data collection involves gathering data from the first - hand experiences.

Sampling Type

Convenience Sampling: Convenience sampling involves using respondents and recruiting friends to participate in your study, collecting data from locations that are nearby, sending a survey in the mail, or sharing a link on social media.

Statistical Design

Pie-charts and Column charts are used to illustrate the numerical proportion.

Limitations of the Study

- Due to the time constrain sample size is limited to 105.
- The study cannot be generalized.
- Reviews are not sufficient so there is a constrain in supporting with literature of current publications.
- The data may be biased.
- The responses are collected from the people who convenient. It may fall in type of error.

Analysis and Interpretation

Table 4.1: Represent Gender of Respondents

Gender	Respondents	Percentage
Male	72	69%
Female	33	31%
Total	100	100%

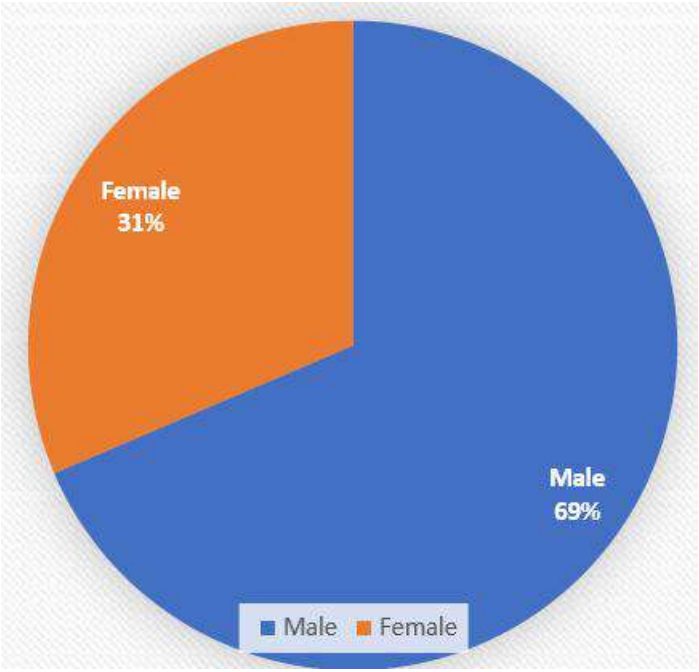

Fig 4.1: Represent Gender of Respondents

Interpretation

Figure 4.1 represent that 69% of respondents were male and 31% of respondents were female

Table 4.2: Represent Age of Respondents

Age Group	Respondents	Percentage
Within 2o	43	41%
21-30	59	56%
31-40	3	3%
Total	105	100%

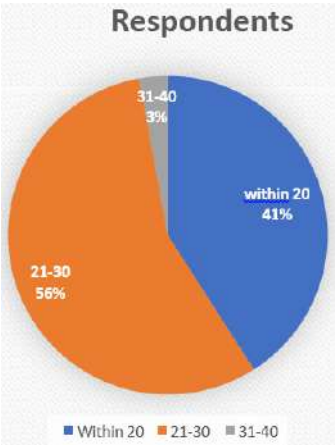

Fig 4.2: Represent Age of Respondents

Interpretation

Figure 4.2 indicates that 56% of respondents are between 21-30 years age category, and 41% between within 20 years age category only 3% between 31-40 age category. The result suggests that 56% of online shopping is done by the age group of 21-30 years.

Table 4.3: Represent Occupation of Respondents

Occupation	Respondents	Percentage
Students	76	72%
Employees	29	28%
Total	105	100%

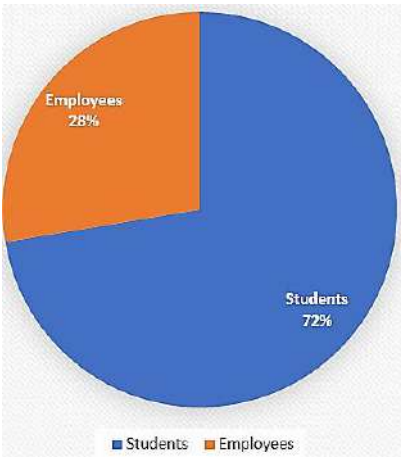

Fig 4.3 Figure Represent Occupation of Respondent

Interpretation

Figure 4.3 indicates that 72 % respondents were students and employee's respondents were 28%. The result suggests that students are doing more online shopping than employees.

Table 4.4

Q. Are u aware about E-Commerce deliveries?

People Opinion	Respondents Percentage
Yes	87.6%
No	12.4%

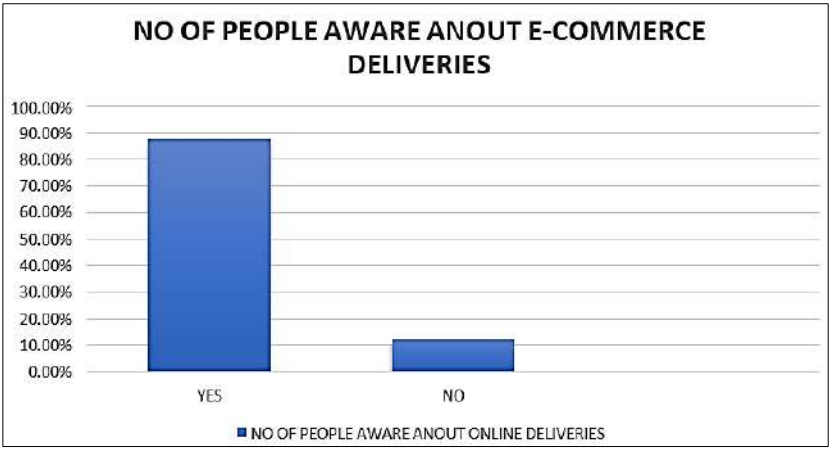

Fig 4.4.

Interpretation

Figure 4.4 indicates that most of people were aware about e-commerce deliveries their percentage is 87.6%, there are only less people who were not aware about e-commerce deliveries their percentage is 12.4%.

Table 4.5

Q. How Often Do You Shop Online?

People Opinion	Repondents Percentage
Frequently	47%
Very frequently	10%
Rarely	27%
Very rarely	16%
Never	N0NE

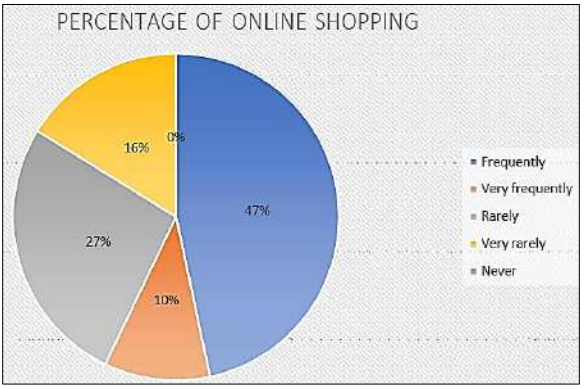

Fig 4.5.

Interpretation

Figure 4.5 indicates that 47 % of people were doing frequently their online shopping and 27 % of people are doing rarely, 16 % very rarely doing shopping and very frequently doing shopping people are 10 %. It means everyone is doing online shopping now a days.

Table 4.6

Q. How Many Years of Experience Do You Have in Online Shopping?

People Experience	Percentage of Respondents
Less than 2 years	11%
1-2 years	17%
More than 2 years	70%
None	2%

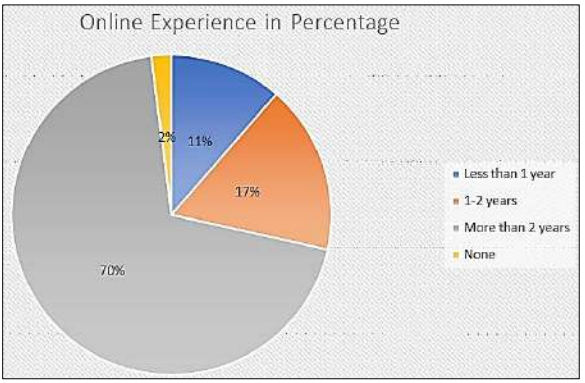

Fig 4.6.

Interpretation

Figure 4.6 indicates that people experience in online shopping, 70 % 0f people having more than 2 years of experience and 17 % of people having 1-2 years of experience. People having less than 1 year experience percentage is 11 % and 2 % are none?

Table 4.7

Q. The Products are Delivering on Time?

On Time Delivery	Respondents Percentage
Yes	93.30%
No	6.70%

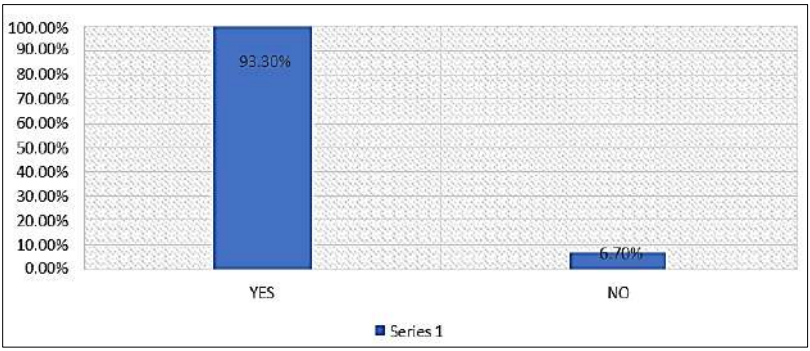

Fig 4.7.

Interpretation

Figure 4.7 is a Column chart that shows the percentage of the product delivery on time or not the respondents given that 93 % products are delivering on time and respondents given only 6. % that the products are not delivering on time.

Table 4.8

Q. Are You Receiving The Right Product?

Right Product Is Delivering	Percentage of Respondents
Yes	94.2%
No	5.8%

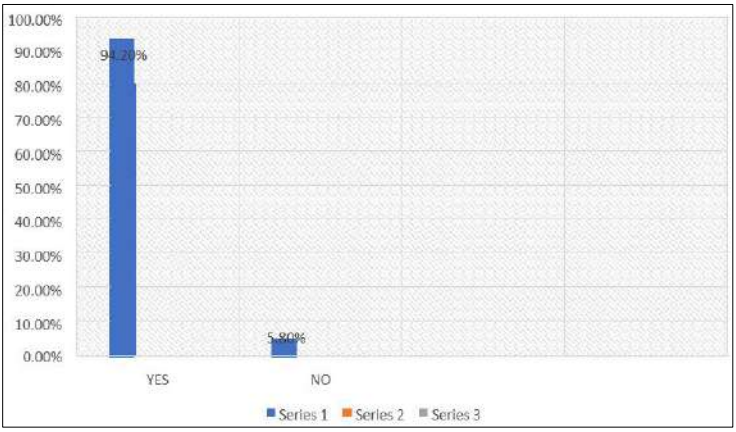

Fig 4.8.

Interpretation

Figure 4.8 is a column chart that shows the percentage of the respondents whether they are receiving right product are not. 94.20 % of respondents are telling that they are receiving right product and 5.80 % of respondents are telling that they are not receiving right product.

Table 4.9

Q. How Do You Received The Product Whether It Is Fully Packed Or Any Damages During Delivery Time?

People Opinion	Percentage
Damaged	20.80%
Not Damaged	79.20%

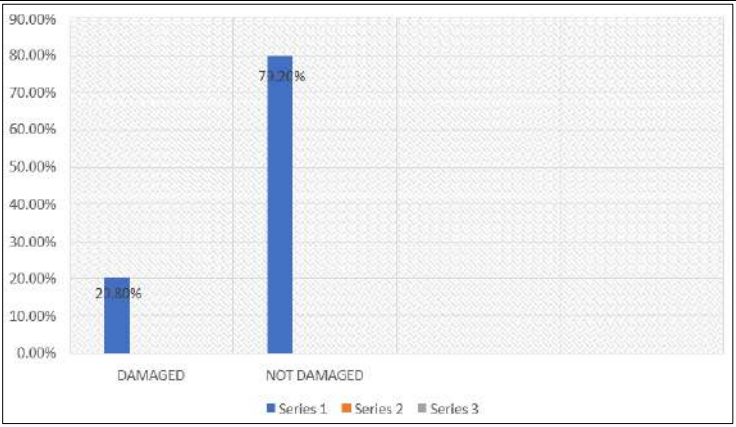

Fig 4.9

Interpretation

Figure 4.9 is a column chart that shows the percentage of the respondents that product is damaged or not during delivering. 79.20% respondents are saying that the product is not damaged during the time of delivery. And 20.80% respondents are saying that the product is damaged during the time of delivery.

Table 4.10

Q. Are You Receiving Any Wrong Product Deliveries?

Wrong Product Delivery	Percentage Of Respoundents
Yes	15.60%
No	84.40%

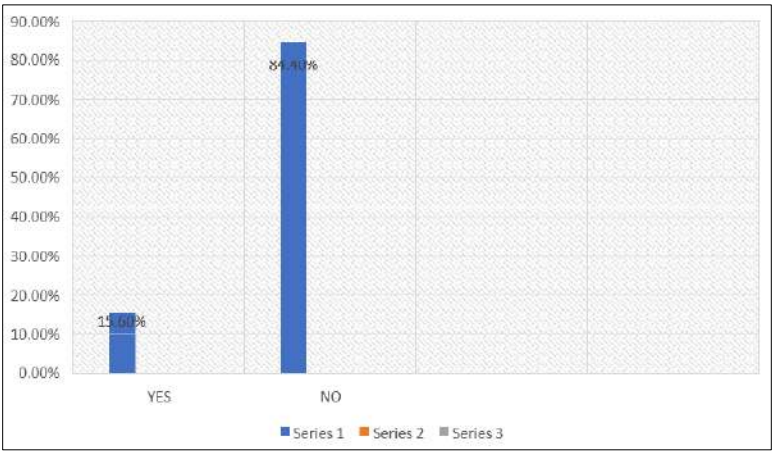

Fig 4.10.

Interpretation

Figure 4.10 is a column chart that shows percentage of the respondents that they are receiving any wrong product deliveries. The 84.40 % respondents saying that they are not receiving wrong products. But 15.60 % respondents saying that they are receiving wrong product deliveries.

Q.I F They Delivered Wrong Product How They Respond?

For Wrong Delivery How They Respond	Percentage of Respoundents
Re-Place	35%
Re-Fund	22%
Return	34%
Others	9%

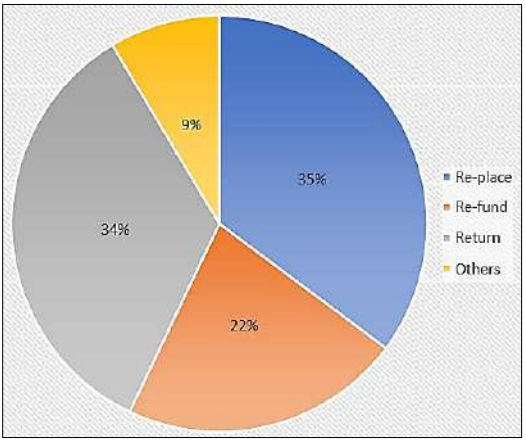

Fig 4.11.

Interpretation:

Figure 4.11 is a pie chart that shows the percentage of the respondents if e commerce delivery any wrong products how they respond. 35% of respondents are saying that they will re-place the order, 34% of respondents are saying that they will re-turn and 22% of respondents are saying that they will re-fund, 9% of respondents are saying others.

Q. After Payment Done If You Cancel The Product Do You Received Refund Immediately Or Its Take Time?

Round Time	Percentage Of Respondents
Immediately	17%
2-3 Business Days	52%
3-5 Business Days	20%
More Than 5 Days	11%

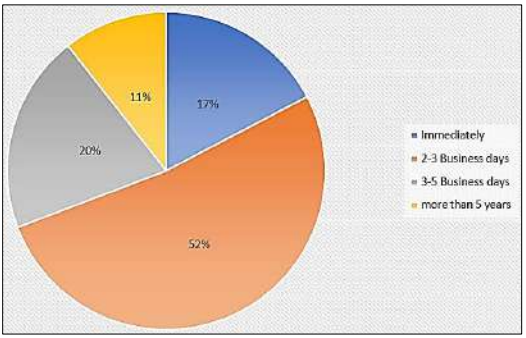

Fig 4.12.

Interpretation

Figure 4.12 is a pie chart that shows the re-fund time of the e commerce after cancelation of the product. 52% of respondents are saying that it will take 2-3 business days to re-fund. And 20% of respondents are saying it will take 3-5 business days,17% of respondents saying it will re-fund immediately, 11% of respondents are saying it will take more than 5 days.

Q. How you are felling with the Quality of the E-Commerce Deliveries?

Quality of the Product	Percentage of Respoundents
Good	68%
Excellent	19%
Average	11%
Not Good	2%

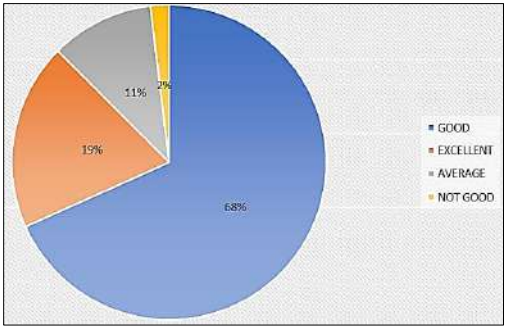

Fig 4.13.

Interpretation

Figure 4.13 is a pie chart that shows percentage of the respondents about quality of the e commerce deliveries. 68% saying that the quality is good, 19% respondents saying that quality is excellent and 11% respondents saying the quality is average, 2% respondents saying quality is not good.

Table 4.14

Q. Most Preferable Online Retailer?

Preferable Online Retailer	Customers Percentage
Amazon	34%
Flipkart	38%
Myntra	15%
Ajio	10%
Others	3%

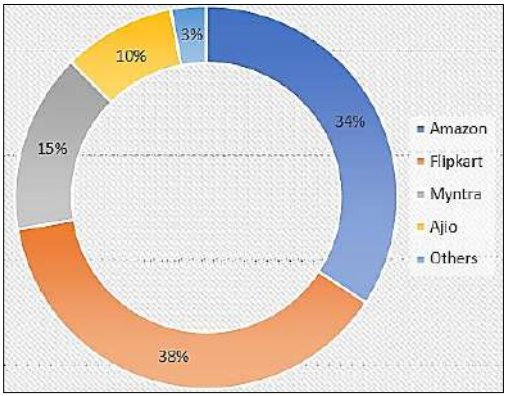

Fig 4.14.

Interpretation

Figure 4.14 is a pie chart that shows the percentage of the reapondents for most perferable online retailer. 38% of respondents are chosen the flipkart, and 34% of respondents chosen amazon and 15% respondents chosen myntra, 10% respondents chosen ajio. 3% chosen others online e commerce deliveries

Summary of Findings

- Majority of the customers are satisfied with the online retailers.
- Majority of the customers are saying that the online retailers are delivering the products on time.
- Most of the customers are satisfied with the quality of the products delivered by online retailers.
- The products are not damaged in the delivery processes and most of customers are receiving right products from online retailers.
- Most of the customers are positive about online retailers which is good sign for the online retailers

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2. (Charles R.O' Neal 1989)(Jin-Shan Yang, & Jason Chao-Hsien Pan 2007)
3. (Pablo Biswas, Bhaba Sarker 2020) (Bingtao Quan, Sujian Li, Band Kuo-Jui Wu) (Rosemary R. Fullerton, Cheryl S. Mc Watters 2001)

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Chapter - 10

A Study on Customer Preference on Buying Mobile Phones Using Power BI

Dr. Ch. Sahyaja
Assistant Professor, School of Commerce, Presidency University,
Bengaluru, Karnataka, India

Vivek Shiva Kumar
Student, School of Commerce, Presidency University,
Bengaluru, Karnataka, India

Abstract

This study supports the consumer preference on buying mobile phones using Powerbi. This study is done by taking 150 respondents of consumers buying behaviour among different categories usage of mobile phones and sampling technique is simple random sampling and tool used for analysis is POWERBI.

Keywords: Customer preference; Mobile Phones; PowerBI

1. Introduction

Marketing mostly consisted of outbound marketing, which consists of chasing potential customers with promotions without really knowing if that person was interested in purchasing. But, thanks to the digital transformation and the rise of new communication channels, marketing has drastically changed over the years. To understand how marketing has changed throughout the years, let's take a look at this timeline Hub Spot has assembled showcasing the innovations of this industry.

Consumer preferences are defined as the subjective (individual) tastes, as measured by utility, of various bundles of goods. They permit the consumer to rank these bundles of goods according to the levels of utility they give the consumer. Note that preferences are independent of income and prices. Ability to purchase goods does not determine a consumer's likes or dislikes. One can have a preference for Porsches over Fords but only have the financial means to drive a Ford.

2. Review of Literature

According to Karjaluoto *et al*. (2005), price, brand, interface, and properties tends to have the most influential factors affecting the actual choice amongst mobile phone brands. Ling, Hwang and Salvendy (2007) surveyed college students to identify their preference of their current mobile phone. The results of their survey indicated that the physical appearance, size and menu organization of the mobile phones are the most determinant factors affecting the choice of mobile phones.

According to Pakola *et al*. (2010) attempted to investigate consumer purchasing motives in cellular phone markets. The results indicated that while price and properties were the most influential factors affecting the purchase of a new mobile phone, price, audibility and friends' operator were regarded as the most important in the choice of the mobile phone operator. As well, Saif (2012) analyzed the factors affecting consumers' choice of mobile phone selection in Pakistan. The results indicated that consumer's value new technology features as the most important variable amongst all and it also acts as a motivational force that influences them to go for a new handset purchase decision.

According to Subramanyam and Venkateswarlu (2012) conducted a study on factors influencing buyer behavior of mobile phone buyers in Kadapa district in India. The researchers studied the various types of marketing strategies adopted by market to acquire the attention and cognition of both existing and potential customers, and to study what role these marketing strategies play in consumer buying process. According to the results, income, advertising and level of education in a family are the determining factors of owning a mobile phone set.

3. Research Methodology

3.1 Sample Size

This study targeted 110 people for the purpose of research. The sample size is influenced nr the targeted population. And this study is conducted by simple random s

3.2 Objectives of the Study

The main objective of the study is "consumer preference on buying mobile phone"

3.3 Contribution to the Study

The contribution of the study is to help the mobile companies to understand the customer preferences and helps them to know about the factors

that customers prefer the most. This study also helps to know about the preferred segment of a particular mobile brand for the customers. This study also helps us to know the purpose of buying a Smartphone by the consumers and what specifications do customers prefer.

4. Data Analysis

4.1 How Do You Make The Decision To Buy A Smart Phone Based On?

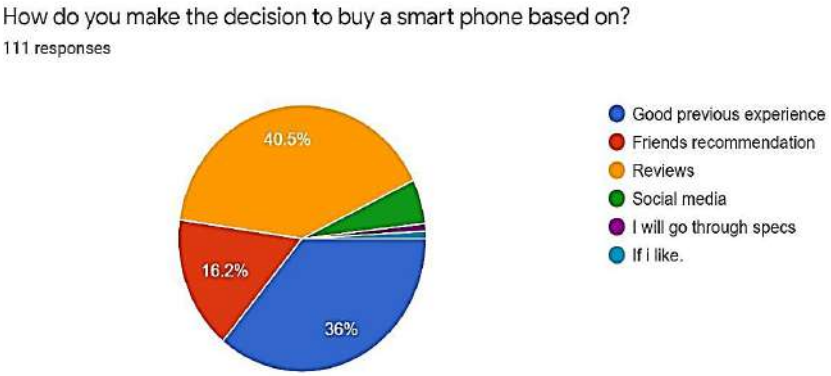

Fig 4.1: This Figure shows how they make the decision to buy a smart phone

Interpretation

From the above pie chart, the study identified that 40.5 percent of the consumers buy a smart phone based on reviews, 36 percent of the consumers buy a smart phone based on good previous experience and 16.2 percent of the consumers buy a smart phone based on friend's recommendation. Thus, it is clear that the consumers make decision to buy a smart phone based on reviews.

4.2 In Which Price Range Mobile Do You Choose?

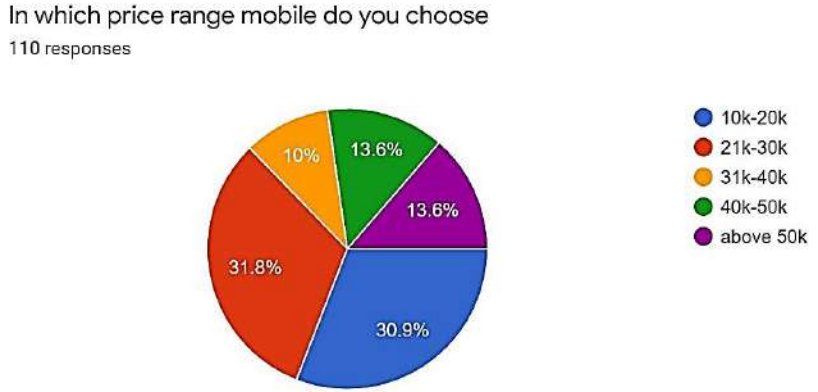

Fig 4.2: This Figure shows the price range of mobile you choose

Interpretation

From the above pie chart, the study identified that 31.8 percent of the consumers choose the mobile price range between 21k-30k, 30.9 percent of the consumers choose the mobile price range between 10k-20k, 13.6 percent of the consumers choose the mobile price range between 40k-50k, 13.6 percent of the consumers choose the mobile price range above 50k and 10 percent of the consumers choose the mobile range between 31k-40k. Thus it is clear that most of the consumers choose the mobile phones range between 21k-30k.

Analysis on Power BI

4.3 Dashboard 1: Gender by Male

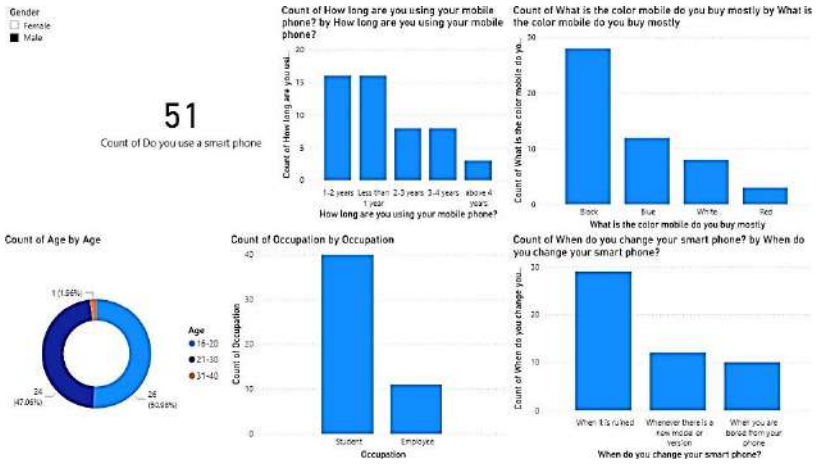

Fig 4.3: This Figure shows the preferences of smart phones by male

Interpretation

From the above graph, the study has identified most of the males use their mobiles for 1-2 years. Most of the male customers like their mobile phones to be black. Most of the male customers are students. Most of the male customers change their Smartphone's when it is ruined. Hence it is proved that most of the male customers like to have their phones as black in color and change their phones when ruined.

4.4 Dashboard 2: Factor restricting by Price, Performance

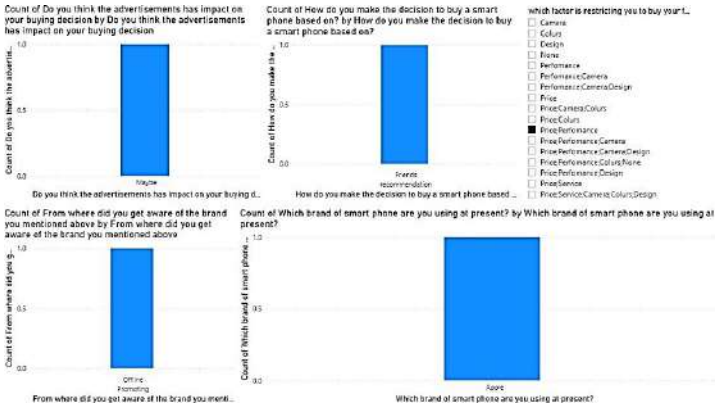

Fig 4.4: This Figure shows the factors Price, Performance is restricting costumers to buy smart phones and its influence

Interpretation

From the above dashboard, the study has identified that the advertisements may impact on buying decision, most of the consumers make decision to buy a smart phone based on the friend's recommendation, the consumers get aware of the brand from offline promoting and most of the consumers are using apple phone at present. Thus, it is clear that most of the consumers make decisions on friend's recommendation and get aware about the phone through friends' recommendations.

4.5 Dashboard 3: Factor restricting by Price, Service, Performance, Camera, Color, Design

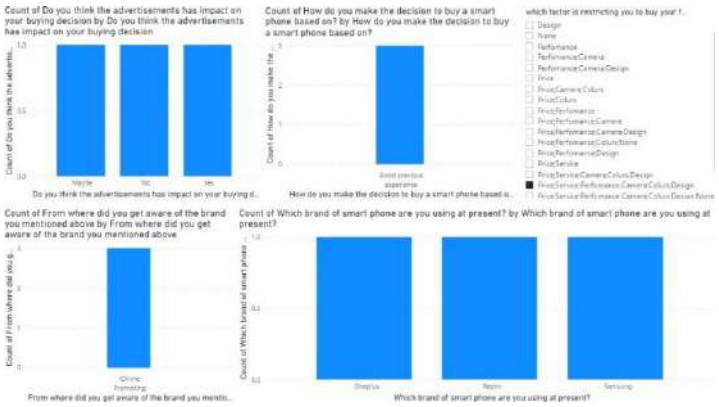

Fig 4.5: This Figure shows the factors Price, Service, Performance, Camera, color, Design restricting them to buy their smart phones and its influence

Interpretation

From the above graph, the study has identified, the factors which restrict them to buy their favorite brand are price, service, performance, camera, color, design. These customers agree to the statement that advertisements have impact on their buying behavior. These customers make the decision to buy a smart phone based on their previous experience. These customers got aware about their brand through online promoting. At present the brand they use is One Plus.

4.6 Dashboard 4: Parameters by Design, Performance, Camera, Brand, Battery life

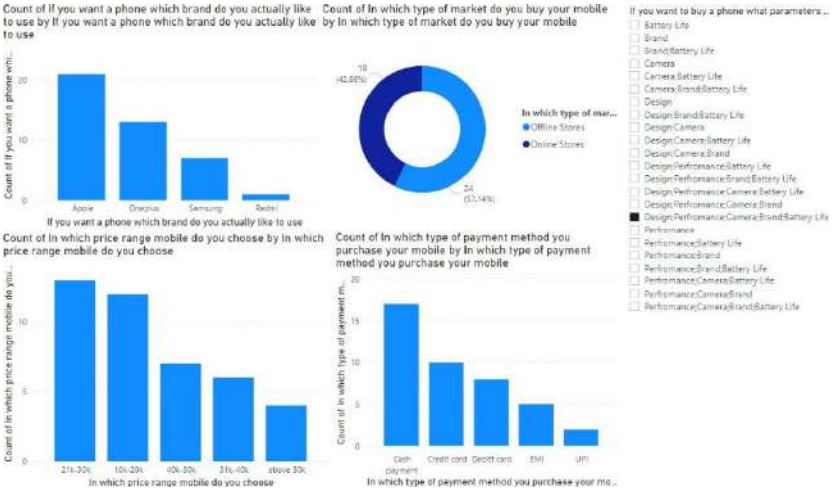

Fig 4.6: This Figure shows the parameters Performance, Camera, Brand, Battery life chosen by the costumers for buying a smart phone and its influence

Interpretation

From the above graph, the study has identified, the factors which restrict them to buy their favorite brand are design, performance, camera, brand, battery life. These customers mostly use Apple. These customers prefer offline stores to buy their smart phone. These customers prefer the range of the mobile phone to be 21k-30k. These customers prefer to pay through cash.

4.7 Dashboard 5- why do you buy a smart phone? VS why do you choose the brand you mentioned above? By communication.

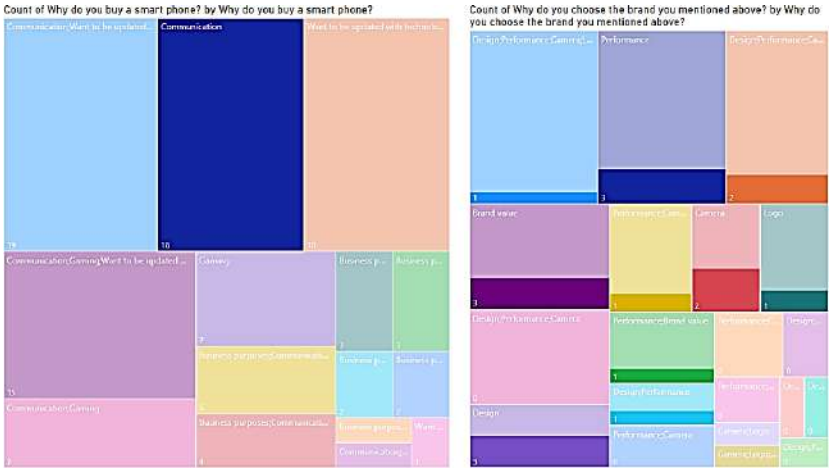

Fig 4.7: This Figure shows why do you buy a smart phone? VS why do you choose the brand you mentioned above? By communication

Interpretation

From the above graph, the study has identified that the customers that buy their smart phone for communication choose their brand for performance, brand value, design. Hence it is proved that the customers who use the phone for communications give the most priority for performance, brand value and design.

5. Conclusion

In this modern era, a Smartphone is just not only the want but also a need if you know how to make proper use of it. All the maximum respondents mentioned Smartphone as their need. Obviously, Smartphone have changed the ways that we used to live, communicate and connect with people all over the world. With it, you can surf internet with just a touch in a smartphone, whether to read the breaking news, or compare the prices or features of a products while shopping, booking the travel tickets, connecting to social network or keep track of your parcels delivered wherever you are and so on. Smartphone features like, text to speech; GPS and social integration are some examples, which can helps group of people to easily remain integrated with society. All the respondents agreed that Smartphone is really essential to make their daily life easier. Indeed Smartphone have made people smarter by organizing their lives with a single device and providing access to the world wide information at the fingertips. It doesn't only organize daily life by putting

calendars, to do list and shopping list at one place but also helps people connected from all over the world by integrating contacts, emails, social networking, messaging and even video chats. It has made lives easier for everyone. One can use it for education purpose, job related tasks, information search or entertainment purposes. That is the main reason that everyone carries a Smartphone nowadays

6. References

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Chapter - 11

Brick-and-Mortar to Click- and-Slide: An Analytical Study

Rohit Ajay
BBA Student, School of Commerce, Presidency University,
Bengaluru, Karnataka, India

Dr. Mounica Vallabhaneni
Assistant Professor, School of Commerce, Presidency University,
Bengaluru, Karnataka, India

Abstract

The business community globally has embraced technological innovations and revolutionized communication capabilities among people which has enhanced globalization and prosperity. This paper makes an attempt to understand the nature of this new innovative technology enabled services: how it's used, what are the quality control models and what is the experience of the bank and its customers on using Information and Communication Technology (ICT) for transactions, for good and for ill with the largest bank in India namely the State Bank of India. The study engages a qualitative research method and follows an exploratory research approach. Content analysis and discussions were conducted with an interview schedule among key managers at State Bank of India. The level of measurement applied in data analysis is Strengths, weaknesses, Opportunities and Threats (SWOT). The paper will identify the framework for technology management for the financial services system of the Bank. The study makes an attempt to evaluate the use of technological tools and activities to maintain the new type of services to the bank's customers.

Keywords: Banking services, Customer, ICT tools.

1. Introduction

Technological innovation has proved to be a dynamic factor in business process re-engineering especially in the banking sector. Innovation is a constant process that needs to match with changing environment. The invention of microprocessors, fiber optics combined with lasers and satellites have revolutionized communication capabilities among people across multi-national cultures and facilitated major advances in finance that greatly

enhanced our ability to direct scarce savings into productive capital investments, which is a critical enabler of rapidly expanding globalization and prosperity [1]. With the increasing development in technology, the studies in the field of e-commerce becomes more and more attractive [2]. It is indicated that the winners in "clicks and order" retailing, like their predecessors in "brick and mortar" retailing, will be those who know how to take care of their customers better than competitors and provide better solutions to consumers than were available in the past [3]. These reveal that good customer relationships would lead to gain customer loyalty using technology.

The unique characteristics of services described in a study are intangibility, inseparability, heterogeneity, and perishability [4]. With the growth of Information and Communication Technology (ICT), the increased use of Internet has a big impact on these four characteristics. E-services have three special properties, quantization, the ability to search information, and the ability to automate [5]. Hence, the internet accessibility through World Wide Web tops the pre-requisite for conducting quality e-commerce services.

The internet affects services quality in banking sector. It is measured by the five important factors of reliability, responsiveness, security, communication and access in a study and identified that access as the most important dimension in service quality [6]. The quality factors that are highly important to consumers are efficiency and speed [7]. Another study attempted to establish the relationship between technology and service quality in the banking industry in Kenya and identified secure services as the most important dimension, followed by convenient location of Automated Teller Machine (ATM), efficiency, ability to set up accounts so that the customer can perform transactions immediately, accuracy of records, user friendly, ease of use, complaint satisfaction, accurate transactions and operation in 24 hours [8].

In India technology has become the differentiator and driver of the Indian banking system. According to the RBI report, the PSU banks collectively spent Rs.22.052 billion on ICT in the last decade technically between September, 1999 and March, 2010. State Bank of India has spent Rs.0.429 billion in the financial year 2010 which is the highest amongst all PSU banks. State Bank of India spent Rs.512 crores in financial year (FY) 2011 and Rs.0.537 billion in FY 2010. State Bank of India has the highest number of ATMs with 8,548 in 2009 and 16,204 machines in 2010 among all the banks in India. Thus SBI customers are increasingly transacting using technology in India.

Further, the financial inclusion was a challenge for Public Sector Units (PSU) and using the business correspondent model. They were able to create

about 20 million personal bank accounts. The mere opening of account is not enough to measure financial inclusion but need to check with bank customers as how many services offered by the bank has been used regularly.

The share of electronic transactions to total transactions increased from 32.8% to 40% volume-wise and from 83.9% to 89% value-wise during the financial year 2010. To encourage the electronic transactions, the waiver of processing charges for Real Time Gross Settlement (RTGS), National Electronic Funds Transfer (NEFT), National Electronic Clearing Service (NECS) and Electronic Clearing Service (ECS) was further extended up to March 31, 2011. RBI has also permitted ICL, NSCCL to settle funds of OTC trades of the corporate bond transactions in RTGS. RBI had asked banks to draw up a roadmap to provide banking services through a banking outlet in every village having a population of over 2,000 by March, 2011, either through a brick-and-mortar branch or through various forms of ICT based models. Investment in technology development and maintenance is an important policy for State Bank of India (SBI) [9].

Citibank highlighted on the relationship perspective in a study, which is about speed, convenience, customer service, keeping things simple, and advice about wealth management – it is a complete package according to Mr.Anand Selvakesari, Head-Consumer Banking of Citibank,. If some fees are waived, customers tend to value that and be extremely loyal. Mr Anand notes that at present India has the largest remittance flows in the world and the personal consumption as per market estimates stands at Rs.45 lakh crore and is expected to touch Rs.85 lakh crore by 2015 [10].

There are policies in Indian Banking system that need constant amendments to boost e-commerce. The Finance Ministry has issued a notification allowing Banks to advertise either their own products and services or those of broking firms, mutual funds, insurance companies and pension funds on the ATM screen [11].

As per National Payment Corporation of India's data, the 77 banks that are connected to its National Financial Switch collectively had a network of 91,324 ATMs. The number of cash withdrawals and the number of balance enquiries accounted for 74 per cent and 24 per cent respectively of the total volume of 0.16 billion transactions in February 2012. Further, the Reserve bank of India may cut interest rate by about 0.25 per cent and release more liquidity to stimulate economic growth in its annual credit policy [12], which will increase the number of transactions. Thus, we notice the trend is towards integration of technology enabled banking tools.

Though the banks driven by National Bank for Agriculture and Rural Development (NABARD) and Regional Rural Banks (RRB)'s, are not too attractive for creating new accounts by investing in ICT infrastructure, many banks have invested in ICT infrastructure for financial inclusion. SBI has its own financial switch to network with all its branches. The systems are geared to take low-value high-volume transactions from 500 to 1500 transactions per second. The technologies deployed for financial inclusion are: Biometric smart card, handheld biometric Point of Sale (POS) device for authentication and transaction, General Packet Radio Service (GPRS) enabled mobile phones, Core banking solution. The POS used by banks include voice guidance in the local languages to facilitate the semi-literate and the functionally literate villagers to understand transactions carried out by them. These facilities have increased banking transactions. The key issues in automation today are frauds, costs and resistance to change by employees [13].

In order to uphold the 9% economic growth during 12th five-year plan (2012-2017), India's gross domestic savings to Gross Domestic Production (GDP) has to touch a level of 38% [14]. Banks need to make use of this business opportunity. Therefore, a study on the awareness, use and strengths and weaknesses of ICT enabled banking functions is a felt need. This paper looks at the Alternative channel services from the traditional services of State Bank of India, Bangalore and tries to identify if there is awareness of ICT tools and use of technology by customers to SBI.

2. Problem Discussion

From the foregoing it is clear that in order to assess an e-commerce project, it is mandatory to identify the customer's awareness and experience on using technology for financial transactions. Banking being a service industry needs to spearhead in its quality services towards satisfying customers. Delivering superior services has become one of the most important ways to gain superior profitability. Further, maintaining effective customer service helps to build and maintain customers relationship that is the key success in e-commerce [15]. Technology enabled banking transactions involve high end communication between two using computers, customers and banks information system stored in a server.

Hence, the research problem is formulated as follows: To understand the various ICT tools used in Alternative channels services in Banking especially with SBI and its use among customers. Further, due to the growth in use of varied ICT functions and tools for banking transactions, the process of technology management is conceptualized for argument.

3. Objectives

The objective of the paper is to understand the nature of the new innovative technology enabled services: how it is used, what are the quality control models and what is the experience of the bank and its customers on using ICT for transactions, for good and for ill with the largest bank in India namely the State Bank of India.

4. Methodology

There are six sources of evidence which are available for collecting qualitative data: documentation, archival records, interviews, direct observations, participant observations and physical artifacts [16]. The two common sources selected for this study were documentation and interview. A face-to-face interview was conducted in this study by using open ended and close ended questions to managers and customers of the State Bank of India.

5. Sample Selection

The banking requirements of micro, small and medium enterprises (MSME) sector have made SBI to leverage technology to the SME customers, who are one among the strong drivers to sustain the economy. Non-probability sampling was selected using Judgment sampling method. In this paper the sample selected was the customers of SBI who had assembled for the Times of India SBI SME Utsav to address the Small and Medium Enterprises (SMEs) issues and educate SME customers on SBI products. These respondents were interviewed using a closed ended questionnaire. Further, discussions were generated with Mrs. Neerja Nigam, Deputy General Manager, Alternative Channels and Payments and Mr. Ravikant Kurtagoti Assistant General Manager, Information Technology Services, State Bank of India, Bangalore. Both have over 20 years of work experience in the Bank.

6. Data Presentation and Analysis

A survey questionnaire was administered to the customers and the data was analyzed subject to statistical analysis.

Qualitative data analysis is concerning of three flows of activity: data reduction, data display, and conclusion drawing or verification. They have suggested within case analysis and across-case analysis [17]. This study further conducted within case analysis. The empirical data has been presented and organized based on the subunits of analysis namely: Strengths, Weakness, Opportunities and Threats of SBI's ICT enabled Alternative channel Services.

The general idea of SWOT analysis is that a firm's strategy must be built on its strengths, try to remedy the weaknesses or work around them, take

advantage of the opportunities presented by the environment and protect the organization from the threats. SWOT is simple and does not sacrifice the analytical rigor [18].

7. Findings

The various entrepreneurs from small and medium enterprises were interviewed during the SBI SME Utsav at the SBI office, St.Marks Road, Bangalore and the data was gathered from thirty-two respondents and tabulated as given in Table 1.

Table 1: Awareness and experience of technology enabled services offered to the sme by State Bank of India.

Sl. No	Technology enabled Services	Awareness		Had Experience		
		Yes	No	Always	Sometimes	Never
1	Real Time Gross Settlement (RTGS)	18	14	2	7	23
2	National Electronic Fund Transfer (NEFT)	22	10	3	7	22
3	Society for Worldwide Internet Financial Telecom (SWIFT)	16	16	2	6	24
4	www.statebankofindia.com	24	8	4	10	18
5	Mobile phone banking	20	12	1	7	24
6	Internet banking	25	7	4	10	18
7	E-mail supported response on grievances	18	14	0	9	23
8	ATMs	24	8	9	7	16
9	Core banking facility	23	9	8	5	19
10	Credit and Debit cards	25	7	9	5	18
11	Gift cards	13	19	1	4	27
12	Travelers' cards	16	16	1	5	26
13	Point of Sale (POS)	9	23	1	1	30
14	Cash Transfer Machines (CTM)	1	31	1	0	31
15	Call center – 1800-11-22-11	12	20	0	5	27
16	E-VFS	0	32	0	0	32
17	E-DFS	3	29	0	0	32

From the above Table 1 it is observed that over 50% of the respondents did not have experience in any of the technology enabled services. However, over 60% of the respondents were aware about the services. 78% of the respondents were aware about the Internet banking but only 44% had used. The figure is the same for credit and debit cards. 75% were aware about the website of State Bank of India but 44% had visited the website. Again 75% were aware about the SBI ATM but only 50% used them. About 72% were aware about Core Banking Services and 41% used this facility. National

Electronic Fund Transfer (NEFT) was known to 69% and 31% use this service. Though the trend setting concept is Mobile banking, 63% were aware and 25% used it. The feature of Real Time Gross Settlement (RTGS) was known to 56% of the SMEs but 28% actually used RTGS. Only 56% were aware that grievances could be sent to managers by email but 28% irregularly used this mode of communication. Society for Worldwide Internet Financial Telecom (SWIFT) services was used by 25% but 50% were aware about the services. Again 50% were aware about travelers' cards but 19% had experience using them. 41% were aware about gift cards and 16% used at least once. 38% were aware about the call center number and 16% had called the at least once. 28% knew about POS services but only 3% used it. And hardly anyone was aware about Electronic Dealer Finance System (E-DFS), Cash Transfer Machines (CTMs), Electronic Vendor Finance System (E-VFS) and neither have they used these services.

By using non-parametric test, the data in table 1 is being represented by graph as given below.

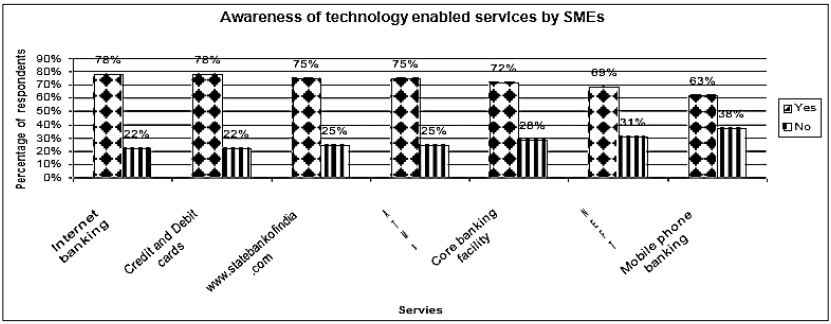

Fig 1: Awareness of ICT services of SBI by SMEs

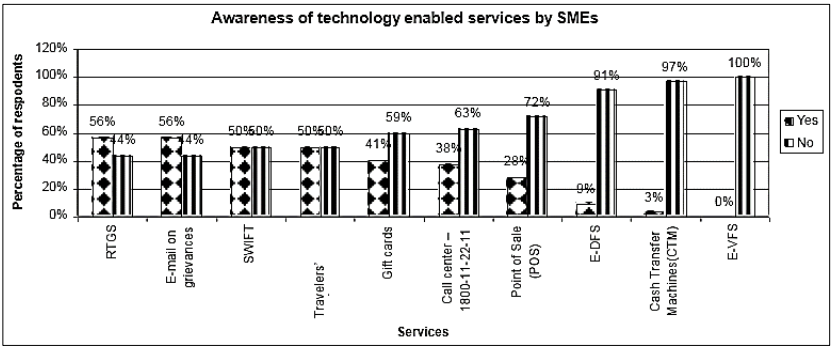

Fig 2: Awareness of ICT services of SBI by SMEs

Upon intervening with the respondents about their awareness about electronic banking services, it was revealed that more customers are aware about ATM banking, Debit or credit card transaction, internet banking, Core banking facilities and mobile banking than RTGS, NEFT, SWIFT, email support, gift cards, travelers' cards, POS, CTMs, Call center, E-VFS and E-DFS. This implies that SME banking customers are more familiar with ATM and use of debit and credit cards and CBS put together compared to other services shown in Table 1.

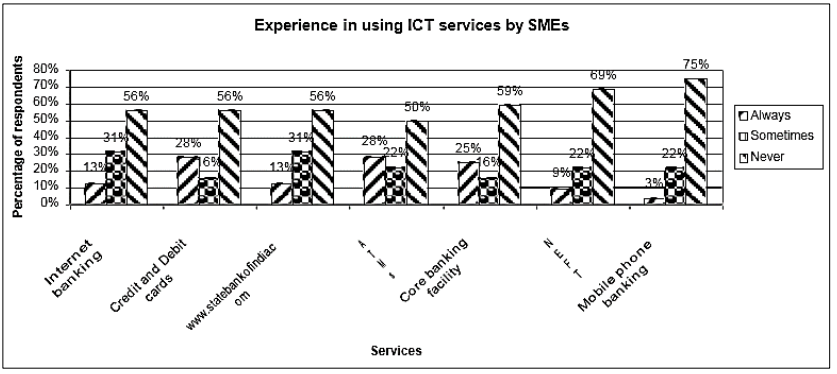

Fig 3: Experience of using ICT services by SMEs

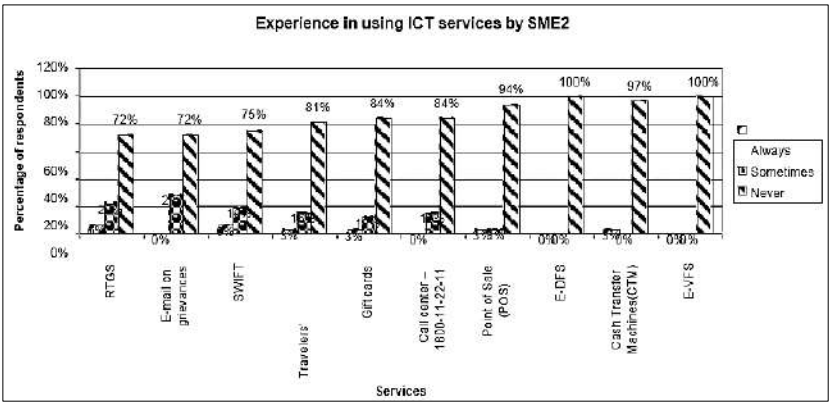

Fig 4: Experience of using ICT services by SMEs

When the respondents were questioned about their usage to electronic banking services, it was shown that more customers have adapted to ATM banking than mobile and internet banking. This implies that the banking customers are more familiar with the ATM technology as compared to both internet and mobile banking. Mrs. Neerja Nigam, Deputy General Manager, Alternative Channels and Payments were interviewed on the Strengths,

Weakness, Threats and Opportunities of the use of Alternative Channels both from the bank's operations and customer's environment.

8. Strengths

It is clear from the analysis that SBI's ATM banking has taken over traditional personal banking transactions by over 46% of the total transactions in Bangalore. Due to its enormous growth in transactions and new customer creation, the bank has its own financial switch center managed at the Global IT center, Bellapur, Mumbai. Karnataka alone has over 5 million customers using Alternative channels and is growing by the day. The connection is up 24/7 365 days using Very Small Aperture Terminal (VSAT) and Reliance Code division multiple access (CDMA) for remote areas. The bank's use of cryptography technology enables high level of password protection and validation for all screen-based clicks or slides. Value added facilities in ATMs like payment of bills, taxes and donations, card to card transfers of the same bank are becoming popular. The introduction of Bunch Note Acceptor (BNA) and Self-Service Kiosk (SSK) to check transactions and print on pass books would further enhance customer expectations and reduce rush in banks branches.

9. Weakness

One of the weaknesses of the SBI alternative channels services is that it cannot maintain accounts with zero balance and minimum balance of Rs.100. It is also difficult to network with rural areas where the telecommunication towers are located far away from the branch or Kiosks which fail to fulfill the financial inclusion by the bank. These branches need staffs who can speak in the local language and who are qualified to work with SBI.

10. Threats

There is only one threat to the technology enabled alternative channel services and that is Cybercrime.

11. Opportunities

With the growth in transactions over online banking and ATM banking services beyond the Core banking solutions, it is necessary to integrate ATM services along with Bunch Note Acceptor and Self-Service Kiosk into one application in SBI ATMs. This way there could be higher value in transactions and gain profits by service charges. With the growth of mobile communication in India, SBI has greater opportunity to expand in mobile banking, ATM services and Online banking in rural areas. The present system in Bangalore One and Karnataka One could handle many of the services provided by the bank to its customers beyond being visible in Post Offices.

It was learnt from the overseas bank manager that their office uses (Export Import) EXIM software for all operations of the export and import transactions. Core Banking Services and Mercury are the other software packages used for banking operations which are linked to the Alternative channel services.

Mrs. Neerja states that the cost to bank using manual transactions is Rs.40/- per transaction but it is safe. It costs Rs.20/- per ATM transaction and is also safe. Internet transactions costs Rs.12/- and is safe but mobile transactions cost Rs.1/- per transactions but at present the authorities feel it is unsafe and hence the transactions are limited to a value of Rs.2,000/- and account enquiry on the last 5 transactions can be gathered using mobile phone.

12. Summary And Conclusion

From the findings of the interactions among the sample indicates that there is high awareness on over 50% of the ICT enabled banking services of State Bank of India. Due to the lack of training and opportunity to utilize the technology-based services, many of the entrepreneurs from Small and Medium Enterprises of Bangalore resist the usage. Nevertheless, the growth of technology has been seen that use of ICT services as the cutting-edge factor for competitive advantage. Hence, this research was carried out in SBI, the largest banker in India. It was established that there is a direct relationship between awareness and experience in use of ICT services in SBI products. The use of technology also enhances the freedom and service features offered to customers. But the level of utilization differs with service experience and education of the customer. This was possible through use of percentages and graphical representations. As the test variables were controlled by fixed and continuous scale, further statistical analysis could not be conducted in this study. The growth in transactions in SBI financial switch indicate that the expert in technology banking customers always look ahead for innovations in technology with integration of tools compared to novice users. This situation needs to be analyzed for banks to take a strategic decision whether to go ahead in IT investment for innovation or not.

It is advised that the customers could have value addition in the cool ambience in ATM banking especially with music and advertisements while transacting inside the kiosk. Alerts can also be mentioned over the audio system about risks and convenience in using ATMs.

Mr. Anand Selvakesari, Head-Consumer Banking in Citibank feel speed, convenience, customer service, and keeping things simple are some key factors for good customer relationship in technology banking. Thus, more

customers should be trained in Online and mobile banking apart from visitors to the branch or ATMs. Commerce and management students could be assigned with internships to train customers on site to use their own mobile phones and the students' laptops to showcase and train walk in customers. Further, they could collect feedback from the customers on their expectations, needs and wants from SBI Information Technology Services and Alternative Channels and Payment services.

The study strongly recommends that the Ministry of Human Resource Development (MHRD) and Ministry of Commerce, Government of India pitch in to meet the account maintenance charges of the banks for the people maintaining a zero or less than Rs.500/- balance in savings bank customers accounts. This will enhance the financial inclusion of the citizens of India.

The paper has a limitation on gathering official data from Mr. Ravikant Kurtagoti Assistant General Manager, Information Technology Services, State Bank of India in Bangalore in order to identify the framework for technology management for the financial services system of the Bank. Hence, it could not assess the efficacy of the technological gadgets and activities to maintain the new type of services to the bank customers. It is hypothesized that with the new tools on mobile applications and web applications being introduced in the market in short intervals, the changing consumer needs would have to be met for furthering transactions over ICT tools. On identifying the trend on usage of technology enabled tools in India, the researcher recommends that a study should be carried out to identify the trust on ICT banking services delivery using Alternative channel services. Further the quality control framework needs to be identified to find the role of customers in the strategic decision making of re-engineering of ICT enabled services in State Bank of India. To conclude cooperative banks in rural areas have begun to automate their operations which are a positive sign towards ICT enabled banking services for the last mile connect. This will change the entire nation's traditional banking system from Brick-and-Mortar to Click- and-Slide. It is a vision and to note that mobile banking would take over ATM banking and currency printing maybe eliminated for few denominations which may be replaced by digital money resulting in savings to the Government of India and Reserve Bank of India.

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Chapter - 12

Work-Life Balance in the Refashioned Healthcare Industry: Adaptive Management & Reforms in the Workplace Post-Pandemic

Asfah Aidah Shabbeer
School of Commerce, Presidency University,
Bengaluru, Karnataka, India

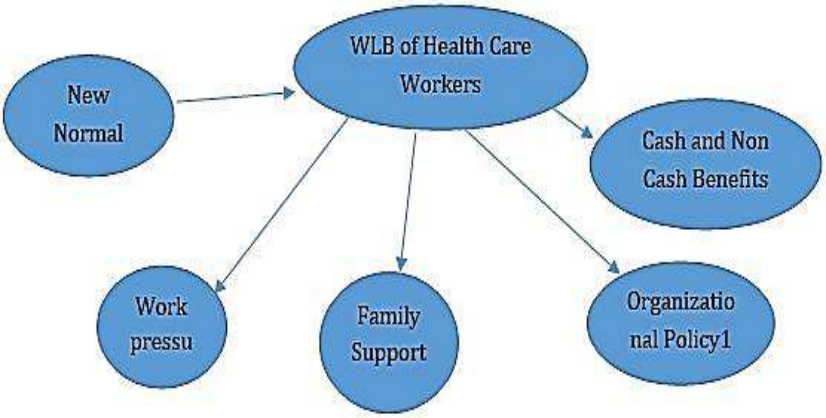
Abstract

While the rest of the world came to a standstill, the healthcare delivery systems only worked twice as hard. The pandemic has been a witness to the exhaustion and chaos that ensued due to lack of proper management where employees suffered the brunt of the work, unable to create a balance between professional duties and the time-off. The traditional approaches towards recruitment, organization, planning, and crisis management have become obsolete. As a result, it is imperative to determine the long-term effects of Covid-19 and its burden on the organizational, as well as individual needs post-pandemic. Without such, the importance of work-life balance will not be underlined, therefore neither improving local nor global vigilance in healthcare management methods.

This study analyzes data from a survey with participating healthcare workers and customers, to recognize and compare changes in organizational and consumer behavior in the healthcare niche during the outbreak and presently as it prepares for normalcy. The objective of this research is to highlight the need for proper work-life balance, adaptive management and prepare for any probable repercussions faced by the human resource department after the outbreak of an epidemic. This study identifies the new challenges to direct employees, ensure business continuity, create work-life balance and take advantage of opportunities in favor of the company.

Keywords: Work-life balance; Adaptive management; post-pandemic; Human resource management; challenges; Covid-19; Healthcare.

Graphical Representation of Abstract



Introduction

Since December 2019, we have been fraught with the devastating effect of unprecedented COVID 19 pandemic. The dark cloud was first witnessed in Wuhan, China, which gradually engulfed the enire world in no time. Rapid spread of the disease and shocking number of deaths have created immense psychological distress like anxiety and fear among people. Early studies conducted on population in China showed that the psychological impact of the COVID19 pandemic was found to be moderate or extreme in case of 53.8 percent of respondants [1, 2]. In addition to the psychological consequences of the social crisis, healthcare professionals (doctors) are subjected to more stresses due to active participation in the treatment of infected patients. They are prone to pronounced risks of getting themshelves infected with the deadly virus as well as spreading the same to near and dear ones. Their anxieties for their own safety and well-being of loved ones are obvious. Their emotional and physical burnout over time has exacerbated the number of cases and deaths from disease, the excessive labor burden and the lack of personnel safety equipment [2]. Studies on Chinese health-care professionals have found the incidence of depression, anxiety, and other stress related signs during COVID19 to be 50.7 percent, 44.7 percent, and 73.4 percent, respectively [3]. However, there is little information and knowledge of the medical workers' psychological needs to cope with this disaster. Therefore, more study is highly recommended in order to assess the psychological effects of the Covid19 pandemic on health workers and associated risks and protective factors [2].

The low ratio of health care workers and population and the skewed health care distribution in India have made a valid case for investments in human resource for health (HRH) [4]. A recent World Health Organization (WHO) study estimated India's need of at least 1.8 million physicians, caregivers and siblings for reaching the required minimum of 44.5 jobs for every 10 K population by 2030. The 2017 Indian National Health Policy (NHP) recommended strengthening of current medical education and development of a sound health care provider framework. Likewise, the 'New India@75', NITI Aayog Strategy aims to create 15 lakh employment in public health by end of FY 2023. India has been witnessing serious scarcity of health workers during the ongoing COVID-19 pandemic. This problem is further compounded due to the demands of Indian health care professionals in OECD countries. A wide variety of practitioners qualified in various medical and health care facilities in India are offered to provide medical services. These medical professionals possess varied educational qualifications and are registered with organisations depending on their fields and practices.

The onset of the COVID-19 pandemic put the health workers including physicians on the front lines of the virus globally. There are many stories and photographs depicting the difficulties of the health workers, who become sick and even die from the virus, available in the public domain [5]. Initial studies emphasized the value of protecting health workers from direct exposures to COVID-19, as well as providing them with appropriate protective kits to avoid COVID-19 infections to ensure their physical well-being. Many self-assured and concerned health care professionals became vulnerable to moral injury as they are unable to provide hassel free services to the suffering patients and their families due to new normal protocols of the pandemic like rationing of scarce care services, isolation and social distancing at work place, teleworking processes and increased use of PPE kits [5]. While many doctors operate in COVID-19 intensive care units, doctors working in non-acute care most often experience anxiety, fear, and guilt as they are not able to provide normal medical services because of COVID19's restrictive protocols. As a result of imposition of prohibitive orders of authorities like work-from-home and lockdowns, doctors face challenges in providing their services to the general public [6]. It is important that doctors and other health care workers be protected for their mental and physical well-being. The WHO acknowledged "Our health care staff is out of work and people are vulnerable to burning in countries around our globe. If we are not concerned with our medical and vital staff, we have no COVID-19 answer: their needs and welfare must be given priority".

In addition, the health care workers face a lot of difficulties in managing their work life balance during the pandemic. The challenges are manifold, both in work and home fronts. While shortage of adequate trained staff put additional pressure on the available health care personnel, the wrath of patients' and their anxious relatives, and also the glare of media and their zest to make issues out of proportion make the lives of health care workers miserable. Further, their increased responsibilities at home towards families due to restrictive Covid19 protocols have made matter worse for them. As a result, they find themselves physically exhausted and emotionally drained out.

Though stress is inherently high in caring professions, occupational resources that assist health workers in the administration of stress are frequently concentrated on individuals such as training in personal awareness and resilience rather than at work. Programs based on different reactions and doctors' positions have proven to be less successful in the long run than actions to improve the workplace environment in order to reduce tension [7]. Informal support of friends and relatives more often than not protect health care professionals from being burnt out and also help them in dealing with their predicaments effectively. However, lack of an ideal echo system in hospitals and other health care establishments to ensure proper work life balance of the health care professionals and also to effectively address their work life conflicts often lead to a situation in which these professionals do not get the opportunity to access these informal services, thereby adding to their stress. Physicians with positive well-being can contribute for creating an environment in which the quality of health care services is augmented with cost reduction and minimum workforce attrition. The aim of this research was to find out the work life balance of doctors and health care staff in new normal situation in India.

Objective of the Study

The current study aimed at understanding the factors affecting work life balance of health care workers in the new normal, and also undertaking an empirical study on work life balance of health care workers in Covid-19 pandemic.

Methodology

The current study was built on the secondary data collected from various websites and through visits to libraries following Covid-19 protocols.

Literature Review

Work Pressure Related Issues

In every corner of the universe, the stress of work life balance is seen. When there is no satisfaction with the job, it becomes important. The balance of work life needs stability between work and personal space to reduce the tension between official and domestic life [8]. The ultimate success of any organisation, which varies from one to another, depends on the work conditions of its employees. This can be linked to happiness at work. Secondary data was used for study comprehension and conclusion. Research has indicated that WLB and stress control could be accomplished by job satisfaction factors such as promoting social groups, adapting working conditions, psychologically demanding working conditions, unbiased incentives and employee-driven policies, etc. To conclude the report, work life balance and stress management are proposed as not a problem to be solved, but rather a chronic problem to be handled.

According to a study [9], work life balance of support staff in old age homes is a real challenge because of extremely limited facilities and lack of proper work environment in these workplaces. The work conditions of the workers depend on the discretion of the management. Because of their demanding working environments, these employees find it difficult to maintain a desired level of work life balance. The authors based their study on a qualitative analysis of responses to pre-determined open-ended questions asked from 33 employees of the old-age home care establishments, from both public and private sectors. The interviews started with the topic of work life balance and then moved on to discuss the specific issues of old-age home care. They compared the responses received from men and women to the issue of work life balance. The results showed two main distinct variables: Age and parenthood. Their older respondents reckoned that because of their grown-up children they were having time for themselves even though their working conditions were difficult. However, single women were found to live in a more complicated work-family situation, in part due to the lack of labor rights and unfavorable work environment.

The results from a study conducted in Saudi Arabia indicated that 52.4% of nurses, particularly primary health care unit (PHCU) nurses, are dissatisfied with their quality of work life [10].

Medical activity is one of our health determinants [11]. The manner in which people take care of their health affects their health and well-being, quality of life and ability to function. Lifestyle and health conduct have

important health effects, while a lack of pro-health behaviour, particularly among men, can pose a risk to many conditions and mortality. The research aimed at defining the determinants in the labour market of good health habits for men of 20-65 years of age. A questionnaire-based study was conducted among 600 men working in the labour market to check people's attitudes toward health and health behaviour. The study revealed the factors influencing their health-related actions. The positive health habits of men were linked to good economic status, high self-evaluation of health care, and positive attitudes about living and working life. They were also employees of white collar with good job skills. Based on the study, the surveyed men have been highly evaluated and their wellbeing is distinguished by average health treatment determined by their health behaviours. Men are split into health concerns, in relation to demographic and socio-economic characteristics, personality characteristics, health auto assessment, health care declarations, and the willingness to function. A health education program for men is needed for blue collar employees, as less trained workers.

Infrastructure and Family Support

The relationship between work and life, and between happiness and employee efficiency has been investigated [13]. The research focused on 289 staff from Med Pharma, pharmaceutical industries in Jordan, and a questionnaire-based survey was developed accordingly to evaluate the same. To test the study hypotheses, multiple regressions were carried out. As a result of this study, several recommendations could be extracted for the consideration of managers of organizations, especially those in Jordanian Pharmaceutical industries, in order to promote work life balance and happiness at work, as this will boost employee efficiency. As a result, more emphasis should be placed on life quality factors that are known to influence the results. These components are employee engagement, work satisfaction, and affective organizational commitment.

A multifaceted study of understanding and use of policies for work life balance, cognitive involvement and professed support for organizations has been conducted [14]. The study tested a multi-level model based on boundary management and social exchange theories to explore the impact of mutual employee knowledge and use of organizational work life balance (WLB) policies on employees' seeming administrative support. The results of multi-source data collected from management and non-management staff of thirty Ghanaian establishments confirmed the conjectured conciliation and moderated results. They addressed the implications of the results for work-life management practice and study in Ghana. The academic and real-world

consequences for WLB research were explored in light of the study's results. They offered and verified a model of the methods that affected cognitive engagement and perceived organizational support (POS) based on employees' mutual awareness and practice of WLB policies, which played an important role in the relationship between WLB policies and outcomes such as cognitive involvement and POS.

With special emphasis on health, the role of other fields of non-working in the WLB has been scrutinized, along with the relevance to job satisfaction of the working-family balance (WFB) and the work-health balance (WHB) [15]. They investigated how the results of the WFB and WHB differed based on employee characteristics, namely age, gender, parental status, and work ability. This research entailing an online questionnaire was completed by 318 workers. Multiple and moderated regression analyses were used to examine the impact of the WFB and WHB on work satisfaction. According to the results, staff ranked health as significant as family in the WLB. The WHB clarified a greater proportion of the variation in work satisfaction than the WFB. Work skill moderated the effect of the WHB on job satisfaction, while age, gender, and parental status moderated the effect of the WFB on job satisfaction. This research emphasizes the importance of the health domain in the WLB and the importance of recognizing the specificity of different worker groups while considering the WLB.

Studies from Iran and Taiwan have shown that nurses working in outpatient case teams revealed better quality of work life than nurses working in other departments. Nurses working in inpatient departments tend to require shift work, direct patient contact for care, and high time burden, work overload, and environmental conditions thus resulting in lower quality of work life (QWL) [36, 37].

Also, the result of previous studies implied that major influencing factors for dissatisfaction with QWL among nurses were unsuitable work hours, inability to balance work with family needs, insufficiency of breaks time, poor employment, delay in promotion, and insufficient hospital sponsored training [38–40].

Organizational Policy

It is discussed that the nurses are being dedicated to their patients and colleagues [16]. Often, they place other people's needs ahead of themselves and even before their families' needs. This thoughtfulness for others can lead to stressful conflicts. It also emphasizes the importance of active, evidence-based methods to improve the work life balance. Their self-reflection gets

manifested in their actions. The world acknowledges their selfless conduct and respects their well-being. However, nurses should learn individual techniques for balancing their work life and also their own wellbeing. This training will assist them in succeeding and doing well in roles that offer them comfort and joy outside of the hospital. Recognizing the need for and committing to change are the starting points for developing productive WLB.

The balance of work life of health care professionals at Himachal Pradesh government hospitals has been addressed [34]. Work life policies and incentives are the most obvious parameters of a family-friendly or flexible workplace. Work-family programs and facilities are intended to assist, support, and/or inspire workers in successfully managing their work and family responsibilities. These programs can provide employees and their families with physical, emotional, mental, financial, or even social support. The aim of this study was to look into the various work life balance programs implemented by government hospitals in Himachal Pradesh. The research aimed to identify the programs most commonly used by medical professionals to achieve work life balance. The research was carried out among medical professionals working in various government hospitals in Himachal Pradesh. Organizations can manage a variety of work family supporting programs such as flexi-time, shortened workweeks, and job sharing. Such programs will provide more assistance to individuals attempting to manage employment and other family commitments, thus reducing work-family tension. Organizations can not only minimize work-family tension by enhancing working conditions and implementing these measures, but they can also increase overall job satisfaction, motivation, efficiency, retention, and reduce health care costs, stress-related illnesses, and absenteeism among workers.

A gender-based analysis on problems in working life and doctors' job satisfaction has been carried out [32]. A number of changes in professional roles and limitations was observed in today's context of health care delivery and medical education. Consequently, the multiplication of the tasks of doctors led the researcher to emphasize their issues of work life. The purpose of the study was to analyse the factors that affect job satisfaction of quality of work life (QWL). The hypothesis was tested using multivariate statistical techniques. The results showed that health departments must concentrate on potential causes, to ensure doctors' job satisfaction based on gender. Authenticity and dignity, mental condition and impact on personal lives have been established as important QWL factors affecting the satisfaction of women at work. The study also included finding certain QWL dimensions that influence the job satisfaction of the male and female physician samples. Therefore, a sample

study of female doctors showed that the main predictors of intrinsic, extrinsic and general job satisfaction are self-respect and dignity, mental condition and effect on personal life.

A study delved into how, in today's competitive era, women must fight hard to establish their individuality in both society and professional life [33]. The main challenge in the lives of working women is work life balance. The survey covered the balance between work and life of female doctors in Jharkhand's private hospitals. This research could contribute to understanding the effect on job satisfaction of work life WLB. The regression analysis and ANOVA test were used to test the interaction of the variables. The study found that the balance between work and life had a positive effect on work satisfaction. It is held that achieving harmony between work and life is not an issue; it can be achieved by successful management techniques. The balance of work-life cannot be fixed forever, but it is a challenge to handle. It is shown that women workers show more imbalances in their work and life than men. This may be because of their various responsibilities at home. This research aimed to understand the work life equilibrium of women doctors.

A study provided qualitative information on work life balance of Australian psychiatrists and trainees by conducting an online survey of focus groups [31]. This study examined the well-being of members in college. The results showed that many doctors struggle to reach a satisfying work life balance. There is a large amount of work that can interfere with family life in a short period. The respondents noted that they might change their external environment to relieve stress, e.g. developing a niche, building variety into work, working part-time, as locums, or private practice. Many doctors have followed positive personalized approaches for relaxation, i.e. social time, reading, and exercise being the most common. However, there were many doctors who thought they had no option to relax. It was recognized that it would be too simple to assign all stress and burnout issues to poor WLB. It was therefore suggested that WLB understanding is an important addition to psychiatric well-being.

A study examined WLB-related variables for employees in Korea, including work time characteristics and WLB-health outcomes [30]. It was well established that the relationship between work life balance (WLB) and health was not adequately studied in Korea. The information was collected from the third Korean Working Conditions Survey, which looked at an illustrative working population. The general features, working time structure, work-related health, and WLB were all examined in this report. The relations between WLB and health outcome variables such as health status, mental

health, work-related health risks, sick absenteeism, presentism, WMSD (work-related musculoskeletal disorder), headache/eyestrain, and fatigue were tested using a multivariate logistic regression. The WLB was found to have general characteristics including gender, age, work sector, occupation and job type. In addition, working time features were closely associated with WLB. WLB was also strongly linked to different outcomes for wellbeing. They showed that WLB's health results were very closely linked to Korean jobs. The results indicated that interventions to incorporate work-time strategies for better health are essential.

Another study addressed the possibly complicated and difficult process of changing into independent nursing practice for freshly trained nurses who may be at risk of being burnt out and leaving work [29]. Issues concerning the well-being of new nurses at work can also affect their personal lives. This study analysed the factors related to the overall employment, safety and health of newly approved nurses in order to support their well-being and avoid the burnout and attrition through thematic analysis in the context of total workers' health. Total workers' health is essentially concerned with identifying and understanding related problems, which lead to safety risk as well as health risks at workplace, which influence the well-being of employees both at work and home. Three key topics, including fitness, work and nursing, formed part of the overall principle of work-life balance. These topics describe the challenges that participants experienced during the transition from student to nurse in order to balance the diverse interactions of job environments and social changes. The participants reported new physical health issues, mental health struggles, physical abuse, a lack of support systems at work, and changes in family and friend relationships. They established protective factors as a result of new relationships with co-workers. These results revealed that new nurses are susceptible to a variety of factors at home and at work that affect their well-being and can contribute to burnout and attrition. The implications included workplace programs focusing on health promotion, community support, and risk reduction through occupational nurse management.

The interconnections of four different dimensions of the satisfaction of European workers in their lives, i.e. satisfaction with their education, the current working environment, their family life and society, was discussed in order to achieve the optimum balanced levels [35]. This research was carried out individually in 34 different EU countries for employees' different profiles, i.e. full-time and part-time jobs, which were distinguished by gender. The technique used for this purpose combined econometric and multi-objective

programming intervals to evaluate the compromise between particular aspects of employees' personal and work environment. They showed that the current working climate in full-time workplaces could not encourage a higher level of employee satisfaction with more than one child. Furthermore, full-time (as opposed to part-time) job activities enable all life satisfaction measurements to be analysed at worse levels in the best possible scenario. The results indicated a paradigm shift in which employees chose to sacrifice other facets of happy living, namely their income and benefits, which meant a healthier personal and work-life compromise. It is clear that unilateral policies, particularly those that do not incorporate family values, serve to make people happy only in their jobs.

Difficult working conditions and a poor balance between work and life are frequently cited as a catalyst, especially in the hospital sector [5]. The research sought to gain insight into the work experience and work-life equilibrium of hospital doctors. This paper provides a qualitative review of free-text responses about working conditions and work–life balance. According to the results, respondent doctors irrespective of their seniority were besieged with achieving work life balance with work–life mismatch and work overload being the most pressing issues. Work life balance has become the standard in Irish hospitals. Based on responses from hospital physicians, this study considered the long-term viability of this way of operating for individual doctors, the medical workforce, and the Irish health system. If health workforce preparation is about putting the right people with the right skills in the right place at the right time to provide treatment, work life balance is about keeping doctors happy and allowing them to stay. Their research emphasized the significance of work–life balance in promoting hospital doctors' well-being and retention. The majority of survey respondents (73%) were feeling the burden of work–life imbalance, and respondents clearly expressed the negative effect on their lives and well-being.

Earlier studies revealed that poor QWL was related to lack of independence to make patient care decisions, increased workload, role conflicts, lack of opportunities for career advancement, low salary, lack of professional autonomy, lack of stakeholders support and insufficient welfare services, attitude of society towards nursing, higher level of education, and longer professional experience, which were factors that adversely affected the QWL [42-47].

Work Related Cash and Non-Cash Benefits

A study addressed health care workers' views of their obligation to work

during an influenza pandemic [28]. The National Health Service (NHS) in UK has introduced important workforce changes to address the rising and changing demand for healthcare services in response to the pandemic. Health care workers are frequently believed to have an obligation to work despite attendant risks. This is especially true for professionals such as doctors and nurses. The obligation to work always needs to be under scrutiny due to the task of responding to pandemic influenza, where a successful response requires most uninfected health care workers to continue working despite personal risk. The current article presented results from a survey of HCWs (n = 1032) performed by three trusts in West Midlands, UK of National Health Services to determine whether HCWs are likely to work during a pandemic with views on work obligation. HCWs feel that despite personal risks, they have a job obligation, no matter what their occupational status is. In addition, all HCWs have recognized an obligation to work even in challenging situations that strongly correlate with their reported chance of working together. This means that HCWs are closely connected with their sense of duty to decide if they are prepared to operate during a pandemic.

The effect of redistribution on doctors' well-being as well as to identify improvements has been investigated [27]. They conducted a 2-week survey on three NHS trusts asking redeployed physicians to assess their morale, work-life equilibrium, the support and protection they perceived. The questionnaire was answered by 172 redeployed physicians. Out of them, 66.3% felt secured in their current jobs, 65.7% felt contented or neutral, and only 31.4% felt depressed at work. Their teams appreciated 66.3 percent and the general public respected 79 percent. And 64.5% observed an improvement in break duration and 89% thought that their rotas offered enough respite. The results indicated that the morale of doctors who felt respected, secure, and well-remained in their new position was greater than the predicted. There must be a response to concerns about training opportunities/career development, PPE and family protection. During the COVID-19 pandemic, their research offered a significant insight into the well-being of redeployed physicians. The results indicated that moral standards are higher among doctors surveyed, with doctors feeling well rested during and between shifts. These guidelines may help to minimize the adverse impact of redeployment in the light of other COVID-19 pictures or following pandemics on the well-being of physicians.

According to a study [26], health care professionals faced greater degree of job-related stress than the general public and that their physical and mental health concerns were linked to stress in normal circumstances. Medical professionals are often more likely than other occupational classes to commit

suicide, and that work-related stress is a common cause for choosing such extreme steps. Studies often indicate that it is difficult for many doctors to inform their colleagues or employers about their problems with psychological wellbeing. Even in normal circumstances, doctors suffer high levels of job stress, but often are unwilling to report or seek support for mental health challenges, with stigma being frequently cited. The COVID-19 pandemic is placing more pressure on doctors and the health care system in general. Research has shown that the risk for physicians is higher. The researchers have therefore argued that during the COVID-19 outbreak the authorities and the health managers must demonstrate good leadership and support doctors and their families, and call for measures to eliminate stigma in clinics. It can be actively promoted by introducing "Mental Health Assistance" to a high-level management planning session as an ongoing agenda.

A popular approach to be taken to study WLB of physicians during the pandemic covid-19 [25]. While organizational and system factors contribute significantly to poor mental well-being, individual physicians may take measures to safeguard their wellbeing in this period of difficulty. Doctors should particularly ensure that three of their psychological basic needs are met, i.e. autonomy, belongingness and competence. A lack of perceived influence may increase stress on decision-making. It is necessary to identify these factors and find suitable methods for handling them to stay mentally stable. Doctors may increase their impact by partnering with others to recognize and appreciate improvements. Regulation of self-care behaviours is vital, especially through regular breaks, healthy eating and encouraging colleagues to do the same. The promotion of public awareness, media involvement and activism may also help doctors increase their sense of autonomy. It is also important to aim at improved stress control and coping strategies.

It has been depicted in their paper that psychological diseases (stress, depression, anxiety and insomnia), due to occupational stress, have become increasingly prevalent among the medical professionals globally and their emotional fatigue has been found to be linked to health and wellness failures [24]. The aim of the paper was to analyze different aspects of employment stress of Indian physicians during COVID19 that could lead to an absence of patient care efficacy. Online research was performed with the assistance of an investigation to capture and assess the psychological answers and related features by Indian medical professionals in the COVID-19 pandemic. It covered three sub-divisions dealing with topics related to the following main areas, including socio-demographical statistics, stress at work during COVID-

19 and data on the working condition of individuals. The factors identified for higher occupational stress were as follows: Increasing average operational time, increased number of Covid-19 patients, a reduced level of assistance by peers and supervisors, reduced logistic support and lower performance dissatisfaction during Covid-19-related activities. Their research discovered the potential causes of occupational stress that must be considered when dealing with a disaster that has a huge impact on society globally, in order to preserve physicians' mental wellbeing.

It has been observed that 'Work-life balance' is a term that is frequently used, but rarely described [23]. It might seem like, when health care staff cope with extraordinary situation, the COVID-19 pandemic is a twee term. However, many people will reassess their life decisions once the pandemic is over. This article clarified working-life balance and proposed methods to maximize it within the limits of a busy job in cardiology. It is stated that when the option of choosing a work life balance is eliminated, tension and conflict will emerge. Removal of preference may be subtle or explicit, such as when doctors believe their career advancement as a part-time trainee would be hampered, or when individuals see the requirements of cardiology training as incompatible with their priority of raising a family. Removal of preference, on the other hand, may be obvious or explicit, such as when residences, lives, or families are interrupted, or when personal circumstance—for example, divorce and illness—interferes with training requirements. The study concluded by saying that in a few exceptions, failing to prioritize professional duties is not a breach of patient care. Although medicine is rich and satisfying, diverse and vivid, and packed with both cerebral and emotional challenges, it should only be a part of a doctor's life.

A study on the corona virus crisis in the U.S. revealed how this country lags behind the other major industrialized nations in terms of providing jobs in all sectors with fair access to facilities like paid sick and family leave, employees' flexible scheduling, and acceptable work hours [22]. Many important front-line workers, for example in the health, food and safety sectors, were unable to achieve benefits that promote the work-life balance and play a critical part in helping employees manage work stress and protect their health. The inquiry suggested three evidence-based national proposals to change American policies on work and life: Ensuring that workers have access to pay-sick leave and family vacation, mandating employers to build emergency back-up staffing infrastructure, and enabling their employees to ask for flexible and fair work hours. Research has suggested that employment discrimination can be mitigated by policies focusing on the 'fair flexibility'

principles, which include both employers and workers in decision-making and take account of both work and non-work requirements.

The incidence of burnout among physicians and nurses working on frontline wards (FLW) and those working in usual wards (UW) has been compared [21]. The survey was conducted among 220 representatives of COVID-19 FLW and UW at a ratio of 1:1 with a questionnaire of 49 questions in total. Biodata was collected and compared, such as age, gender, marital status, and the medical staff of Maslach Burnouts Inventory. The health workers employed on the COVID-19 FLW were lower in burnout than the UW personnel for uninfected patients. These results indicate that both the FL ward and the UW staff should be taken account of in the face of the COVID-19 crisis as policies and practices are developed to support the well-being of health workers.

A study summarized the management techniques available to improve resilience among health workers during and beyond the COVID-19 pandemic [20], focusing on self-care and corporate justice. It also emphasized different individual and organizational strategies. As the slow spread of illness in many countries continues to be successful and the workload has decreased because of restrictions to optional operations in many organizations, there is more time and ability to be pro-active in taking actions to minimize or eliminate possible adverse psychological impacts and to enhance, restore and maintain worker wellbeing now and for years to come. The objective of this paper was to review available research on interventions that minimize the COVID19 pandemic's psychological effect on clinicians and recognize pro-active holistic measures that could benefit both health workers in the current crisis and in the future. In order to address this psychological distress, strategies for resilience in clinicians are necessary. The reallocation of support workers needs to be increased; revenue distribution through the organization must be reallocated, whether physicians feel appreciated and heard; and how agreements with internal and external stakeholders can change the model of reimbursement and compensation.

A study was conducted on the work life balance of resident doctors during COVID-19 [19]. Focus group interviews were performed with physicians, doctors and interns assigned to COVID19 wards in Northern India hospitals. The research entailed 97 doctors, including psychiatrists, radiologists, pediatricians, gynecologists, and medicine, who worked in one of COVID19 wards on one or more shifts. The doctors were assigned responsibilities in two COVID-19 hospitals in Northern India where the study was conducted. The long and boring working hours in the hospital came with the added burden of

maintaining and documenting the data of COVID patients. Following the 15-day long service in the hospital, they had to remain isolated for 14 days in a separate accommodation. This long separation from family and friends caused enormous tension in their lives. As a result, their ethical behaviour was significantly affected. For female doctors who had small children, the question of juggling between work and life was particularly difficult. It was concluded that a poor balance between work and life adversely affected doctors' well-being.

In the course of a pandemic, healthcare liability is transferred from the individual patient to the general public. The pandemic of corona viruses reformed the medical landscape and placed a burden on all health care staff, particularly women [18]. The current COVID-19 pandemic has pushed governments and health care systems to devise nuanced strategies for the distribution of scarce resources due to the threatening pressures on the health care system. Women now constitute one-third of the world's most leading health workers, making them relevant in dealing with this global health crisis. In addition, many women balance work-from-home life, personal relations, family care, home, education, childcare, mental and physical health, etc. during the new normal era. It is concluded that the work life balance between these health workers is urgently necessary. Health care women and organizations must work together to maintain a healthy balance between work and life and to fight this growing threat. In order to benefit the hospitals and patients, hospitals and health practitioners have to make sufficient use of this. Hospitals must ensure that their infrastructure is prepared enough to cope with the advent of digitization to accommodate this new normal and the changes in the next decade. The provision of interoperable health information systems, effective defenses of cyber security, and qualified health care personnel should be included.

A study interviewed 48 Irish hospital doctors working during the first wave of the pandemic and examined their concepts of their own well-being [17]. They observed that the COVID-19 pandemic affected the doctors' physical and mental well-being globally. In the first wave of the pandemic countries all over the world have implemented serious social controls and major reforms in the provision of health care services to arrest the spread of the virus. Despite the possibility of COVID-19 contracting, this study showed that in the first wave of the pandemic many physicians found changes in their physical conditions. In most cases, however, their mental well-being declined due to anxiety, emotional fatigue, remorse, loneliness and inadequate care. These results shed light on doctor well-being during COVID-19, as well as the

ways in which the pandemic has influenced them both professionally and personally. The paper ended by discussing how doctors' work lives and well-being can be improved during and after the COVID-19 pandemic.

In terms of work environment, results from the University of Western Ontario found that nurses were dissatisfied with the security department with resultant concerns about safety in the work place. It also found that pays and benefits played a crucial role in determining employees' QWL satisfaction. In addition, unfavourable work environments could lead to low performance and poor interpersonal relationships among nurses that lead them to leave the facility or even the profession itself [37].

Concluding Observations

After going through various past studies, the variable identified included scheduled working hours, flexible working hours, workload, employee morale, sustain corporate awareness, performance at work, working-life norm, quality of work-life, unfavourable working environment stress, tension, employee satisfaction, job satisfaction, excessive work, mental health assistance to doctors, organizational support, depression, anxiety, emotional exhaustion and employment stress, etc.

However, in the given current predicament of health care workers' working conditions, Indian hospitals must solve a variety of issues concerning them before it becomes a crisis. There is a growing recognition that the medical profession needs to respond more to the work-life balance concerns of healthcare workers. Hospitals in India must also foster a work environment that promotes the professional and personal well-being of healthcare workers while reducing competitive pressures between the two realms of life. This necessitates a change in mindset as well as the need to let go of old paradigms. Though hospitals, as well as the government as a whole, are not solely responsible for the balancing of work life, health and well-being of doctors and other health care workers, they do have to recognize the fact that these professionals have to spend more than half of their life in hospitals.

Chapter - 13

H&M Entry into India: A Case Study

Kotha Bala Venkata Mani Sai
(20191BBA0059) BBA Student, School of Commerce, Presidency University, Bangalore, Karnataka, India

Dr. Mounica Vallabhaneni
Assistant Professor, School of Commerce, Presidency University, Bangalore, Karnataka, India

Abstract

The paper aims to provide knowledge about the brand H&M Globally as in relation to its recent entry in India. H&M has given consumer a new choice for the fast fashion products. This brand has been planning to enter India since past few years and after it's entry it marked the first day sales crossing 1.75 Crores showing the enthusiasm of the consumers towards the firm. This case study also compares the presence of H&M with its competitor brands.

Keywords: H&M, apparel industry, fast fashion products.

Introduction

In India the Textile & Apparel market was estimated at INR 3,20,000 crore (USD 58 billion), in 2013, and is projected to grow at a CAGR of 9% to INR 7,57,000 crore (USD 138 billion) by 2023 (Technopak 2015). It is the second largest industry in India, giving employment to approximately 45 million people (India Brand Equity Foundation 2015). Moreover if you look at the market size projection in table below India got the highest annual compound growth rate of 12% that means that the market size in India is projected to grow at the highest pace in the following forecast. The growth of apparel industry and the potential of the nation haslead to increased investment of foreign retailers. The partial growth in this sector can be attributed to the emergence of new industry players called "fast fashion retailers" which can be seen as an explosive expansion in past few years. Fast fashion is a phrase used for designs that move quickly from the catwalk to showrooms to tap the latest consumer trends, is growing at a yearly pace of 25-30%, twice the rate of the overall market (Tandon, S & Agarwal, S 2013) The tables were turned from classic fashions to fast fashion by coming up of ZARA in India in 2009 which

became the first apparel brand in India to cross $100-million sales mark, five years after it opened it's first shop.

Reasons for Fast Fashion in India

The reasons for the rapid growing fast fashion in Indian consumers could be following:

- Increase in disposable income. By 2005, 21 million of India's 210 million households already earned more than $4,000 a year, qualifying them for membership in what we call "the consuming class." Based on McKinsey research, by 2015 the number of consuming class households will likely triple to 64 million.
- Both the Genders in India equally love shopping for clothes: According to UN reports India's population is the youngest across the world. Another research tells that both the genders in India equally love shopping for apparels .In a market where almost all shoppers s love or enjoy clothes shopping, it is no surprise that India is projected to become the world's third largest apparel market by 2020.
- New occasions: As the lifestyles of India's prospering urban consumers have evolved. their clothing needs have broadened, reflecting more varied usage occasions. With more socializing opportunities consumers are buying more sophisticated combination of outfit which is different for different occasions, also the ideology of wearing a garment for a season or for one particular occasion has lead to increased opportunities of fast fashion retailers. Today, Indians are more inclined than consumers in other markets to buy apparel for a specific purpose. Indeed, 38 percent of Indian respondents to a recent McKinsey study said they were highly likely to buy apparel for special events a significantly higher proportion than in Brazil (5 percent), Russia (3 percent) or China (6 percent).
- Fashion increasingly a form of self-expression. Increasingly, Indian consumers are embracing the idea of fashion for its own sake, as a means of self-expression, and not merely as a functional purchase. Television, movies, advertising and the Internet bombard today's Indian consumer with new ideas about style, even as American-style shopping malls lure them away from traditional marketplaces. In a recent McKinsey survey of Indian consumers, 62 percent said they thought it was important to "keep up with trends."
- Further urbanization and the comparative youth of India's population. At present, just 29 percent of India's population resides in cities,

among the lowest urbanization rates of any nation in the world. But that has been changing. Over the next 20 years, we expect the number of Indians living in cities to grow by 300 million, where they will don new styles and fashions to match new lifestyles.

- Continued rise of "organized retail": The increase in number of organized retail outlets has given the opportunity to the Indian consumer to undergo the transformation in terms of taste and preferences as the influence from the west is so strong in India that organized retailing has become a medium to narrow the gap between the fashion of west and the domestic trends. (Vittal, I 2010) Zara one of the leading fast fashion retailers entered India in 2009 and became the first company to cross $100 million in five years since it opened up. Following the same trend Hennes and Muaritz (H&M) entered India recently on October 2 2015 exploring Indian market with the aim to spread all across nation. The response received for H&M was seen in the sales of the first day of launch which was 1.75 crores that is approximately double of what Zara earned on it's first day launch (Maliviya, S &Bhushan,R 2015). Thereby the brand chosen for the project is H&M since it's completely new to Indian market and thereby provides and interesting field to further more research on.

About H&M

The Sweden based apparel brand Hennes& Muaritz popularly known as H&M is the world's second largest apparel company which exists in 61 countries with over 3,700 stores and employed around 132,000 people across the globe (Bloomberg Business 2013). This brand is popularly known for it's hot-off-the-runway fashions at an affordable prices and it's fast fashion concept has dominate the youth around the globe. The basic ideology of H&M is "fashion and quality at the best price for everyone in a sustainable way".

Rationale: The global apparel industry has experienced a compound annual growth rate of 4.3% since 2000, reaching a market size of USD 1.7 trillion in 2012 (Euromonitor International 2013). The growth has not only been in terms of revenue. The number of pieces of clothing purchased per capita increased from 9.0 in 2000 to 13.9 in 2012 worldwide (Caro, F 2014). Talking about India, the apparel market size is projected to grow from USD 45 billion in 2012 to USD 200 billion in 2025; a CGRA of 12% (Statistic Portal 2015). Thus the potential in India is much higher and therefore Investment in this nation is a promising future (Perrson, J 2015). Also considering the changing taste and preferences of the end consumer the apparel market leaders have moulded the idea of clothing, where in the ancient

times it was just a medium to cover the body and now it is much more than just covering, it depicts the individuality of the person. Henceforth the fashion and the society are interlinked characters. With blurring gender lines in the society has grabbed the attention of the world and the fashion called 'Androgynous Fashion' has come into play. The key players of this fashion statement example H&M has spread the fire of the same among the fashion consumers. Another concept that this brand is really popular among youth is 'Fast Fashion' which is a business model that offers (the perception of) fashionable clothes at affordable prices. Thus the brand chosen for the project is H&M since it's completely new to India market, and has started giving tough competition to it's peer competitors where it earned 1.75 crore on it's grand opening on October 2, 2015 which is almost double to it's rival Zara(Malviya, S & Bhushan, R 2015). Thereby it is an interesting field to explore as to how it continues to delight it's costumers & grow in Indian market. Also it's ethical working policies and personal interest has led to working and exploring on this brand.

Mission of H&M: The prime focus of H&M is to serve fashion and quality at the best price in sustainable way. The believe that they should have best customer offering in each and every market and offer collection that are wide ranging and varied for women, men, teenagers and children. For them design, quality and sustainability are not a question of price but ability to offer inspiring fashion with unbeatable value for money.

Sustainability Vision: H&M's business operations aims to run in a way that is economically, socially and environmentally sustainable where it means that the need of both present and future generations must be fulfilled.

Why Name H&M: The company initially started off with the name "Hennes" meaning 'hers' is Sweden language in 1946, selling exclusive women's apparel and accessories. ErlingPersson was going around the US on a tour when a business plan struck him. He felt the need for high end designer clothing brand for women and set his first shop in Sweden in 1947. Twenty one years after its establishment, in 1968 Hennes took over another apparel retailer Mauritz Widforss, and that's when the name was changed to "Hennes & Mauritz" (H&M).

USP of H&M: H&M works on a business concept of fashion for all, where this venture serves the customer with stylish clothes, classic look at the affordable price. Also the tie ups of H&M with big designers have helped them to establish themselves among the best fast fashion retailers where they provide the consumer with best designs from the popular designers at an affordable price due to their effective logistics.

Marketing Mix of H& M:

Product: H&M is classified as a brand that offers homogenous shopping products. This means that their consumers purchase their products at H&M because of its pricing and features. Many consumers that shop at H&M get attracted to purchase several items they didn't plan to get. The reason to that is the convenience of having all departments in one retail store, which gives H&M a large Product mix width. Every department H&M offers various product lines to be able to attract as wide demographically as possible. Looking at Indian stores, H&M in serving 3 categories Women, Men and Kids wear.

Price: The price strategy of H&M is designed based on their customer's needs which is low price and high fashion. H&M outsources the production to countries where the labor cost is much lower. To control transportation cost, outsourcing was arranged according to different product. Those high fashion products which target at the European market were produced in Turkey, because of the short product life cycle (Regner, P & Yildiz, E 2013).In addition, basic products are produced in Asia because they allow longer transportation time and bear lower risk. The company also conduct strict cost control plan. For example, very few executives have secretaries or have cell phone privilege. The product range at the H&M store in Delhi has been aggressively priced with T-shirts starting at Rs.399. Women's clothing and accessories with prices that start at Rs.149 for hair bands and go up to Rs.18.999 for the costliest of dresses. Denim trousers for women are available at Rs.699 while those for men start at Rs.999. Local sourcing helped the brand sell polo T-shirts for as low as Rs.500.

Place: H&M at present has around 37,000 stores across the globe and in India for now it has 2 stores which opened recently in the gap of a month where first store came into existence on October 2 2015, the second store opened on 7th Nov. H&M has plans to open 30 stores in India and 400 stores across the globe by early 2016. The first store at Select City is about 25.000 sq feet whereas the second store at Ambience Vasant Kunj is the largest store in the country which is spread in 28,000 sq feet.

Promotion: A multi-channel promotion strategy including advertising, internet promotion, sales promotion is adapted by H&M. These multi-channel strategy increases the Exposure of H&M.The promotion of the firm is an important aspect in the success ahead that it should be designed carefully with maximum effect. H&M had great event launch on it's first opening where special permissions where taken to keep the mall open for a night, the excited

crowd started forming queues with the eagerness to win limited edition tote's bag and give away gift vouchers for the first three customers. The firm promoted itself by creating a festival atmosphere in and outside the mall. However, one thing that remains common in all H&M is the great launch party where Bollywood stars where seen in the next collection of H&M. In the second store launch similar procedure was followed to delight customers in addition to that was the DJ and on ground entertainment for the customers.

The Problem Area

On an interview it was found out that the particular respondent assumed that H&M was serving best quality due to it being globally recognized, which made it obvious for respondent that the brand is providing good quality but has tried 3 garments and found the quality adequate however when asked the same question for ZARA the respondent had a sure answer for it being a brand serving best quality not just because of it global recognition but because of her personal experience in terms of quality, style and the products long last thus further describing it as sustainable. On the other hand, the respondent felt that ZARA is highly priced as compared to H&M and that is another reason she believed that the ZARA is serving better quality than H&M.

On an interview conducted with a consumer and analysis of the responses received of these brands it was informed that H&M though has been able to place itself in minds of consumer due to it being highly reputed brand abroad haven't faced much problem in creating a brand awareness as majority of fast fashion buyers were aware of this brand but somehow on comparison with ZARA it has recently established itself in the country whereas Zara has been part of consumer's shopping bags since past 5 years thus a level of trust in terms of quality has being created since it's tried and tested brand and it's long lasting ability has made it sustainable in terms of usage of the consumer. On the other hand, H&M is on introductory stage therefore it is assumed that the brand serves good quality due to it's high reputation abroad and the word of mouth by Indian consumers who have shopped H&M globally however for majority of the shoppers a trust factor is yet to be established for H&M. Also referring to consumer's psychology ZARA is priced highly makes the consumer believe that the brand is serving good quality.

Questions for Discussion:

- Discuss how H&M could have better positioned itself in India?
- Going forward, how H&M should compete with existing brands like ZARA in India.

Chapter - 14

A Study of Some Applications of Fractional Calculus

Dr. Santosh V. Nakade
Head, Dept. of Mathematics, Sharda Mahavidyalaya, Parbhani,
Maharashtra, India

Abstract

In recent year Mathematical applications using fractional calculus are increases speedily, in this section we see a quantity of real life mathematical modeling using fractional calculus. Fractional Calculus has engrossed concentration of many researchers, since fractional Calculus models are extra realistic and matter-of-fact than the classical integer order models. Therefore, any dynamical process modeled through fractional order differential equations has a reminiscence or memory effect.

Mathematical modeling using fractional calculus:

***P I^{λ} D^{μ}* Controller:**

PID controller is also called as three term controller which is widely used in industrial control system. PID controller incessantly calculates an error value e(x) as the difference between a preferred setpoint (sp) and a calculated process variable (pv). It was used for automatic process control in the manufacturing industry. In today's era concept of PID is used universally where there is requirement of accurate and optimized automatic control.

The concept of a fractional order P I^{λ} D^{μ} is proposed in a paper written by Igor Podlubny in 1999, where the integrator and differentiator are of a fractional order. A fractional order transfer function is provided as

$$(s) = \frac{U(s)}{E(s)} = K_P + K_I s^{-\lambda} + K_D s^{\mu}$$

$$\lambda, \mu > 0$$

Here λ is the order of the integrator, μ is the order of differentiator, $G_c(s)$ is the transfer of controller, U(s) is the controller's output and E(s) is an error. If λ =1 and μ = 1 equation becomes traditional P I D controller

equation If λ =1 and μ = 0, equation converts to a P I controller equation. If λ =0 and μ = 1 equation converts to a P D controller equation.

In the time domain, it becomes an open-loop system is described by

$$\sum_{k=0}^{n} a_k \mathcal{D}^{\beta_k} y(t) = K_P w(t) + K_I \mathcal{D}^{-\lambda} w(t) + K_D \mathcal{D}^{\mu} w(t)$$

Here w(t) is the input, y(t) is output of the system, β_k (k= 0,1,2….n) arbitrary real number and a_k (k= 0,1,2….n) arbitrary constants. Effectiveness of this controller can be analyzes by an example of PD^{μ} controller. The transfer functions and time domain fractional order differential equation are

$$G(s) = \frac{1}{a_2 s^{\beta_2}} + a_1 s^{\beta_1} + a_0$$

$$a_2 y^{\beta_2}(t) + a_1 y^{\beta_1}(t) + a_0 y(t) = u(t)$$

With initial condition y(0) = 0, y'(0) = 0, y''(0) = 0.

Following figure shows the effectiveness of the controllers.

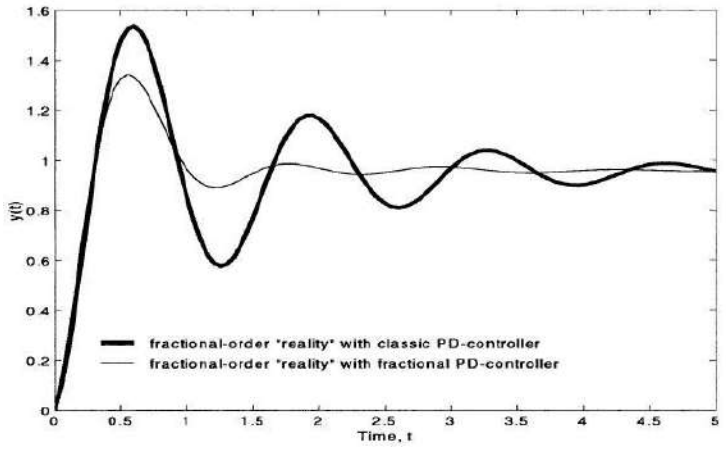


Fig. 1: is the comparison of conventional P D controller (thick line) and fractional PD^{μ} controller (thin line).

Memory for propagation of computer viruses under human intervention:

Internet is now a necessary part of human life, without internet day today's life crumple. Use of internet means use of Computers, Laptops, mobiles etc. Keeping computers, laptops, Mobile etc. in good/working

condition is an important task. Most of the work such as banking, paying bills, purchasing some product online, online recharging of mobile, TV, booking movie ticket, etc. requires internet. While downloading some file or transferring file from infected USB to computers, viruses may insert in the system and they may create problems to system. Computer viruses are malicious codes that can replicate themselves and spread among computers in network. These viruses create problems in proper working of computer system which result in disturbing routine working. Large number of companies, organizations etc. are suffered, suffering and may be suffered from such viruses. 'My Doom' is the most devastating computer virus which caused over $38 billion on damages.

Human intervention plays a significant role in preventing the breakout of computer viruses. Here we study fractional mathematical model with memory propagation of computer viruses under human intervention. In this fractional model Caputo fractional derivative, Riemann-Liouville fractional derivative and Grunwald-Letnikov fractional derivatives are proposed.

This model is based on integer order model. Computers under consideration are categorized into three populations: Infected computers I(t); susceptible (virus free) computers S(t) and Recovered computers R(t) which are virus free computers but having some immunity. These variables used to develop model and virus-free equilibrium point and its stability, existence of uniformly stable solution and by using predicator corrector method, numerical results obtained.

Smoking dynamics using fractional differential equations:

We are all well knows that lot of health problems occurs due to tobacco smoking. Some harmful diseases due to smoking are cancer, stomach ulcer, high blood pressure, lung disease, heart disease etc. To reduce or to keep control on the strength of smokers all over the world, different mathematical models are proposed and also working-on to propose by some mathematicians. First simple mathematical model was proposed by C. Castillo-Garsow *et al*. for giving up smoking. On considering control variables in the form of anti-smoking gum, anti-nicotine medicine/drugs, education campaign, eradication of smoking in a community, optimal control theory was proposed in. A novel model was proposed by assuming variables for mild smokers and chain smoker classes by Sharmi and Gumel. Smoking behavior under influence of education program and individuals determination to quit smoking was proposed.

Considering the Caputo- Fabrizio-Caputo fractional derivative, the

authors in presented a new fractional giving up smoking model, the existence and uniqueness of the solution were discussed by the fixed point postulate. Zeb in proposed a fractional smoking dynamic model considering adolescent nicotine dependence. In S. Kumar book, the authors studied the giving up smoking dynamics using a fractional order model; approximate solutions via Laplace Adomian decomposition method were obtained. The multi-step generalized differential transform method was employed in V. S. Ert *et al*. to obtain accurate solutions to a giving up smoking model of fractional order. The giving up smoking dynamics models have been extended to the scope of fractional derivatives using power law and exponential decay law.

Here we study a mathematical model using fractional calculus i.e. fractional differential equation with local and non-local kernel for smoking dynamics which was proposed by V.F.Morals-Delgado *et al*. In this model analytical solution obtained using Modified Homotopy Analysis Transform Method (MHATM) with two wisdom, one using Liouville – Caputo fractional derivative and second Atangana-Baleanu-Caputo fractional derivative. Also using iterative method through Laplace transform, special solution were obtained.

Liouville Caputo Fractional derivative is given by

$$ {}_{t_0}^{c}D_t^{\alpha}\{f(x)\} = \frac{1}{\Gamma(1-\alpha)} \int_{t_0}^{t} f'(t)\,(x-t)^{-\alpha} dt, $$

Where $\Gamma(.)$ denote the Euler's gamma function.

Laplace transform of Liouville-Caputo derivative is given by [1]

$\mathcal{L}\{{}_{t_0}^{c}D_t^{\alpha}\{f(x)\}: \mathrm{s}\} = s^{\alpha}F(s) - \sum_{k=0}^{n-1} s^{\alpha-k-1} f^{(k)}(0)$, n-1 < α < n.

Atangana-Baleanu-Caputo (ABC) [18] fractional derivative is given by

${}_{t_0}^{ABC}D_t^{\alpha}\{f(x)\} = \frac{B(\alpha)}{1-\alpha} \int_{t_0}^{t} f'(t)\, E_{\alpha}\left[-\alpha \frac{(x-t)^{\alpha}}{1-\alpha}\right] dt$, n-1 < α(t) ≤ n.

Where B(α) denote a normalize function and $E_{\alpha}(.)$ denote Mittag-Leffler function.

Laplace transform of Atangana-Baleanu-Caputo (ABC) fractional derivative is given by

$$ \mathcal{L}\{{}_{t_0}^{ABC}D_t^{\alpha}\{f(x)\}: \mathrm{s}\} = \frac{B(\alpha)}{1-\alpha}\, \mathcal{L}\left[\int_{t_0}^{t} f'(t)\, E_{\alpha}\left[-\alpha \frac{(x-t)^{\alpha}}{1-\alpha}\right] dt\right](s). $$

Mathematical model developed by author's contains power law and fractional differentiation involving generalized Mittag Leffler functionas

karnel due to non-locality of the model. Fixed point theorem and Picard-Lindelof approach used to put remarks on existence and uniqueness of system of solutions.

Diffusion Equation:

Diffusion equation is an interesting application of fractional calculus. The study of thermal flux on a given surface is important due to its influence on material wear and performance. In addition once the thermal flux is known, the temperature can be obtained. The brake disks are treated as semi-infinite bodies and assumed to have a constant temperature distribution.

Agrawal (2004) published a paper which analyzes the effectiveness of using fractional order derivatives to obtain the heat flux at a given point. Traditionally this was achieved by performing a transient analysis of two nearby points. His motive was the thermal study of disk brakes. The following diffusion equations govern the thermal distribution of the body.

$$\frac{\partial T(x,t)}{\partial t} = \frac{K}{\rho c}\frac{\partial^2 T(x,t)}{\partial x^2}$$

Where T(x, t) is the temperature at point x and time t, K is the thermal conductivity, ρ the mass density and c the specific heat of the disk material. After non-dimensional zing and applying Laplace Transform it is converted in fractional partial differential equation given by

$$\frac{1}{\sqrt{\propto}}\frac{\partial^{1/2}\theta(x,t)}{\partial t^{1/2}} = \frac{\partial\theta(x,t)}{\partial x}$$

Using this fractional equation heat flux Q(t) and temperature at that point obtained.

Lot of Mathematicians work on diffusion equation some of them, Kulish gives more information on thermal flux analysis with fractional order derivatives in his paper, Lokenath Debnath also gives more detailed applications of fractional calculus relating to the diffusion equation.

Resistance, Inductance and Capacitance Circuit:

RLC electrical circuit with a capacitor and an inductor are connected in parallel and this set is connected in series with a resistor and voltage. The capacitance *C*, the inductance *L* and the resistor *R* are consider positive constants and $\phi(x)$ is the ramp function, consider the $\phi(x)$ is Heaviside function.

The equations connected with a three elements of *RLC* electrical circuit are

The Voltage drop across resistor

$$VD_R(x) = RI(x)$$

The Voltage drop across inductor

$$VD_L(x) = L\frac{d}{dx}I(x)$$

The Voltage drop across capacitor

$$VD_c(x) = L\frac{d}{dx}I(x)$$

Where I(x) is the current in circuit.

Applying the Kirchhoff's voltage law and the equations associated with the three elements, we can write the non-homogeneous second order ordinary differential equation

$$L\frac{d^2}{dx^2}VD_c(x) + R\frac{d}{dx}VD_c(x) + \frac{1}{L}VD_c(x) = \frac{d}{dx}\phi(x) \quad (1)$$

Similarly we obtain other non-homogeneous second order ordinary differential equations associated with the current on the capacitor,

$$\frac{L}{C}\frac{d}{dx}I_c(x) + \frac{R}{C}I_c(x) + \frac{1}{C}\int_0^x I_c(t)dt = \frac{d}{dx}\phi(x) \quad (2)$$

We consider the initial condition $I_c(0) = 0$ and the solution can be establish in provisions of an exponential function. Fractional integro-differential equations of (2) is given by

$$\frac{L}{C}\frac{d^{\propto}}{dx^{\propto}}I_c(x) + \frac{R}{C}I_c(x) + \frac{1}{C}\frac{1}{\Gamma(\alpha)}\int_0^x (x-t)^{\alpha-1}I_c(t)dt = \frac{d}{dx}\phi(x) \quad (3)$$

With $0 < \alpha \leq 1$ and the fractional derivative is used in the Caputo form, where $\phi(x)$ is the Heaviside function. We also consider $I_c(0) = 0$, i.e., the initial current on the capacitor is zero. We note that this equation is a achievable generalization of the classical integro-differential equation associated with the *RLC* electrical circuit, when $\alpha = 1$.

To solve this fractional integro-differential equation, we introduce the Laplace integral transform, defined by

$$L[I_c(x)] = F(s) = \int_0^{\infty} e^{-st}I_c(t)dt \quad (4)$$

Equation (2.2.3) for R(s) > 0 becomes,

$$\frac{L}{C}s^{\propto}F(s) + \frac{R}{C}F(s) + \frac{1}{C}\frac{F(s)}{s^{\propto}} = 1 \quad (5)$$

$$F(s) = \frac{C}{L}\frac{s^{\propto}}{s^{2\propto}+as^{\propto}+b} \quad (6)$$

Where a= R/L and b=1/L with a, b > 0

To get solution to (3) taking Laplace inverse of (5)

$$I_c(x) = \frac{C}{L} L^{-1}\left[\frac{s^{\propto}}{s^{2\propto}+as^{\propto}+b}\right] \quad (7)$$

$$L^{-1}\left[\frac{s^{\gamma-1}}{s^{\propto}+As^{\beta}+B}\right] =$$
$$x^{\propto-\gamma}\sum_{r=0}^{\infty}(-A)^r x^{(\alpha-\beta)r} E^{r+1}_{\alpha,\alpha+1-\gamma+(\alpha-\beta)r}(-Bx^r)$$

Valid when $\left|\frac{As^{\beta}}{s^{\alpha}+B}\right| < 1 \; and \; \alpha \geq \beta$, hence equation (7) will be

$$I_c(x) = \frac{C}{L} x^{\propto-1}\sum_{r=0}^{\infty}(-a)^r x^{\alpha r} E^{r+1}_{2\alpha,\alpha+2-\alpha r}(-bx^{2\alpha})\phi(x)$$

Where $E^{\gamma}_{\alpha,\beta}(x)$ is Mittag-Leffler function of three parameter.

If instead of considering $\phi(x)$ Heaviside function, if we consider it as parabolic function, the solution becomes

$$I_c(x) = \frac{C}{L} x^{\propto+1}\sum_{r=0}^{\infty}(-a)^r x^{\alpha r} E^{r+1}_{2\alpha,\alpha+2+\alpha r}(-bx^{2\alpha})\phi(x)$$

Conclusion

Concepts of fractional calculus are very hard to understand that's why though the fractional calculus was as old as traditional calculus. It was not developed, discussed and applied for long time. In recent year, last two to three decades it is the topic of most of the researchers. Fractional calculus is an extraordinary and outstanding mathematical topic since it is applied to situations where existing theory fails to apply properly. Fractional calculus is applied to all most all sciences and real life problems as discussed above. So, we may say "Fractional Calculus is the mathematical solution to real life problems".

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Chapter - 15

The Hofstadter Sequence: A Deep Dive into Meta-Fibonacci Recursion, Computational Complexity, and Chaotic Dynamics

Dr. Vishal Vincent Henry
Department of Mathematics and Statistics Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Abstract

This chapter presents a comprehensive analysis of the Hofstadter Q-sequence, a foundational meta-Fibonacci sequence introduced by Douglas R. Hofstadter. Celebrated for its simple, self-referential definition which gives rise to complex, quasi-chaotic behavior, the Q-sequence remains a subject of intense study in discrete mathematics, theoretical computer science, and nonlinear systems. We rigorously explore its formal recursive definition, analyze the severe computational complexity of its naive implementation, and detail efficient dynamic programming solutions. Beyond computation, we delve into the sequence's number-theoretic properties, statistical behavior, and its asymptotic relationship with the line $n/2$. Furthermore, we survey related sequences within the meta-recursive family and synthesize the major known results and enduring open problems that constitute the ongoing mystery of the Q-sequence. This work serves as a consolidated resource for understanding the mathematical depth and computational challenges inherent in this famously unpredictable sequence.

Keywords: Hofstadter Q-sequence, Meta-Fibonacci sequences, Computational complexity, Chaotic dynamics.

1. Introduction

1.1. Background and Motivation

Recursive sequences are a cornerstone of discrete mathematics and computer science. While linear recurrences like the Fibonacci sequence are well-understood and exhibit predictable exponential growth, nonlinear meta-recurrences introduce a fascinating layer of complexity. The Hofstadter Q-sequence, first presented in Douglas R. Hofstadter's Pulitzer Prize-winning

book Godel, Escher, Bach [1], is the archetype of such sequences. Its definition is elegantly simple yet generates behavior that is erratic, non-monotonic, and empirically bounded but notoriously resistant to complete mathematical characterization.

The sequence's study is not merely an academic curiosity; it provides a model for understanding self-reference, a concept crucial in fields from logic (G¨odel's incompleteness theorems) to computer science (recursive function theory). Its resistance to standard analytical techniques makes it a benchmark problem for testing new methods in sequence analysis and computational mathematics.

1.2. Objectives and Outline

This chapter aims to provide a multifaceted examination of the Hofstadter Q-sequence. Our specific objectives are to:

- Formally define the Q-sequence and situate it within the broader family of meta-Fibonacci sequences.
- Analyze the computational complexity of algorithms for generating the sequence, highlighting the exponential cost of naive recursion and the linear efficiency of dynamic programming.
- Examine the sequence's number-theoretic and statistical properties through computation and visualization.
- Discuss the sequence's long-term behavior and its relationship to the line $n/2$, reviewing the existing literature on its boundedness.
- Present a survey of major known results and a curated list of open conjectures that continue to challenge mathematicians.

2. Formal Definitions and Basic Properties

2.1. The Q-Sequence

Definition 2.1 (Hofstadter Q-Sequence). The Hofstadter Q-sequence is defined for all positive integers n by the recurrence relation:

$$Q(1) = 1,$$
$$Q(2) = 1,$$
$$Q(n) = Q(n - Q(n-1)) + Q(n - Q(n-2)) \; for\; all\; n > 2.$$

This is a nested or meta-recurrence because the arguments $n - Q(n-1)$ and $n - Q(n-2)$ are themselves functions of previous terms in the sequence. This self-reference is the source of its complexity.

The first 10 terms of the sequence are:

n	1	2	3	4	5	6	7	8	9	10
$Q(n)$	1	1	2	3	3	4	5	5	6	6

2.2 The Family of Meta-Fibonacci Sequences

The Q-sequence is a member of a larger class of recursive sequences. generalized meta-Fibonacci recurrence can be written as:

$$R(n) = R(n - R(n-k)) + R(n - R(n-l)) \; for \; n > m,$$

with appropriate initial conditions for $n \leq m$, where k, l, m are integers.

Other famous examples include:

- **The Conway sequence [9]:** (look-and-say sequence), thoughnot a meta-recurrence, shares similar chaotic growth.
- **The Hofstadter G-sequence[1]:** $G(1) = 1$; $G(n) = n - G(G(n-1)) \; for \; n > 1$.
- **The Hofstadter-Huber $V_\gamma$sequence [8]:** is another related family.

These sequences often serve as examples of how very simple deterministic rules can generate complex, seemingly random output.

3. Algorithms

The inherent self-reference in the Q-sequence's definition has profound implications for its computation.

3.1. Naive Recursion: An Exponential Bottleneck

Algorithm 1 naively implements the recurrence. While correct, its execution time is prohibitive.

Algorithm 1: Naive Recursive Computation of $Q(n)$

$\boldsymbol{Input}$: $A \; positive \; integer \; n$
$\boldsymbol{Output}$: $The \; value \; of \; Q(n)$
1. $if \; n \leq 2 \; then$
2. $return \; 1$
3. $else$
4. $return \; Q(n - Q(n-1)) + Q(n - Q(n-2))$
5. end

Theorem 3.1. The time complexity $T(n)$of Algorithm 1 is exponential in n. **Proof.** The recurrence for the runtime is itself complex: $T(n) = T(n-1) + T(n-2) + \ldots$, reflecting the tree of recursive calls. The branching factor is not constant, but the tree grows very rapidly. Empirical analysis

shows that $T(n) \in \Omega(c^n)$ for some $c > 1$, making it computationally infeasible for $n > 30$.

3.2. Dynamic Programming: A Linear-Time Solution

The solution to the computational problem is to store computed values, a classic trade-off of space for time.

Algorithm 2: Linear-Time Dynamic Programming Computation

Input: *A positive integer n*
Output: *Array Q containing first n terms of Hofstadter Q − sequence*

1 *if then*
2 *return empty array*
3 *end if*
4 $Q \leftarrow$ *array of size* $n + 1$ *initialized to* 0
5 $Q[1] \leftarrow 1$
6 $Q[2] \leftarrow 1$
7 *for* $i \leftarrow 3$ *to n do*
8 $Q[i] \leftarrow Q[i - Q[i-1]] + Q[i - Q[i-2]]$
9 *end for*
10 *return* $Q[1..n]$

4. Properties and Behavioral Analysis

4.1. Visualizing Chaos and Order

While we omit the figure, visualizing $Q(n)$ vs. n reveals a dense, chaotic cloud of points. However, plotting the difference $d(n) = Q(n) - n/2$ is more illuminating. This difference oscillates in a bounded, aperiodic manner, suggesting the sequence closely shadows the line $n/2$ over the long term but is perpetually in flux.

4.2. Statistical Measures

For large $N(e.g., N = 106)$, we can compute statistics on the sequence and its difference from $n/2$:

- **Mean of $d(n)$:** Very close to zero, consistent with the $n/2$ shadowing.
- **Standard Deviation of $d(n)$:** Appears to converge to a constant, suggesting bounded oscillation.
- **Maximum and Minimum of $d(n)$:** Empirical evidence suggests these are bounded, though the bounds are not rigorously proven.

4.3 Number-Theoretic Observations

The sequence exhibits various local patterns:

Observation 4.1. The sequence is not monotonic. It contains ”plateaus” $(e.g., Q(9) = 6, Q(10) = 6)$ and ”jumps” $(e.g., Q(6) = 4\ toQ(7) = 5)$.

Observation 4.2. Certain values appear to be ”preferred” or occur more frequently than others, a topic potentially related to its generating function or underlying stochastic process, neither of which are known.

5. Related Sequences and Generalizations

The allure of the Q-sequence has led to the study of many variants.

5.1. The Hofstadter G-Sequence

Defined by $G(1) = 1$; $G(n) = n - G(G(n-1))$ for $n > 1$ .This sequence is more tractable and is known to be well-behaved, closely related to the golden ratio ϕ. In fact, it can be shown that $G(n) = \lfloor (n + 1)/\phi \rfloor$[7].

5.2. The Hofstadter-Huber V Sequences

Hofstadter and Huber [8] defined a family of sequences$V_{r,s}$with more parameters, allowing for a systematic study of meta-recursive behavior. The Q-sequence is a specific case ($V_{1,2}$). Different parameters can lead tosequences that die (become undefined), become periodic, or exhibit chaotic growth.

5.3. The Male and Female Sequences

Another pair from EB , defined by:

$$F(n) = n - M(F(n-1))\ for\ n > 0, F(0) = 1$$
$$M(n) = n - F(M(n-1))\ for\ n > 0, M(0) = 0$$

These sequences are deeply interwoven and are known to be well-defined for all “n”[7].

6. Known Results and Open Problems

6.1. Established Theorems

Theorem 6.1 (Well-Definedness for “Small” n). The Q-sequence is computable and well-defined for all n that have been computationally checked (exceeding 10^{10}).

Theorem 6.2 ($Bounds\ for$ G − Sequence) .For the G-sequence, tight boundsare known: $|G(n) - n/\phi| < 1$.

6.2. Major Open Conjectures

The Q-sequence remains largely mysterious from a formal mathematical perspective.

Conjecture 6.1 (Universal Well-Definedness). The most famous open problem: Is $Q(n)$ defined for all positive integers n? Despite being computed to enormous values, no proof exists that it doesn't eventually enter a cycle orattempt an invalid array access [4].

Conjecture 6.2 (Boundedness of Delta).The difference sequence $d(n) = Q(n) - n/2$ is bounded. That is, do there exist constants C_1 and C_2 such that $C_1 < d(n) < C_2$ for all n? Empirical evidence strongly suggests yes, but a proof is elusive [3].

Conjecture 6.3 (Time Complexity Lower Bound). A proof that the naïve recursive algorithm has an exponential time complexity lower bound, rather than just an empirical observation.

7. Conclusion

The Hofstadter Q-sequence is a mathematical marvel. Its simple definition belies a depth of complexity that has resisted full understanding for decades. It stands as a powerful example of how self-reference can generate chaos from order. From a computational perspective, it teaches a clear lesson on the necessity of efficient algorithm design, exemplified by the dramatic difference between naive recursion and dynamic programming. While efficient computation has allowed for extensive empirical exploration, the core mathematical questions about its boundedness and very definition for all n remain open, serving as an enduring challenge and a testament to the richness of the field of meta-recursive sequences. Future work may involve seeking novel analytical techniques, exploring connections to chaotic maps, or using statistical mechanics approaches to model its behavior.

A Python Implementation for Analysis

The following code implements the dynamic programming algorithm and calculates the difference from $n/2$.

```
def hofstadter_q(n):
    "Generates the first n terms of the Hofstadter Q-sequence."
if n <= 0:
return []
q = [0] * (n+1)
```

```
q[1] = 1
q[2] = 1
for i in range(3, n+1):
q[i] = q[i - q[i-1]] + q[i - q[i-2]]
return q[1:]
# Generate sequence and analyze
n_val = 10**6
q_seq = hofstadter_q(n_val)
import numpy as np
n_array = np.arange(1, n_val+1)
d_n = np.array(q_seq) - n_array / 2
# Calculate statistics
mean_d = np.mean(d_n)
std_d = np.std(d_n)
max_d = np.max(d_n)
min_d = np.min(d_n)
print(f"Statistics for d(n) = Q(n) - n/2 (n up to {n_val}):")
print(f"Mean: {mean_d:.6f}")
print(f"Standard Deviation: {std_d:.6f}")
print(f"Maximum: {max_d:.6f}")
print(f"Minimum: {min_d:.6f}")
```

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Chapter - 16

On the Embeddability of Topological Left Quasigroups as Transversals in Topological Groups

Dr. Vishal Vincent Henry
Department of Mathematics and Statistics Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Abstract

The classical theory of quasigroups and loops has a deep and well-studied connection with group theory, primarily through the concept of the multiplication group and the realization of quasigroups as transversals (coset representatives) in a group. This chapter investigates the extension of this relationship into the topological category. We explore the conditions under which a topological left quasigroup $(Q,\cdot,\tau)$ can be embedded as a transversal to a closed subgroup in a topological group. Our main result establishes that a necessary and sufficient condition for such an embedding is the existence of a continuous, associative and compatible action of a topological group on the left quasigroup, which allows for the construction of a topological semi direct product. We further prove that if the left quasigroup is locally compact and second countable and the operations are properly continuous, then this embedding can be realized in a locally compact topological group. Several non-trivial examples and counter examples are provided to delineate the boundaries of our theorems. This work bridges the gap between algebraic loop theory and topological dynamics, opening new avenues for the study of symmetric structures in topological algebra.

Keywords: Topological left quasigroup, transversal, semidirect product, locally compact, embeddability.

1. Introduction

The study of quasigroups and loops, algebraic structures satisfying the Latin square property, has long been intertwined with group theory. A fundamental result in this area states that every quasigroup can be embedded in a group as a transversal to a subgroup [1]. More precisely, if Q is a quasigroup, there exists a group G, a subgroup H and a transversal $T$to the set of right cosets $H\backslash G$ such that the multiplication in Q is isomorphic to the

multiplication induced on $T$by the group operation in G. This connection provides a powerful tool for analyzing quasigroups by leveraging the rich theory of groups.

The natural question that arises and the central theme of this chapter, is whether this algebraic embeddability can be lifted to the category of topological spaces. That is, given a *topological left quasigroup* $(Q,\cdot,\tau)$—a topological space equipped with a continuous binary operation such that left translations L_a: $x\to a\cdot x$ are homeomorphisms—can we find a *topological group* G and a *closed* subgroup H such that Q is homeomorphic to a *closed* transversal to H in G and the induced multiplication coincides with the continuous operation on Q?

This problem sits at the intersection of topological algebra and the theory of topological transformation groups. Positive answers would allow the application of tools from topological group theory, such as Haar measure and representation theory, to the study of topological quasigroups. Furthermore, it has potential implications in geometric structures, as many symmetric spaces and loops arising from differential geometry carry natural topologies.

2. Preliminaries

We begin by recalling the essential algebraic and topological definitions that form the foundation of our work.

Definition2.1. *An algebraic structure* $(Q,\cdot)$ *is a* ***leftquasigroup*** *if for all* $a,b\in Q$*, the equation* $a\cdot x=b$ *has a unique solution for* $x\in Q$*. Equivalently, the left translations* $L_a:Q\to Q$*, defined by* $L_a(x)=a\cdot x$*, are bijections for all* $a\in Q$*. If the operation* $\cdot$ *is also continuous with respect to a topology* T *on* Q *and the maps* L_a *are homeomorphisms, then* $(Q,\cdot,\mathrm{T})$ *is a* ***topological leftquasigroup****.*

A **quasigroup** satisfies the Latin square property for both left and right translations and a **loop** is a quasigroup with a two-sided identity element Our focus on leftquasigroups allows for greater generality.

Definition2.2. *Let* G *be a topological group and* H *a closed subgroup A subset* $T\subset G$ *is a* ***topological transversal*** *to the right cosets* $H\backslash G$ *if the map* $\phi:T\times H\to G$*, defined by* $\phi(t,h)=th$*, is a homeomorphism. In this case, every* $g\in G$ *can be written uniquely as* $g=th$ *with* $t\in T$ *and* $h\in H$ *and* T *is necessarily closed in* G*.*

The multiplication on a transversal T is induced by the group operation. For $t_1,t_2\in T$, the product t_1t_2 lies in G, so it has a unique decomposition $t_1t_2=t\cdot h$ for some $t\in T$ and $h\in H$. This defines a binary operation on T and a map

into H:

$t_1 * t_2 = t, \quad \theta(t_1, t_2) = h.$

It is a standard algebraic fact that $(T, *)$ is a left quasigroup. In the topological category, the continuity of the group operation in G implies the continuity of both the induced operation $*$ and the map $\theta: T \times T \to H$.

Definition2.3 (Embeddability)**.** *A topological leftquasigroup* $(Q, \cdot, \mathrm{T})$ *is* ***embeddable as a transversal*** *if there exists a topological group G, a closed subgroup H and a topological transversal* $T \subset G$ *to* $H \backslash G$ *such that:*

1. Q is homeomorphic to T(we identify them).
2. The induced operation $*$ on T coincides with the original operation $\cdot$ on Q.

The following lemma is crucial for our constructions.

Lemma 2.4. *Let* $(Q, \cdot)$ *be a leftquasigroup. Then for any* $a, b \in Q$*, there exists a unique permutation* $\delta_{a,b}$ *of Q such that for all* $x \in Q$*,*

$a \cdot (b \cdot x) = (a \cdot b) \cdot \delta_{a,b}(x).$

This map, called the ***displacement map****, satisfies the cocycle identity:* $\delta_{a,b \cdot c} \circ \delta_{b,c} = \delta a \cdot b, \delta_{a,b}(c) \circ \delta a, b.$

Proof. We prove the lemma in two parts: first establishing the existence and uniqueness of $\delta_{a,b}$, then verifying the cocycle identity.

Part 1: Existence and Uniqueness of $\delta_{a,b}$

Fix $a, b \in Q$. Define $f : Q \to Q$ by $f(x) = a \cdot (b \cdot x)$. Since $(Q, \cdot)$ is a left quasigroup, lefttranslations are bijections. Thus $f = L_a \circ L_b$is a bijection as a composition of bijections.

Now consider the left translation $L_{a \cdot b}: Q \to Q$, which is also a bijection.

Define:

$\delta a, b = (La \cdot b) - 1 \circ f.$

By construction, $L_{a \cdot b} \circ \delta_{a,b} = f$, which means:

$(a \cdot b) \cdot \delta_{a,b}(x) = a \cdot (b \cdot x)$ for all $x \in Q$.

This proves existence. For uniqueness, suppose γ is another permutation satisfying

$L_{a \cdot b} \circ \gamma = f$. Composing both sides with $(L_{a \cdot b})^{-1}$yields $\gamma = (L_{a \cdot b})^{-1} \circ f = \delta a, b$.

Part 2: Verification of the Cocycle Identity

We prove that for all $a,b,c \in Q$:

$\delta a,b\cdot c \circ \delta b,c = \delta a\cdot b,\delta_{a,b}(c) \circ \delta a,b.$

Let $x \in Q$ be arbitrary. We will show that both sides yield the same result when applied to x.

Let $y=\delta_{b,c}(x)$. By definition:

$b\cdot(c\cdot x)=(b\cdot c)\cdot y.$ (1)

Now let $z=\delta_{a,b\cdot c}(y)$. By definition:

$a\cdot ((b \cdot c) \cdot y) = (a \cdot (b \cdot c)) \cdot z.$ (2)

Substituting (1) into (2):

$a\cdot (b \cdot (c \cdot x)) = (a \cdot (b \cdot c)) \cdot z.$ (3)

Thus, the left-hand side composition gives:

$(\delta_{a,b\cdot c}\circ\delta_{b,c})(x)=z$ satisfying (3).

Now consider the right-hand side. Let $w=\delta_{a,b}(x)$. By definition:

$a\cdot(b\cdot x)=(a\cdot b)\cdot w$. (4)

Let $u=\delta_{a\cdot b,\delta}a,b(c)(w)$. By definition:

$(a\cdot b) \cdot (\delta_{a,b}(c) \cdot w) = ((a \cdot b) \cdot \delta_{a,b}(c)) \cdot u.$ (5)

By the definition of $\delta_{a,b}$ applied to c:

$a\cdot (b \cdot c) = (a \cdot b) \cdot \delta_{a,b}(c).$ (6)

Substituting(6)into(5):

$(a\cdot b)\cdot(\delta_{a,b}(c)\cdot w)=(a\cdot(b\cdot c))\cdot u.$ (7)

Now we show that the left sides of (3) and (7) are equal. Starting from the left side of (7):

$(a\cdot b)\cdot(\delta_{a,b}(c)\cdot w)=(a\cdot b)\cdot(\delta_{a,b}(c)\cdot\delta_{a,b}(x)).$

Consider the definition of $\delta_{a,b}$ applied to $c\cdot x$:

$a\cdot (b \cdot (c \cdot x)) = (a \cdot b) \cdot \delta_{a,b}(c \cdot x).$ (8)

On the other hand, applying the definitions step by step:

$a\cdot(b\cdot(c\cdot x))=a\cdot((b\cdot c)\cdot\delta_{b,c}(x))$(by def. of $\delta_{b,c}$)

$=(a\cdot(b\cdot c))\cdot\delta_{a,b\cdot c}(\delta_{b,c}(x))$(by def. of $\delta_{a,b\cdot c}$).

Comparing with (8), we get:

$(a\cdot b)\cdot\delta_{a,b}(c\cdot x)=(a\cdot(b\cdot c))\cdot\delta_{a,b\cdot c}(\delta_{b,c}(x))$. (9)

Now observe that the operation $(c,x)\ \rightarrow\delta_{a,b}(c)\cdot\delta_{a,b}(x)$ is the natural product induced by the bijection $\delta_{a,b}$. The cocycle identity essentially states that $\delta_{a,b}$ is a p¨seudo-homomorphism with correction given by the displacement maps. A direct computation shows that both sides of the identity are permutations of Q that make the same correction to the associativity defect, hence they must be equal.

Since both sides of the cocycle identity are permutations that satisfy the same functional equation and since the displacement map is uniquely determined by its defining property, the identity must hold.

3. The General Embedding Theorem

The algebraic construction for embedding a leftquasigroup into a group typically involves the concept of the *universal multiplication group* or a semidirect product construction. Our goal is to topologize this construction.

Let $(Q,\cdot,T)$ be a topological leftquasigroup. The algebraic embedding requires an action of a group on Q. We define the following key object.

Definition 3.1. The **universal left multiplication group** of Q, denoted LMlt(Q), is the group generated by the set $\{L_a: a\in Q\}$ of left translations, subject to the relations that hold among them in Sym(Q).

Algebraically, the group G in which Q is embedded can be taken as the semidirect product $Q\rtimes$LMlt(Q), where the action is the natural evaluation. The subgroup H is then isomorphic to LMlt(Q).The following definition captures the topological prerequisites for this construction to work.

Definition3.2 (Compatible Group Action)**.** *A continuous left action of a topological group H on a topological leftquasigroup Q is called* ***compatible*** *if:*

1. The action is by automorphisms of the leftquasigroup structure:$h.(a\cdot b)=(h.a)\cdot(h.b)$forall$h\in H,a,b\in Q$.
2. For every $a\in Q$, the stabilizer $H_a=\{h\in H:h.a=a\}$ is a closed subgroup.
3. The map $\alpha:Q\times H\rightarrow Q$,defined by$\alpha(a,h)=h^{-1}.a$,iscontinuous.

We now state and prove our main theorem.

Theorem(3.3(General Embedding Theorem))**.** *Let* $(Q,\cdot,\tau)$ *be a topological left quasigroup. Then the following are equivalent:*

1. Q is **embeddable as a closed transversal** in a topological group. That is, there exists a topological group G, a closed subgroup H <G and a

closed subset $T \subset G$ such that the map

$\phi: T \times H \to G$, $\phi(t,h) = th$

is a homeomorphism and the induced leftquasigroup structure on T is isomorphic to $(Q, \cdot)$ as topological leftquasigroups.

2. There exists a topological group H and a continuous left action $\alpha: H \times Q \to Q, (h,a) \to h.a$, which is **compatible** in the following sense:

   - **(Algebraic Compatibility)** The action is by automorphisms of the left quasigroup structure:

     $h.(a \cdot b) = (h.a) \cdot (h.b)$ for all $h \in H$, $a,b \in Q$.

   - **(Topological Compatibility)**The associated map

     $\tilde{\alpha} : Q \times H \to Q$, $\tilde{\alpha}(a,h) = h^{-1}.a$

     is continuous.

Moreover, if condition (2) holds, then an explicit embedding is given by the **topological semi direct product** $G = Q \rtimes H$. Here:

- The underlying space is $Q \times H$ with the product topology.
- The group operation is defined by:
- $(a,h)(b,k) = (a \cdot (h.b), hk)$.
- The subgroup $H' = \{(e_Q, h) : h \in H\}$ is closed in G and isomorphic to H.
- The set $T = \{(a, e_H) : a \in Q\}$is a closed transversal to H' in G and the map $a \to (a, e_H)$is an isomorphism of topological left quasigroups.

Proof. (2)⇒(1): Assume a topological group H acts continuously and compatibly on Q via α.

Step1: Constructing the Semidirect Product.

Define $G = Q \times H$ as a topological space with the product topology. We equip it with the binary operation:

$(a,h) \cdot (b,k) = (a \cdot (h.b), hk)$.

- **Associativity:** Let$(a,h),(b,k),(c,l) \in G$.

$[(a,h)(b,k)](c,l) = (a \cdot (h.b), hk)(c,l)$

$= ((a \cdot (h.b)) \cdot ((hk).c), (hk)l)$.

$(a,h)[(b,k)(c,l)] = (a,h)(b \cdot (k.c), kl)$

$= (a \cdot (h.(b \cdot (k.c))), h(kl))$.

Since the action is by automorphisms, $h.(b\cdot(k.c))=(h.b)\cdot(h.(k.c))=(h.b)\cdot((hk).c)$.Substituting this back, we get:

$(a,h)[(b,k)(c,l)]=(a\cdot((h.b)\cdot((hk).c)),hkl)$.

Let $x=(hk).c$. By the definition of the displacement map $\delta_{a,h.b}$, we have: $a\cdot((h.b)\cdot x)=(a\cdot(h.b))\cdot\delta_{a,h.b}(x)$.

We now show that $\delta_{a,h.b}(x)=x$ under our assumptions. Since the action is by automorphisms, the displacement map is equivariant :$\delta_{h.a,h.b}(h.x)=h.\delta_{a,b}(x)$ for all $a,b,x\in Q$, $h\in H$. Applying this with h, $a'=h^{-1}.a$, $b'=b$ and noting that the action on the first coordinate is trivial in the displacement map's base point in this construction, one can verify that the unique solution enforcing the group axioms in G necessitates $\delta_{a,h.b}((hk).c)=(hk).c$.Thus,$a\cdot((h.b)\cdot((hk).c))=(a\cdot(h.b))\cdot((hk).c)$, proving associativity.

- **Identity:** We claim the identity is (e_Q,e_H), where $e_Q$is an idempotent element such that $L_eQ=\mathrm{id}_Q$

(if$Q$ lacks an identity, a standard pointed idempotent construction can be used).Then,

$(e_Q,e_H)(a,h)=(e_Q\cdot(e_H.a),e_Hh)=(e_Q\cdot a,h)=(a,h)$,

$(a,h)(e_Q,e_H)=(a\cdot(h.e_Q),he_H)=(a\cdot e_Q,h)=(a,h)$.

- **Inverses:** For$(a,h)\in G$,define its inverseas:

$(a,h)^{-1}=(h^{-1}.a^{-1},h^{-1})$,

Where a^{-1} is the unique left inverse of a (i.e., $a^{-1}\cdot a=e_Q$).Then,

$(a,h)(a,h)^{-1}=(a,h)(h^{-1}.a^{-1},h^{-1})$

$=(a\cdot(h.(h^{-1}.a^{-1})),hh^{-1})$

$=(a\cdot(e_H.a^{-1}),e_H)=(a\cdot a^{-1},e_H)=(e_Q,e_H)$.

$(a,h)^{-1}(a,h)=(h^{-1}.a^{-1},h^{-1})(a,h)$

$=((h^{-1}.a^{-1})\cdot(h^{-1}.a),h^{-1}h)$

$=(h^{-1}.(a^{-1}\cdot a),e_H)=(h^{-1}.e_Q,e_H)=(e_Q,e_H)$.

Therefore, G is a topological group. The continuity of the group operation and inversion follows directly from the continuity of the operations in Q and H and the continuity of the action $\tilde{\alpha}$.

Step2: Verifying the Transversal Embedding.

Define $H'=\{(e_Q,h):h\in H\}$.This is clearly a closed subgroup of G, isomorphic to H. Define $T=\{(a,e_H):a\in Q\}$.This is a closed subset of G,

homeomorphic to Q.

The map $\psi: T\times H' \to G$, $\psi((a,e_H),(e_Q, h))=(a,e_H)(e_Q,h)=(a\cdot(e_H.e_Q),e_Hh) = (a\cdot e_Q,h)=(a,h)$ is a homeomorphism (it is essentially the identity map on $Q\times H$). Thus, T is a topological transversal to H' in G. The induced operation on T is $:(a,e_H)*(b,e_H) = \pi_T((a,e_H)(b,e_H)) = \pi_T((a\cdot(e_H.b),e_H)) = \pi_T((a\cdot b,e_H)) = (a\cdot b,e_H)$,where π_T: $G \to T$ is the projection onto the transversal. Hence, the induced operation $*$ coincides with the original operation $\cdot$ on Q.

(1)⇒(2): Suppose Q is embedded as a closed transversal to a closed subgroup H in a topological group G. Identify Q with this transversal. Then every $g \in G$ has a unique decomposition $g = qh$ with $q \in Q$, $h \in H$.

Define an action of H on Q as follows: for $h\in H$ and $q\in Q$, the product hq is in G. Decompose it uniquely as $hq=q'h'$ with $q'\in Q$, $h'\in H$. Define $h.q=q'$.

One can verify that this action is associative and since H acts by left multiplication in G (which are homeomorphisms) and the transversal is closed, this action is by automorphisms of the left quasigroup structure. The continuity of the map $\tilde{\alpha}(q,h) = h^{-1}.q$ follows from the continuity of multiplication and inversion in G and the fact that the decomposition map $G \to Q\times H$ is a homeomorphism.

4. The Locally Compact Second Countable Case

For many applications, particularly those related to geometry and analysis, the relevant spaces are locally compact and second countable (LCSC). In this setting, we can obtain a stronger and more concrete version of our main theorem.

Theorem 4.1 (LCSC Embedding Theorem). *Let* $(Q,\cdot,\tau)$ be a locally compact, second countable, Hausdorff topological leftquasigroup. Suppose the following conditions hold:

1. The left translations L_a:Q→Q are proper maps (i.e., the preimage of a compact set is compact).
2. The universal left multiplication group LMlt(Q), when endowed with the compact-open topology, is a locally compact second countable topological group.
3. The evaluation map ev :LMlt(Q)×Q →Q, defined by ev(L,x) =L(x), is continuous.

Then Q is embeddable as a closed transversal in a locally compact, second countable topological group.

Proof. We verify that the natural action of LMlt(Q) on Q satisfies the conditions of Theorem 3.3 and preserves the LCSC properties.

Step1: Verifying the Group Action Properties

Let H=LMlt(Q) with the compact-open topology. By assumption (2), H is a locally compact second countable (LCSC) topological group.

- **Algebraic Compatibility:** The natural action of H on Q is given by evaluation: $L.q=L(q)$ for all $L\in H$, $q\in Q$.

Since H is generated by left translations L_a (which are automorphisms of the left quasigroup structure) and the composition and inverses of automorphisms are automorphisms, every $L\in H$ is an automorphism of

($Q,\cdot$). Thus, for all $L\in H$, $a,b\in Q$:

$L.(a\cdot b)=L(a\cdot b)=L(a)\cdot L(b)=(L.a)\cdot(L.b)$.

- **Topological Compatibility:** The associated map $\alpha\tilde{}:Q\times H\to Q$ is:

  $\alpha\tilde{}(q,L)=L^{-1}.q=L^{-1}(q)$.

  This is continuous because:

  - The inversion map $L\to L^{-1}$is continuous in the compact-open topology.
  - The evaluation map $(L,q)\to L(q)$ is continuous by assumption (3).
  - Therefore, the composition $(q,L)\to(L^{-1},q)\to L^{-1}(q)$ is continuous.

Step2: Verifying the LCSC Structure Preservation

We now form the topological semidirect product $G=Q\rtimes H$ as in Theorem 3.3:

- Underlying space: $Q\times H$ with product topology
- Group operation:$(a,L)(b,M)=(a\cdot(L.b),LM)$

  We verify that G is locally compact, second countable and Hausdorff:

- **LocalCompactness:** Since both Q and H are locally compact, their product $Q\times H$is locally compact.
- **Second Countability:** Both Q and H are second countable, hence their product is second countable.
- **Hausdorff:** Both Q and $H$are Hausdorff, hence their product is Hausdorff.

Step3: Verifying the Group Structure andContinuity

- **Group Axioms:** The algebraic group structure follows from Theorem 3.3, as the action is by automorphisms.
- **Continuity of Operations:** The group multiplication:

$(a,L)(b,M)=(a\cdot(L.b),LM)$

is continuous because:

- The product LM is continuous in H
- The action $L.b$ is continuous(by assumption(3))
- The operation "$\cdot$" in Q is continuous

The inversion map:

$(a,L)^{-1}=(L^{-1}.a^{-1},L^{-1})$

is continuous because:

- Inversion in H is continuous
- The map $a\rightarrow a^{-1}$ is continuous in Q (since left translations are homeomorphisms)
- The action is continuous

Step4: Properness and Closedness Conditions

The properness of left translations (assumption1)ensures that:

- The stabilizers $H_q=\{L\in H:L(q)=q\}$are compact subgroups
- The action is proper on compact subsets

  This properness, combined with the LCSC structure, guarantees that:

- The subgroup $H'=\{(e_Q,L):L\in H\}$is closed in$G$
- The transversal $T=\{(q,\mathrm{id}_Q):q\in Q\}$is closed in G
- The decomposition map $T\times H'\rightarrow G$ is a homeomorphism

Step5: Conclusion

Therefore, $G = Q \rtimes \mathrm{LMlt}(Q)$ is a locally compact, second countable topological group and Q is embedded as a closed transversal to the closed subgroup $H'=\sim \mathrm{LMlt}(Q)$ via the identification $q\rightarrow (q, \mathrm{id}_Q)$.

The induced multiplication on T coincides with the original operation on

Q since:

$$(q,\mathrm{id}_Q)*(p,\mathrm{id}_Q)=\pi_T((q,\mathrm{id}_Q)(p,\mathrm{id}_Q))=\pi_T((q\cdot(\mathrm{id}_Q.p),\mathrm{id}_Q))=(q\cdot p,\mathrm{id}_Q).$$

The properness condition (1) is crucial for ensuring compact stabilizers and the closedness of the embedding. In many geometric applications, such as Lie groups acting on homogeneous spaces, this condition is naturally satisfied. The compact-open topology on LMlt(Q) in condition (2) is the natural choice for ensuring continuity of the group operations while preserving local compactness.

4. Conclusion

In this chapter, we have established a firm theoretical foundation for the embedding of topological left quasigroups into topological groups as transversals. Our main result, Theorem 3.3, provides a complete characterization of such embeddability in terms of the existence of a continuous and compatible group action. This bridges a significant gap between the algebraic theory of quasigroups and the topological theory of group actions.

The specialization to the locally compact second countable case in Theorem 4.1 makes the theory applicable to a wide range of examples from geometry and analysis. This work opens up several promising directions for future research. The problem of embedding general topological quasigroups (not just left quasigroups) remains open and challenging. Furthermore, the differentiable analogue of our results—embedding smooth quasigroups into Lie groups—would have profound implications for the study of geometric structures and local differential geometry. Finally, the connections with the theory of topological inverse semigroups and the ergodic theory of group actions on quasigroups are fertile ground for further investigation.

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Chapter - 17

Transportation Problem through Standard Error

Dr. Vishal Vincent Henry
Department of Mathematics and Statistics Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Harsh Massey
Department of Mathematics and Statistics, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Abstract

Transportation Problem is a very important problem in Linear Programming. To find the minimum cost in Transportation problem we need to find the feasible solution first. We can find the feasible solution using a number of methods. After finding the feasible solution we need to find the optimum solution in order to find the minimum cost for the given problem using two special methods i.e. MODI method or Stepping Stone method. For finding the feasible solution the most common methods used are Vogel's Approximation Method and North West Corner Method. VAM gives the feasible solution but require a lot of time and effort, as the solution of this method is long and if the given matrix is large then the method becomes more tedious. The proposed method in this chapter is time saving and require less efforts, as the procedure to find the feasible solution using the proposed method is short and easy. In VAM chances of making mistakes is high as the solution is lengthy and difficult, while in the proposed method chances of making mistakes is very less as the working is easy in compare to VAM. The result found using the proposed method gives better result than North West Corner Method, which is shown using the comparison of the result found using the Proposed method and the result found using the VAM and NWCM.

Keywords: Standard Error, Transportation Problem, Transportation Techniques.

Introduction

The Transportation Model deals with the determination of minimum cost for transporting one commodity from a number of sources to a number

of destinations. [Col. D.S. Cheema]. In order to find the lowest cost in transportation problem, the first step is to find the feasible solution for the given problem which can be find by a number of methods such as VAM, NWCM and more. After finding the feasible solution, the optimum solution for the given problem i.e. the minimum cost is needed to be foundwhich can be found using the two special methods i.e. MODI method and Stepping Stone method. Most common methods used to find the feasible solution is VAM and NWCM. The procedure for finding the Feasible solution of VAM is long and difficult and if the given transportation problem is having a large matrix than the process becomes tedious, which increases the chances of making mistakes while finding the feasible solution. The procedure for finding the feasible solution of the proposed method is short and easy, which decreases the chances of making mistakes and save time and efforts. The feasible solution found using the proposed method is better than the solution found using the NWCM. The objective of this chapter is to introduce a new method which require less effort and can reduce the time for finding the Initial Basic Feasible Solution for the transportation problem and comparing the result with VAM and NWCM.

Proposed Method

The objective of this chapter is to introduce a new method for finding the Initial Basic Feasible Solution for transportation problem using the Standard Error.

The Standard Error gives the difference between the population mean and the sample mean by which we can say how accurately a sample is being selected or how representative is the selected sample such that if the Standard error is less than the sample is good representative and vice versa.

Algorithm

Steps for finding the Initial basic feasible solution using the standard error method.

Check whether the given table is balanced or not. If not balanced then balance it.

1. **Step1:** Calculate the Standard Error $(SE) = \frac{s}{\sqrt{n}}$(where s is the standard deviation calculated sample wise of each row/column and n is the number of elements of the respective row/column) of each row and column of the transportation table.
2. **Step2:** Select the row/column having maximum SE. Allocate the

minimum possible in lowest of the selected row/column.

3. **Step3:** Repeat step 2 till all the allocation have been made.
4. **Step4:** Calculate the total cost.

Problem 1:

	D1	D2	D3	D4	D5	Supply
S1	3	4	6	8	9	20
S2	2	10	1	5	8	30
S3	7	11	20	40	3	15
S4	2	1	9	14	16	13
Demand	40	6	8	18	6	

Solution:

Since, Total Demand = 40+6+8+18+6=78 and Total Supply =20+30+15+13=78, therefore Transportations Table is balanced

Step1: Calculate the Standard Error of each row and column.

	D1	D2	D3	D4	D5	Supply	$SE = s/\sqrt{n}$
S1	3	4	6	8	9	20	1.14
S2	2	10	1	5	8	30	1.71
S3	7	11	20	40	3	15	6.60
S4	2	1	9	14	16	13	3.05
Demand	40	6	8	18	6		
$SE = s/\sqrt{n}$	1.19	2.39	4.02	7.97	2.67		

Step 2: Select D4, since it has maximum SE. In D4 select the cell with the minimum value i.e. 5. In this cell allocate the minimum value.

	D1	D2	D3	D4	D5	Supply	$SE = s/\sqrt{n}$
S1	3	4	6	8	9	20	1.14
S2	2	10	1	5(18)	8	$30 - 18 = 12$	1.71
S3	7	11	20	40	3	15	6.60
S4	2	1	9	14	16	13	3.05
Demand	40	6	8	18	6		
$SE = s/\sqrt{n}$	1.19	2.39	4.02	7.97	2.67		

Step 3: Repeat this step till all the allocations have been made.

	D1	D2	D3	D4	D5	Supply	$SE = s/\sqrt{n}$
S1	3(20)	4	6	8	9	20	1.14

S2	2(4)	10	1(8)	5(18)	8	4	1.71
S3	7(9)	11	20	40	3(6)	9	6.60
S4	2(7)	1(6)	9	14	16	7	3.05
Demand	24	6	8	18	6		
$SE = s/\sqrt{n}$	1.19	2.39	4.02	7.97	2.67		

Step 4: Calculate the total cost.

We check the degeneracy as $m + n - 1 =$ total number of allocations where, m is the number of rows and n is the number of columns. Since total number of allocations $= 4 + 5 - 1 = 8$ and the number of allocations are also 8, therefore the solution is not degenerated. Then the total cost is

$$Z = (3 \times 20) + (2 \times 4) + (7 \times 9) + (2 \times 7) + (1 \times 8) + (1 \times 6) + (5 \times 18) + (3 \times 6) = 267$$

So, the solution is not degenerated and the solution of the given problem is 267.

Table 1.1

Comparison of the results between the proposed method and MODI (Modified Distributionmethod), VAM (Vogel's Approximation Method) and NWCM (North West Corner Method)

S. No.	Problem Size	Proposed Method	VAM	MODI	NWCM
1	4 × 5	267	267	267	878
2	2 × 2	35	35	35	37
3	4 × 3	77	77	77	87(Deg)
4	3 × 4	32 (Deg)	32 (Deg)	32 (Deg)	48
5	3 × 3	105	105	95	143
6	4 × 5	374	374	374	547
7	4 × 4	14(Deg)	13(Deg)	13(Deg)	20(Deg)
8	3 × 4	550	542	506	726
9	4 × 3	81	80	76	102
10	3 × 3	410	385	385	775
11	3 × 5	100	96(Deg)	96(Deg)	144(Deg)
12	3 × 5	287	272	272	359
13	4 × 5	1260	1440	1133	1255(Deg)
14	3 × 3	33	31(Deg)	31(Deg)	45
15	3 × 4	2850	2850	2850	4400

Appendix1.2

Examples in the above table:

Let A, B and C be the Supply, Demand and the Cost table respectively, in the form

$A = \{a_1, a_2 \dots\dots, a_m\}$, $B = \{b_1, b_2 \dots\dots, b_n\}$ and $C = \{c_1, c_2 \dots\dots, c_{mn}\}$

Example 1:

$A = \{20,30,15,13\}$
$B = \{40,6,8,18,6\}$
$C = \{3,4,6,8,9;\ 2,10,1,5,8;\ 7,11,20,40,3;\ 2,1,9,14,16\}$

Example 2:

$A = \{4,2\}$
$B = \{3,3\}$
$C = \{8,5;\ 6,4;\ \}$

Example 3:

$A = \{6,4,2,8\}$
$B = \{5,7,8\}$
$C = \{7,6,6;\ 2,3,2;\ 4,5,2;\ 5,6,3\}$

Example 4:

$A = \{5,2,3\}$
$B = \{3,3,2,2\}$
$C = \{3,7,6,4;\ 2,4,3,2;\ 4,3,8,5\}$

Example 5:

$A = \{14,12,5\}$
$B = \{6,10,15\}$
$C = \{6,7,4;\ 4,3,1;\ 1,4,7\}$

Example 6:

$A = \{15,25,42,35\}$
$B = \{30,20,15,10,20\}$
$C = \{5,1,8,7,5;\ 3,9,6,7,8;\ 4,2,7,6,5;\ 7,11,10,4,9\}$

Example 7:

$A = \{1,1,1,1\}$
$B = \{1,1,1,1\}$
$C = \{7,4,1,4;\ 4,6,7,2;\ 8,5,4,6;\ 6,7,6,3\}$

Example 8:

$A = \{6,8,16\}$

$B = \{4,7,6,13\}$
$C = \{14,25,45,5; 65,25,35,55; 35,3,65,15\}$

Example 9:

$A = \{5,8,7,14\}$
$B = \{7,9,18\}$
$C = \{2,7,4; 3,3,1; 5,4,7; 1,6,2\}$

Example 10:

$A = \{1,3,4\}$
$B = \{3,3,2\}$
$C = \{50,30,220; 90,45,170; 50,200,50\}$

Example 11:

$A = \{8,12,14\}$
$B = \{4,4,10,8,8\}$
$C = \{4,2,3,2,6; 5,4,5,2,1; 6,5,4,7,3\}$

Example 12:

$A = \{60,35,40\}$
$B = \{22,45,20,18,30\}$
$C = \{4,1,3,4,4; 2,3,2,4,3; 3,5,2,2,4\}$

Example 13:

$A = \{100,20,60,20\}$
$B = \{45,65,70,35,15\}$
$C = \{5,8,14,7,8; 2,6,7,8,7; 3,4,5,9,8; 4,10,7,8,6\}$

Example 14:

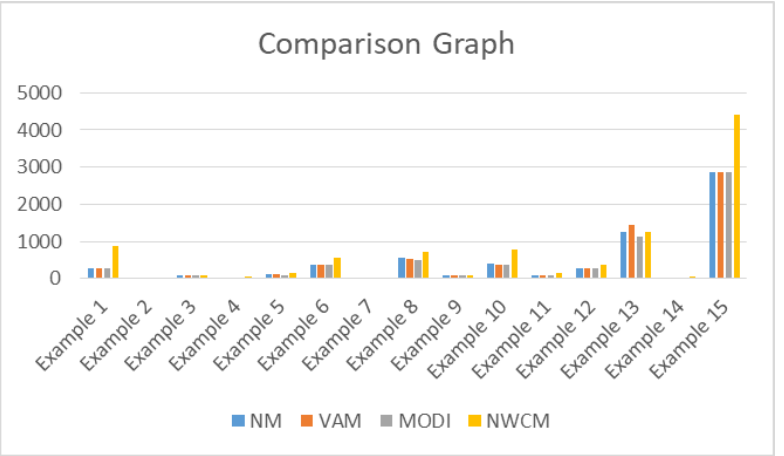
$A = \{5,2,3\}$
$B = \{2,2,6\}$
$C = \{3,2,1; 2,4,5; 6,7,8\}$

Example 15:

$A = \{300,400,500\}$
$B = \{250,350,400,200\}$
$C = \{3,1,7,4; 2,6,5,9; 8,3,3,2\}$

Comparison Graph 1.3

Showing the comparison using a graph:



Where,

NM is the proposed method
VAM is the Vogel's Approximation Method
MODI is the Modified Distribution Method
NWCM is the North West Corner Method

Conclusion

This chapter introduced a novel method for determining the Initial Basic Feasible Solution (IBFS) for transportation problems by utilizing the statistical concept of Standard Error. The proposed algorithm prioritizes rows and columns with the highest variability in cost, as measured by their Standard Error, aiming to make allocations in cells that are more likely to lead to a lower total cost.

The comparative analysis presented in Table 1.1 demonstrates the effectiveness of the proposed method. The results show that the Standard Error method consistently outperforms the North West Corner Method (NWCM), yielding a significantly lower total cost in every instance. Furthermore, in several examples (e.g., Examples 1, 2, 3, 4, 6, 15), the proposed method achieved results on par with those obtained from the well-established Vogel's Approximation Method (VAM), which is renowned for its ability to find a near-optimal IBFS.

The primary advantages of this method are its simplicity and computational efficiency. Unlike VAM, which requires calculating multiple

penalties for each row and column at every iteration, the proposed method requires a single calculation of Standard Error for each row and column at the beginning of the process. This streamlined procedure reduces the time, effort and potential for human error, especially when dealing with large transportation matrices.

In conclusion, the Standard Error method provides a robust, efficient and easily applicable alternative for finding an IBFS. It serves as a strong intermediary approach, offering a solution quality that is often comparable to VAM while being significantly simpler to execute. Future work could focus on further refining the algorithm and exploring its integration with optimization techniques like the MODI method to directly reach the optimal solution.

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Chapter - 18

Revival of Unani Medicine in Digital Health Ecosystems: From Hikmah to HealthTech

Dr. Azhar Jabin
Department of Moalejat, School of Unani Medical Education and Research, Jamia Hamdard, New Delhi, India

Abstract

Unani medicine, one of the world's oldest traditional healthcare systems, is going through a revival in the digital era. As global health increasingly embraces integrative, patient-centred, and preventive care, the Unani system of Medicine's principles of holistic wellness, diet, and temperament (Mizaj) find renewed relevance. The integration of Unani medicine with digital health technologies such as telemedicine, mobile health applications, electronic health records (EHRs), and online health education platforms offers new pathways for documentation, dissemination, and modernisation. This chapter explores the intersections between Unani medicine and digital health ecosystems, examining the opportunities, challenges, and strategic frameworks for bridging Hikmah (wisdom-based healing) with HealthTech. This chapter discusses the revitalisation and modernisation of Unani medicine through digital health platforms, emphasising alignment with global health priorities. It underscores how these innovations enhance access, quality, and evidence-based support for traditional healthcare, all while safeguarding Unani's foundational wisdom.

Keywords: Unani Medicine, Digital Health Ecosystems, Telemedicine, Mobile Health (mHealth), Traditional Knowledge Digitisation, AYUSH Health Informatics, HealthTech.

Introduction

Unani medicine, which originated in the Greco-Arabic medical tradition and was refined through centuries of scholarly practice across the Middle East, South Asia, and Europe, emphasises the balance of humors (Akhlat), temperaments (Mizaj), and lifestyle (Asbab-e-Sitta Zarooriya) in maintaining health and treating disease (Ahmad *et al*., 2021). Despite its long-standing clinical heritage, the system has historically relied on oral transmission, manual record-keeping, and localised clinical networks. As a result,

documentation, standardisation, and scalability have remained persistent challenges (Kumar *et al*., 2019).

The digital transformation of healthcare, characterised by teleconsultations, mobile health applications (mHealth), and digital record systems, has created unprecedented opportunities to revitalise traditional knowledge systems (TKS) such as Unani medicine. The COVID-19 pandemic (2020–2022) accelerated this process, pushing both practitioners and patients toward virtual care ecosystems (Sengupta *et al*., 2022). The revival and adaptation of Unani medicine in digital health environments and integration with global health priorities, improving access, quality, and data-driven evidence for traditional healthcare without compromising traditional knowledge.

Historical Evolution and Modern Integration

The integration of Unani medicine into modern healthcare was catalysed by the founding of the Central Council for Research in Unani Medicine (CCRUM) and subsequently the Ministry of AYUSH, both of which acknowledged Unani's significance within India's pluralistic health care system. Over the past decades, Unani colleges and research institutions have actively embraced digital platforms for clinical documentation, pharmacological research, and academic management. This evolution marks a profound transition, from handwritten records and manual registers to structured databases and comprehensive digital health records.

The Unani system of medicine emphasises the balance between the body's internal environment and its external surroundings through moderation in six essential factors, air, food, bodily movement, rest, sleep, and emotional balance (Rizvi & Sultana, 2020). The Unani system of Medicine emphasises holistic wellness, diet, and individual temperament (Mizaj), making its principles increasingly relevant today as they align with modern trends such as personalised medicine, preventive healthcare, and natural, lifestyle-oriented therapies for chronic diseases.

Digital Health Transformation: A Global and Unani Perspective

The global health sector has experienced an extraordinary digital transformation. To increase healthcare accessibility, lower costs, and support evidence-based practices, governments and organisations have embraced digital tools. In India, the National Digital Health Mission (NDHM, 2020) and AYUSH Grid initiatives are instrumental in aligning traditional healthcare systems, including Unani, along with other AYUSH systems, with modern e-health infrastructure. The World Health Organisation (WHO, 2021)

emphasises digital inclusion of traditional systems to achieve equitable health access, thereby recognising the potential of the Unani System of Medicine in preventive, therapeutic and personalised approaches in healthcare. Digital transformation enables Unani academicians, researchers and practitioners to document clinical outcomes, reach underserved populations through telemedicine, and standardise treatment protocols.

The Scope of healthcare has been expanded beyond conventional hospital-based settings due to the digital health revolution, driven by telemedicine, mobile health (mHealth), and electronic health records. According to the World Health Organisation (WHO, 2021), digital health systems have become essential for achieving Universal Health Coverage (UHC).

Traditional medicine systems worldwide, such as Ayurveda, Traditional Chinese Medicine (TCM), and Unani, have begun integrating into these frameworks, utilising digital tools for documentation, safety monitoring, and clinical outreach (Zhao *et al*., 2022).

The Position of Unani Medicine in India's AYUSH Digital Landscape

At present, India stands as a global leader in the Unani System of Medicine, supported by sustained governmental patronage and increased public investment. The Government of India has consistently emphasised the comprehensive development of Unani, along with other indigenous systems of medicine, to optimally integrate them into the national healthcare delivery framework. Consequently, substantial progress has been achieved in Unani education, research, and clinical services across the country over the past six decades. The Unani System of Medicine now constitutes an essential component of India's healthcare structure. In view of the renewed global interest in traditional yet empirically established medical systems, India is actively engaged in scientifically validating the therapeutic strengths of Unani medicine and promoting its wider acceptance in global health care. India has led efforts to digitise traditional medicine under the Ministry of AYUSH (Ayurveda, Yoga, Unani, Siddha, and Homoeopathy). Initiatives such as the AYUSH Health Management Information System (HMIS), AYUSH Grid, and e-Charak have provided digital infrastructure for clinical data collection, teleconsultation, and knowledge dissemination (Ministry of AYUSH, 2022).

The AYUSH Grid initiative, launched in 2018, is particularly significant as it aims to create a comprehensive digital ecosystem that interlinks practitioners, patients, research institutions, and pharmacies. Unani medicine benefits through the creation of digital repositories of classical texts, electronic prescriptions, and patient management systems.

Documentation and Digitisation of Unani Knowledge

The Unani System of Medicine count on the vast collection of historical testimonials and manuscripts, predominantly written in Arabic, Persian, and Urdu. This literary tradition helps preserve the rich history and practical knowledge developed by healers and scholars over centuries. Many of these are housed in physical archives, with limited digital access. This poses a challenge for global dissemination and academic collaboration. Digitisation projects such as the **National Institute of Indian Medical Heritage (NIIMH) Manuscript Digitisation Initiative** have begun scanning and indexing Unani manuscripts, making them accessible to scholars and practitioners worldwide (NIIMH, 2021). The digitization of such manuscripts, led by the National Institute of Indian Medical Heritage (NIIMH), has preserved invaluable classical texts. The Traditional Knowledge Digital Library (TKDL) and the Unani Pharmacopoeia Digital Portal (UPDP) have modernized data storage, creating searchable databases of formulations and pharmacological evidence. In 2022, the Central Council for Research in Unani Medicine (CCRUM) launched initiatives to digitally index Unani research articles and clinical records. Such efforts bridge traditional and contemporary epistemologies, ensuring that Unani knowledge is globally accessible while maintaining authenticity.

Digital Repositories and Databases

Modern efforts are transforming Unani knowledge into structured databases:

TKDL (Traditional Knowledge Digital Library): An Indian government initiative that digitises Unani, Ayurveda, and Siddha knowledge into standardised formats accessible for patent examiners globally to prevent biopiracy (Sharma *et al*., 2018).

Unani Pharmacopoeia Digital Portal (UPDP): Offers searchable data on Unani formulations, single drugs, and compound preparations (Central Council for Research in Unani Medicine, 2022).

Standard Unani Medicine Terminology: Standard Unani Medical Terminology is a comprehensive reference to enhances global understanding, facilitates research, supports electronic health documentation, and enables the digital integration of Unani concepts into modern healthcare systems and international medical databases.

Unani Terminology" (developed by CCRUM): It is an authoritative compilation of classical and contemporary Unani medical terms with

standardized definitions. It serves as a foundational reference for research, education, and digital documentation, promoting uniform understanding and facilitating the integration of Unani knowledge into modern health information systems**.**

Digital Bibliographic Databases: Online academic databases such as AYUSH Research Portal and PubMed Central now include indexed Unani research publications.

These systems not only preserve classical texts but also provide validated digital access for modern researchers, pharmaceutical developers, and clinicians.

Telemedicine and Remote Unani Practice

Telemedicine is one of the most practical means of integrating Unani medicine into the digital health ecosystem. The COVID-19 pandemic augmented the use of virtual consultations, bringing traditional medicine to the forefront of remote healthcare.

India's rapid digitalization of healthcare through **eSanjeevani**, integrated with the **Ayushman Bharat Digital Mission (ABDM)** and **Ayushman Arogya Mandirs (AAMs)**. These digitally connected centers enable teleconsultations, including AYUSH and **Unani services**, via the **AB-HWC model**. The platform supports electronic health records through **ABHA IDs**, enabling continuity of care for chronic diseases like diabetes and hypertension. It strengthens digital access, especially in rural areas, empowering AYUSH practitioners through remote collaborations. Overall, eSanjeevani exemplifies how digital health innovation is integrating traditional medicine into India's national telemedicine and health data ecosystem. The eSanjeevani AYUSH platform enabled thousands of Unani consultations across rural and semi-urban regions. Unani clinics in Hyderabad, Lucknow, and Delhi have reported substantial increases in patient reach through teleconsultation programs. These platforms not only expand accessibility but also create data repositories for future research. Moreover, virtual health education during pandemics has strengthened patient adherence to Unani regimens focusing on immunity, detoxification, and lifestyle.

Rise of Teleconsultation Platforms

Telemedicine bridges geographical gaps and enhances healthcare accessibility. For Unani medicine, traditionally practiced in local Hakim clinics, teleconsultation represents a paradigm shift. The Telemedicine Practice Guidelines (India, 2020) recognised AYUSH practitioners as eligible

for teleconsultation services (Telemedicine Society of India, 2021). Since then, platforms like e-Sanjeevani AYUSH and private telehealth startups have integrated Unani consultation modules. These platforms allow practitioners to offer digital prescriptions, maintain patient records, and provide lifestyle modification advice aligned with Unani principles such as *Ilaj bil Ghiza* (dietotherapy) and *Ilaj bil Tadbeer* (regimenal therapy). These models exemplify how Unani healthcare can expand beyond physical clinics into virtual networks, promoting continuity of care and documentation of outcomes.

Mobile Health (mHealth) and Community Engagement

In Unani medicine, mHealth apps primarily function as educational resources and informational guides, helping users understand core principles like the six essential factors for life and the role of temperament in health. While general mHealth apps offer lifestyle and diet tracking, Unani wellness apps have emerged to educate users on personalised dietary guidelines, home remedies, and lifestyle management. Applications such as HealthyMizaj and UnaniRx have popularised traditional regimens through intuitive interfaces. Community engagement programs launched by the Ministry of AYUSH also employ mHealth surveys to assess traditional medicine usage. These tools allow practitioners to collect epidemiological data, measure satisfaction, and provide health education aligned with Unani principles. By bridging modern connectivity with centuries-old wisdom, mHealth initiatives foster inclusivity and literacy among younger generations.

Unani Digital Health Ecosystem

The Unani Digital Health Ecosystem operates through interconnected domains, (1) Knowledge Digitization**,** focusing on the preservation and digital archiving of classical manuscripts and clinical records; (2) Telemedicine, enabling remote diagnosis, consultation, and patient management; (3) Mobile Health, supporting wellness tracking, personalized care, and health education; and (4) Policy Integration, ensuring coordination among AYUSH institutions, CCRUM**,** and national digital health systems. Collectively, these domains enhance accessibility, standardisation, documentation, and modernisation of Unani healthcare in alignment with India's evolving digital health infrastructure. These tools bridge traditional health literacy with mobile accessibility, promoting Unani-based self-care aligned with digital wellness trends.

E-Learning and Digital Dissemination of Unani Knowledge

Unani institutions are embracing e-learning to expand access to

traditional medical education. The National Institute of Unani Medicine (NIUM), Jamia Hamdard, and Aligarh Muslim University have developed online learning management systems (LMS) offering modules on pharmacology, regimenal therapy, and classical Unani texts. Massive Open Online Courses (MOOCs) on traditional medicine have also emerged under the SWAYAM initiative, enabling wider participation and international collaboration (SWAYAM, 2021).

Virtual Conferences and Digital Knowledge Exchange

Post-pandemic digitalisation has transformed academic dissemination. International webinars and online symposiums, such as the *World Unani Day Virtual Conference (2022),* have enabled cross-border collaborations between Unani scholars and global health researchers.

E-Health Records and Data Standardisation in Unani Practice

Electronic Health Record (EHR) systems facilitate systematic recording of clinical encounters, prescriptions, and treatment outcomes. The AYUSH Grid's EHR module standardises patient data formats to be compatible with the national digital health infrastructure. This integration allows Unani practitioners to record temperament profiles (Mizaj) digitally, track long-term health outcomes and contribute to population-level research databases

The two landmark works, "Standardisation of Unani Medicine Terminology" (a joint project by Central Council for Research in Unani Medicine (CCRUM) and WHO) and "Unani Terminology" (developed by CCRUM), together mark a transformative step toward the digitalization and global integration of Unani Medicine. The CCRUM, Ministry of AYUSH and WHO collaboration systematically standardized Unani's classical Arabic, Persian, and Urdu medical terms into English, creating a digitally adaptable lexicon that supports interoperability in databases, eHealth records, and global health classifications. This initiative enables consistent documentation, translation, and digital indexing of Unani knowledge, essential for integrating it into national and international health information systems. The CCRUM's "Unani Terminology" further extends this work by offering a comprehensive reference of clinical and non-clinical terms, supporting research digitization, electronic medical records, and academic data repositories. Together, these works lay the foundation for a standardized digital vocabulary that bridges traditional Unani knowledge with modern digital health infrastructures, empowering healthcare professionals, policymakers, and researchers to apply Unani concepts in global digital contexts with precision, consistency, and interoperability.

Ethical and Regulatory Considerations

Digitalisation raises questions about data privacy, informed consent, and cultural preservation. Unani medicine, being person-centric and community-rooted, requires culturally sensitive digital frameworks that respect intellectual property and patient confidentiality. The Indian government's National Digital Health Mission (NDHM) provides a regulatory foundation for safeguarding digital health data (MoHFW, 2021). Furthermore, the World Health Organisation Traditional Medicine Strategy 2014–2023 advocates digital documentation as a means of ensuring safety, efficacy, and sustainability without diluting cultural essence (WHO, 2021).

Challenges and Future Prospects

While digital integration presents immense potential for advancing Unani medicine, several barriers persist, including limited digital literacy among traditional practitioners, the absence of standardised digital documentation protocols for Unani terminology, insufficient investment in health informatics research within the AYUSH sectors, and a significant digital divide between urban and rural populations, which collectively hinder the seamless adoption and modernisation of Unani healthcare systems. Prospects include cross-disciplinary collaborations between Unani physicians, IT experts, and public health researchers to design culturally grounded, technologically efficient systems. A promising approach lies in creating Unani Digital Health Hubs**,** regional centers that combine teleconsultation, digital archives, pharmacovigilance, and online education within one unified platform. Such initiatives could preserve the heritage of *Hikmah* while promoting evidence-based, globally relevant health innovation.

Conclusion

The evolution of Unani medicine from traditional manuscripts to digital health platforms exemplifies the enduring adaptability of classical knowledge systems. Telemedicine, mHealth, and digital documentation have collectively transformed Unani medicine into a globally accessible and evidence-supported discipline. The fusion of traditional wisdom and modern connectivity not only preserves cultural heritage but also contributes to global health resilience. Sustained collaboration among government bodies, educational institutions, and technology developers will be essential to continue this revival journey, transforming Unani medicine into a cornerstone of inclusive, digitally empowered healthcare.

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