

# TELECOM BUSINESS REVIEW

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# TELECOM BUSINESS REVIEW

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## Editorial Message



It gives me immense pleasure in presenting to you the ninth issue of Telecom Business Review (TBR 2016). The TBR has been a platform for scholars, teachers, professionals and students to contribute and showcase their knowledge, research, experience, study results and findings in the relevant areas of Technology, Business and Management. In the TBR September 2015 Issue, we published articles on diverse topics such as Flexible Spectrum management: Approaches for India, Management of Service Gaps by Infusion of Technology, Exploration of product centric Factors in Telecom Industry, On the History of Telecommunications: Patents, Disputes and Rivalries that shaped the modern Telecommunications industry, Social Networking Sites Continuance: An application of extended theory of planned behaviour, Analysing the Indian Subscriber behaviour towards mobile social media-A data monetization and customer engagement perspective, Innovative product management driving enhanced customer experience, Wrist wars: Smart watches vs Traditional watches.

I am sure this year's issue of the TBR 2016 will also help to trigger quality studies in the field of Telecom Business Management and enlighten and educate the telecom fraternity.

At the release of the ninth issue, I thank all the contributors for their thought provoking articles. I also express my heartfelt gratitude to the members of the Editorial Review Board and all our esteemed reviewers. I also seek the support of the telecom fraternity in our efforts of making the TBR global by contributing research papers that highlight global issues in telecom business.

**Prof. Sunil Patil**  
Director SITM

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2. Title of the paper is no more than 15 words, centered and in 16pt font.
3. Section/sub-titles are in numbered sequentially, in bold and 14pt font.
4. All text should be in 12-point Times New Roman Font, Justified, Double spaced, 1 inch margin on all four sides. Professionally drawn graphs and diagrams must be provided wherever necessary along with the manuscript.
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6. Footnotes, figures, tables and graphs should be numbered serially and should appear at desirable place in the text itself, with proper reference made in the text. Wherever necessary, the source should be indicated at the bottom.
7. Figures, text or tables are not colored or shaded.
8. Tables or figures do not break across two pages.
9. No footnotes, but End-notes are included.
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### **For Working Papers, Dissertations and Papers Presented at Meetings**

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# Profitable Solution to Emerging Market Challenges through 'Internet of Things'

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## ABSTRACT

The world is undergoing a dramatic transformation, rapidly transforming from isolated systems to ubiquitous internet-enabled 'things' capable of generating data that can be analysed to extract valuable information. Commonly known as the internet of things (IoT), this new reality will enrich everyday life, increase business productivity, improve monitoring of traffic, control crime and improve government efficiency, etc. The IoT is based on the integration of billions of different things, from tiny sensors to video cameras, from cars to production machines. The main objective is to integrate or connect things that can be used as sensors or actuators.

Developing & under-developed economies constitutes about 80% of world population. This paper talks about how these strata of population can benefit from Internet of Things, which according to Ericsson vision of Networked society will connect some 50Bn devices across the globe by 2020.

**Keywords:** IOT, Profitable Solutions, Smart Environment, Smart Business Solutions, IOT Operations

## 1. INTRODUCTION

### 1.1 Internet of Things

The vision of the Internet of Things has evolved due to a convergence of multiple technologies, ranging from wireless communication to the Internet and from embedded systems to micro-electromechanical systems. This means that the traditional fields of embedded systems, wireless sensor networks, control systems, automation (including home and building automation), all have contributions to enable the Internet of Things (IoT)

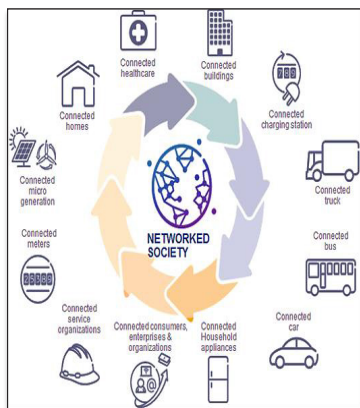


Fig. 1: Ericsson's Vision of Networked Society

### 1.2 IOT: Future of Human Progression

Study shows that the Internet doubles in size every 5.32 years. Using the below mentioned figure in combination with the number of devices connected to the Internet in 2003 (500 million, as determined by Forrester Research), and the world population according to the U.S. Census Bureau, Ericsson has estimated the number of connected devices per person.

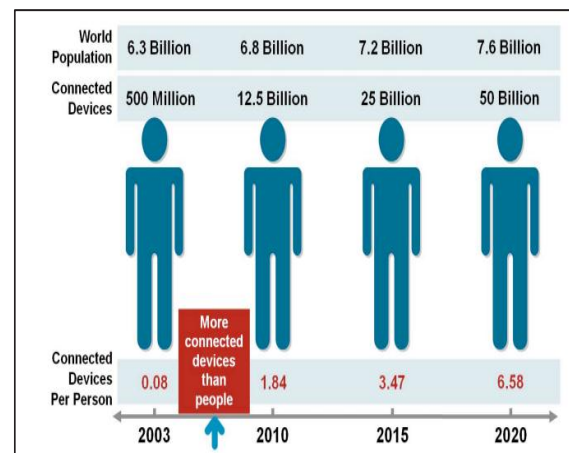


Fig. 2: No. of Connected Devices Per Person

Source: Ericsson



Prediction tells that there will be 25 billion devices connected to the Internet by 2015 and 50 billion by 2020. It is important to note that these estimates do not take into account rapid advances in Internet or device technology; the numbers presented are based on what is known to be true today. IoT is something that is common amongst Nature, Animals, Vehicles, and People. When we crossed the threshold of connecting more objects than people to the Internet, a huge window of opportunity opened for the creation of applications in the areas of automation, sensing, and M2M communication.

*Traffic free roads for Ambulance!Where:* A moving ambulance can be monitored by central traffic management department and signals can be made free by stopping vehicles from other side to cross, allowing the ambulance to reach hospital faster.

*Holy Cow!* In the world of IoT, even cows will be connected. Implanting sensors in the ears of cattle will allows farmers to monitor cow's health and track their movements, ensuring a healthier, more plentiful supply of milk and meat for people to consume.

In fact, the possibilities are almost endless. With the knowledge we have acquired for working in emerging markets & IoT, we are confident that a lot of challenges faced by these counties can be mitigated to a significant extent by leveraging IoT.

At high level we have clustered the use cases (which are potential business offerings) in two core themes which are central to a sustainable future of emerging markets societies:

- **Environmental** challenges faced due to climate change or pollution and how IoT can help solve the same
- **Societal** cases deal with the real life challenges in law and order

*Benefits, operating model and monetization model* are highlighted for each of the use-cases/offering. Different Use-case will have different operating model and monetization models and thereby different technology requirements for communication, sensing instruments and their effectiveness, complexity of the NOC as well as the other business and operational processes.

## 2. ENVIRONMENTAL USE-CASES

### 2.1 Control the Extent of Natural Calamity

Global warming and Climate change is leading to unexpected natural occurrences. This is our 1<sup>st</sup> use case

where Sensor apparatus could have informed about cloud burst, flash floods, earthquakes or Tsunamis that can help the authorities to take pre-emptive control and property. In the era where drones, balloons and satellites can help us communicate, use case will become a reality soon.



**Fig. 3: Massive Wave Illustration**

Source: [blogspot.com/](http://blogspot.com/)

#### 2.1.1 Background

Flash floods in 2014 in Kashmir & Uttarakhand, India; have led to massive devastation of life, environment. The loss in terms of damage to property rises up to USD 16Bn. It killed more than 500 people in Jammu & Kashmir, India and more than 4500 people in Uttarakhand, leaving thousand other homeless. The federal government sent more than \$164Mn for relief and reconstruction in Jammu and Kashmir alone. Tsunami in 2004 in the Indian Ocean was the deadliest one was caused by a 9.0 magnitude earthquake, killing more than 250,000 people in a single day.

#### 2.1.2 Benefits

The extent of disaster could have been avoided had there been effective information on the impending calamity, saving precious lives and property to an extent

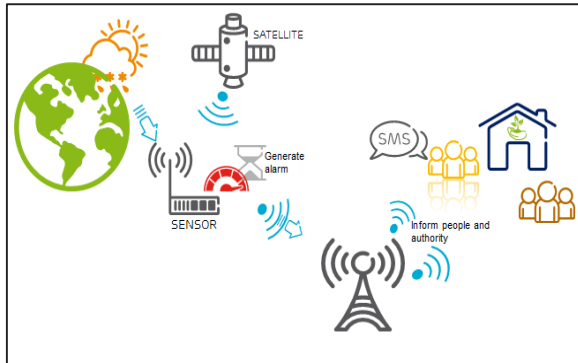
#### 2.1.3 Operational Model

Strategically placed sensors sensing an unpredictable event like movement of tectonic plate, formation of disastrous cloud, underground volcanic movement can trigger a quicker disaster control response and if acted upon on time it has the potential to save precious life & property.

- Sensor would communicate with Satellite for exchanging information
- In case of any disaster forecast by the sensors the NOC alarm would be triggered with disaster man-



agement instructions. This would help in taking pre-emptive measures for evacuation



**Fig. 4: Communication Network for Natural Calamity Alert**

-It can be integrated with area specific mobile telecom system to generate SMS/alerts to inform people and provide direction for evacuation.

#### 2.1.4 Monetization Model

Currently the Government spends Millions of dollars post any disaster. Telecomservice provider can offer an integrated technology solution to the government in a managed services model.

## 2.2 Smart Field, Green Environment, Happy Farmers!

Field shall tell the farmer 'I am thirsty'. So can a lawn or a garden to a gardener. The idea is to install soil specific sensors that can measure the dryness of soil, the minerals required, ambient temperature and thereby informing the water and mineral requirements to the owners or simply transmitting them to a water pump receptor which would automatically start watering the field.



**Fig. 5: Agriculture Field Sensor: Illustration**

### 2.2.1 Background

Fresh water resources are limited and with rise in temperatures glaciers are melting faster. At the same time agriculture intensive emerging economies also need to produce food and use water. Idea is to optimize the water needs, to draw only the amount of water needed and at a time when required.

### 2.2.2 Benefits

Saves water, reduces electricity usage and thereby the carbon emissions. With the kind of scale of cultivation and gardening (5% of total earth area). This will have a profound positive impact on environment.

### 2.2.3 Operational Model

Sensors have to be placed in the field at suitable spatial intervals in a mesh style which will send the readings to a central intelligent unit. Based on the data received, the unit will decide when to start the watering process, in which part of the field and for what duration.

Sensors can communicate with the intelligent unit using appropriate communication technologies. Also, the sensors are not required to send frequent readings to the Central Unit and therefore the data requirements and extent of data processing are not of the highest order, thereby helping in the viability of the solution.

- To reap economies of scale, the intelligent unit can be centrally placed at Service provider premises and operated in a virtualized cloud based multi-tenanted model.

-NOC alarm can be raised if sensor is out of order and the fault notification shall be sent to the land owner and the service provider for correction.

### 2.2.4 Monetization Model

Farm owners, gardeners, co-operatives as well as irrigation ministry and government can all be the clients for this kind of futuristic solution. The operator can keep the pricing of such solution based on the number of sensors installed or the area of the farmland.

## 3. SOCIETAL USE CASES

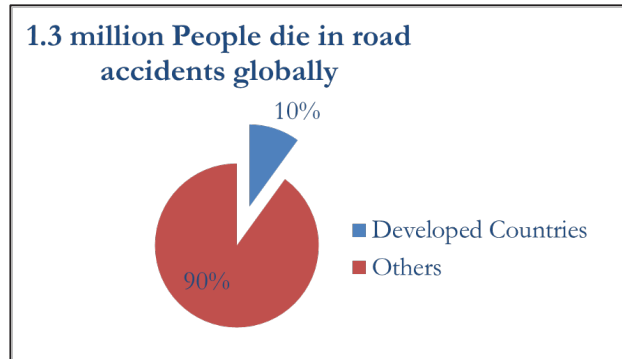
### 3.1 How Can IoT improve Biker's Safety?

According to the World Health Organization, road traffic injuries causes an estimated and remains unacceptably high at around 1.3 million deaths worldwide in a year.

Only 28 countries, representing 449 million people (7% of the world's population), have adequate laws that address all the risk factors. Even if the riders are aware of the safety norms, many a cases they avoid wearing helmets.

What if even without the traffic law a technology was in place which makes sure that riders wear helmet?

### 3.1.1 Background



**Fig. 6: Road Accident Comparison**

Source: [www.who.int](http://www.who.int)

- Over 90% of all road fatalities occur in low and middle-income countries.
- The number of motorcycle rider deaths is nearly 30 times more than drivers of other vehicles
- Major reasons of death on the spot include brain hemorrhage, internal injury to organs or due to blood loss
- Riders wearing an approved helmet reduce the risk of death by 37 percent

### 3.1.2 Benefits

Instead of trying to stop someone from violating safety norms by not wearing a helmet, we would have a technology in place which won't allow them to do it in the first place. Fatal injuries to the brain can be avoided.

### 3.1.3 Operational Model

The helmet is to have sensors which would tell the motorcycle whether the motorcyclist and the pillion has worn helmet or not.

### 3.1.4 Smart Helmet

Helmet to have a chip integrated which would generate radio signals. The helmet is authenticated via one of the several antennas in the motorcycle's bodywork. The motorcycle with a smart helmet can disengage the immobilizer and automatically unlock the bike.



**Fig. 7: Illustration: Bike Proximity Sensor**

A secondary proximity sensor can sense whether a pillion is sitting or not and whether the pillion is wearing an approved helmet

### 3.1.5 Human Body Capacitance

Treadmill safe key, capacitive touch phones, calorie/speed monitor devices and many others use human body capacitance as the medium to transmit signal. The small chip for the security system can be embedded on the helmet inner surface. As soon as the rider wears the helmet and touches the handle of the motorcycle, the body will act as the capacitor completing circuit between the helmet and the bike. This will activate the ignition without inserting a key in the ignition. The push button when pressed will ignite the engine



**Fig. 8: Illustration: Body Capacitance as the Ignition Activation Medium**

### 3.1.6 Monetization Model

#### Production & Marketing

- The market for branded helmets (ISO certified) all around the world and especially in developing and under developed countries is much smaller compared to the unbranded ones, which do not provide safety from fatal accidents.
- Just like a car manufacturer's tie-up with a tire manufacturing company, if motorcycle manufacturing companies have tie ups with helmet manufacturers, it will be a win-win situation for both. Consumers will have access only to branded ISO certified helmets. Helmet manufacturers will be able to sustain well with better quality products as competition from the unbranded market will die out.
- If one loses ones helmet or if it is damaged, one can simply call up the customer care to block the access of the helmet and issue a new helmet within a day. Simply walk into the nearest dealer, give your credentials and once the seller encodes the chip inside helmet and gives the access to the bike key, walk away with a new helmet.

### 3.1.7 Eco-system

- Government mandate can make the motorcycle manufacturers include this feature in their vehicle by default. If the entire eco system is developed, no user (rider) can skip a helmet.
- Also, this can lessen the theft of bikes as just a mechanical key won't be the access to start a bike. Electronic key with unique identification and key numbers (just like a credit card) can provide good amount of security towards theft of bike.

### 3.1.8 Financial Viability

- Financial viability is one big concern, but the way price for touch sensors in mobile phones or simcards have come down, paying a small premium for security from life threatening accidents should not be a matter of great concern.
- Government can reduce taxes on helmets and motorcycles having this feature.

## 3.2 Crime Control through Real-time video Surveillance with Smart Cameras

### 3.2.1 Background

Income inequality has given rise to sharp increase in crime rates and is a major concern for law makers and parents of school going children, corporate bodies in BPO industry where staff travels during nights and in general women safety in buses. Cameras installed inside vehicles are a deterrent but the stored video clips come handy for investigations post any crime. What if the cameras can be connected through wireless networks that can not only multicast real-time feed to be viewed by multiple stakeholders with personal safety interest but also send alarm to nearest police vehicle/station with location coordinates and other details. Thus raising the deterrence level manifold

### 3.2.2 Benefits

Online remote surveillance will provide real time feed to which security officer / parents / corporate bodies can subscribe and monitor the vehicle and kids' activities. Smart relay of vehicle condition would help in taking informed decision of whether to travel in the vehicle or for the owner to get servicing done.

- Improved vehicle monitoring
- Improved kids/traveler's safety
- Crime control by monitoring the inside activities of the bus
- These surely are the USP & differentiation for transport provider



**Fig. 9: Real Time Feed from Bus**

Source: Google Pics

### 3.2.3 Monetization Model

Service provider can monetize by selling the service to entities including schools, transport operator, parents etc. The revenue models can be of various type including fixed fee/ fixed and variable fee / monthly fee/ transaction based fee etc.

## 3.3 Pollution Free Air to Breathe In!

Monitor & notify air quality at pre-determined locations so that authorities can take measures to control, commuters can take informed decision on their planned visit, Alternate routes display for navigation.

### 3.3.1 Background

One of the greatest problems that the world is facing today is that of air pollution, increasing with every passing year and causing grave and irreparable damage to the earth. Leave aside other flora & fauna, people especially children are hugely affected by air pollution. It is thus important to curb air pollution and also important to avoid the regions with high amounts of nitrous oxides, carbon monoxides, Sulphur dioxides, lead, and biological pollutants.



**Fig. 10: Illustration of Pollution Free Zone**

### 3.3.2 Benefits

Informed decision to pollution control board would help them in understanding the exact nature of the pollution, reason for it and how to control and curb it. Parents can take informed decision for visiting a particular place or taking a particular route, to safeguard their children from deadly pollutants.

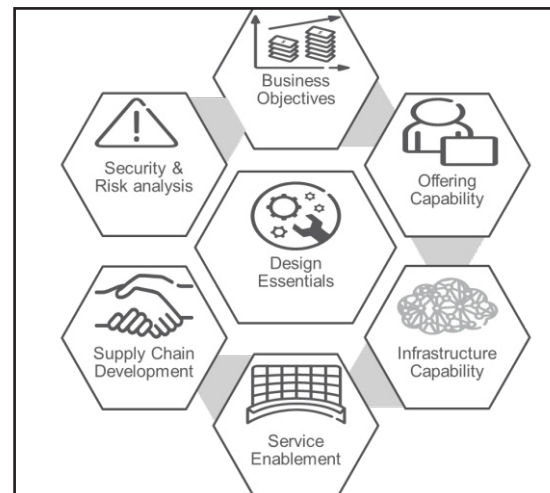
### 3.3.3 Monetization Model

Sensors installed across places and localities, factories, mills would generate data about the contents of the air

and send it across to the central body where the data can be processed and can generate real time reports for each area. Pollution control board, NGOs, general population can buy these reports or log on to websites where real time reports are published. A premium can be charged accordingly.

## 4. BUSINESS DESIGN ESSENTIALS

Ideas and use-cases are good only if they can be technologically implemented, manageable and scalable.



**Fig. 11: Ericsson Design Essentials**

This section discusses some of the fundamental design aspects that an organization would need to follow intending to capture one or more IoT opportunity:

- Outlines the strategy and policy to get into 1 or more IoT growth areas based on the Analysis of Local market and regulatory environment,
- Identifies target Business Segments and GTM offerings and works to develop the capability to offer those Products & Services
- Identifies and develops the Resource Infrastructure with appropriate capabilities required to create the products. This can range from creating the following:
- Cloud platform to offer services (offering scalability, multi-tenancy, etc.),
- Suitable communication infrastructure (Operators are showing keen interest in using Wi-Fi capabilities due to the higher data rates, no spectrum fee. However, other technologies might be more relevant example satellite communication for remote rural reach.





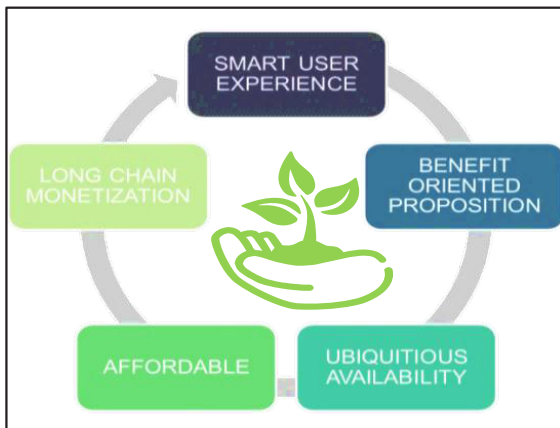
**Fig. 12: Guiding Principles**

Source: Ericsson IOT

- Identifies the Activation and provisioning of services to fulfill the market offerings
- Finalizes build-buy-partnership decisions and forges partnerships to create e2e supply chain
- Identifies the risks to the business and take actions to control the risks.

## 5. GUIDING PRINCIPLES FOR BUILDING AN IOT APPLICATION

- *Small Changes* can make a lot of impact provided they are delivered right and at the right time
- *Smart experience*: Only work if easy & intuitive to use



**Fig. 13: Guiding Principles**

Source: Ericsson IOT

- *Success Mantra*: Benefit and end usage focused propositions. Should help in solving real life difficulty
- *Long tail monetization*: Make it reach the mass market, the cost of solution & offering has to be affordable
- *Easily Available*: Smartphone App, Smart TV, Web interface etc. Application that gives whole gamut of services: Front end followed by tabs for each of the area ex tab for Home Energy usage

## 6. CONCLUSION: NEXT STEP

As discussed in this paper, 'Internet of Things' is at a stage where disparate networks and a multitude of sensors must come together and interoperate under a common set of standards. This effort will require businesses, governments, standards organizations, and academia to work together toward a common goal.

There are a few hurdles in the road to a 'Connected World' which have the potential to slow the development of IoT. The three biggest barriers are the deployment of IPv6, power for sensors, and agreement on standards. It is important to note that while barriers and challenges exist, they are not insurmountable. Given the benefits of IoT, these issues will get worked out. It is only a matter of time.

Next, for IoT to gain acceptance among the general populace, telecom operators, service providers and others must deliver applications that bring tangible value to peoples' lives.

In conclusion, IoT represents the next evolution of the Internet. IoT has the potential to change the world as we know it today - for the better. How quickly we get there is up to us.

## 7. BIBLIOGRAPHY

Source: Wikipedia, 2014

Sources: U.S. Census Bureau, 2010; Forrester Research Transforming Smart City ideas into Reality: Retrieved from Ericsson research paper presentation

<https://www.ericsson.com/spotlight/services/>

<https://iot-marketplace.ericsson.net/>

Realizing the connected world – how to choose the right IoT platform Retrieved from

[https://www.bosch-si.com/media/bosch\\_software\\_innovations/documents/white\\_paper/iots\\_1/20141007\\_](https://www.bosch-si.com/media/bosch_software_innovations/documents/white_paper/iots_1/20141007_)

bosch\_software\_innovations\_iot\_whitepaper\_technology\_final.pdf

Sources: Cisco IBSG: [http://www.cisco.com/web/about/ac79/docs/innov/IoT\\_IBSG\\_0411FINAL.pdf](http://www.cisco.com/web/about/ac79/docs/innov/IoT_IBSG_0411FINAL.pdf)

Developing Solutions for the IoT- Retrieved from Intel report- <http://www.intel.in/content/dam/www/public/us/en/documents/white-papers/developing-solutions-for-iot.pdf>

Source: "India Has Its Own Kind of Power Struggle," The Wall Street Journal, Jackie Range

Road safety data. Retrieved from <http://www.who.int/mediacentre/factsheets/fs358/en/>

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He is a thought leader with Go-Getter attitude and is backed with solid credentials from reputed institutes (MBA, Computer Engineering and Professional certifications)



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Hi consultative skills is backed with credentials from reputed institutes (MBA, Electronics Engineering and Professional certifications)

# Implicit Testing - An Improved Way of Testing Software

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## ABSTRACT

This Paper talks about implicit testing in software, Implicit is defined as, “Suggested though not directly expressed, Implied, indirectly suggested; unconditional, contained within.” Implicit testing has many dimensions however it is slightly ignored or can say untouched. This Paper is going to explore and get to know it in detail for better usability, get the maximum returns from the software to achieve better customer satisfaction. This paper will talk about the comparison between Maslow’s Hierarchy of Needs and Software needs to explain the correlation between human needs and software needs and different ways of conducting implicit testing; for example, Intuitive Testing, Exploratory, Accessibility, Heuristics, Hypothesis and Usability Testing. Life cycles of Software needs.

**Keywords:** Implicit needs, Implicit testing, Hierarchy of Needs

## 1. INTRODUCTION

In the software context, Implicit needs means needs or requirements which are not mentioned in any specification documentation such as BRD/SRD/HLD. Now, one will ask why one needs to test this “Implicit Need” when it is not mentioned in any specification documentation, absolutely correct!

We have been taught that “Software testing is a procedure of using a software system or application with the concentrating on discovering the software issues/problem or defects”, and defect is nothing but “Deviance from the requirement stated in the software system/Application functional requirement document”

So will a good tester always refer to specification documentation (like BRD/SRD/HLD/User Story) and skip testing implicit needs?

Or shall we stop referring to specification documentation?

One should keep using/referring to specification documentation. There is more to test apart from these Documents and that is called as “Implicit Needs of a

Customer”, if one skips testing it then one is not doing his/her job devotedly. We can say that one is not working on enhancing customer experience.

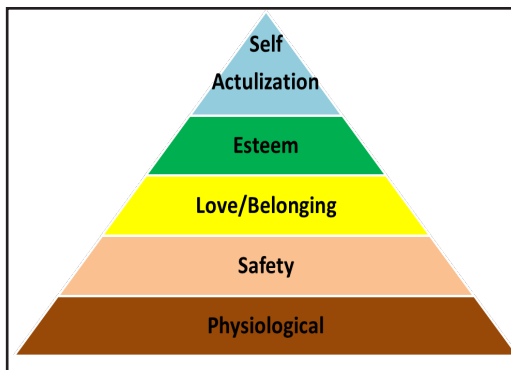
This technical Paper discusses the Hierarchy of Needs and different types to conduct implicit testing and life cycle of software needs.

## 2. COMPARING TWO NEEDS MODELS

Here, we discuss the Hierarchy of Needs, and compare Maslow’s Hierarchy of Needs Model [1] with a Software Needs Model. For a better understanding of the topic, this paper will do a high level study of Maslow’s Hierarchy of Needs.

**A. Concept of Maslow’s Hierarchy of Needs<sup>[1]</sup>** - Abraham Maslow created a model. He explained that elementary needs such as physiological and safety must be fulfilled before superior needs such as love, esteem or self-actualization. In this model, only when an elementary need is satisfied, can the next superior need start to be fulfilled. Maslow’s hierarchy of needs diagram follows:





**Fig. 1: Maslow's Hierarchy of Needs**

**Physiological Needs** are low level needs which are basics to endure life, such as:

- Air
- Water
- Food /Nourishment
- Sleep

As per Maslow's theory, if low level needs are not fulfilled then one will try to fulfil these needs first. Superior needs like social or esteem needs are not sought after until one has fulfilled the basic needs to one's living.

**Safety Needs** When physiological needs are fulfilled, then one will start thinking about safety and security.

These needs can be fulfilled by:

- House/ Home
- Medical facilities
- Job/ service
- Financial security

As per Maslow's theory, if safety needs are not fulfilled then one will try to fulfil these needs first. One will not think about superior needs.

**Social Needs** When one has fulfilled low level physiological and safety needs, only then will one start thinking about superior needs like social needs. Social needs are related to communicating with other people:

- Family
- Friends
- Love

**Esteem Needs** When one fulfils social needs, then one starts thinking about other superior needs, like esteem

needs. Esteem needs are categorized as internal or external. Examples of internal esteem needs are self-esteem and accomplishment. Examples of external esteem needs are social status and respect.

- Dignity
- Accomplishment
- Responsiveness
- Appreciation
- Status

**Self-actualization Need** is the top most need of Maslow's hierarchy of needs. It is related to one's development as a person. This need is never fully fulfilled; as there are constantly new prospects to grow.

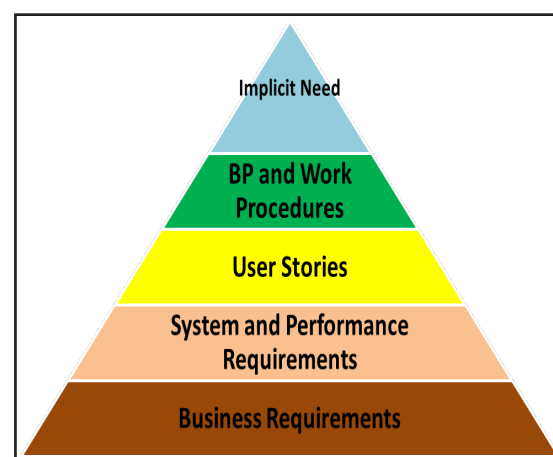
Self-actualization needs include:

- Reality
- Honesty/ Integrity
- Knowledge
- Significance

As per Maslow, only a small proportion of people reach the self-actualization level.

## B. Concept of Hierarchy of Software Needs

The Hierarchy of software needs is a model describing hierarchy of needs in the context of software. Project teams (Dev and QA teams) start working on specified needs, which are all documented, and once all needs are met, sometimes on different levels of documentation, then only can they think about higher level needs such as Implicit needs. The hierarchy of Software Needs is shown in the following diagram



**Fig. 2: Hierarchy of Software Needs**

**Business Requirement** Business requirements are nothing but foundation blocks for creating an application or System. A client creates BRs. BRs are provided to deliver value, products, systems, software, and processes to satisfy business requirements of clients. These Requirements are basic and needed to endure the project. Unless we have BRD, the project team cannot think about higher level needs/requirements document. This is a basic need to start with any project.

**System and Performance Requirements** are more detailed and descriptive requirements. They describe what is expected from an application or Software system to satisfy the client's needs. SRs are written as statements, opinions, and performance requirements; including levels of security, safety, dependability of the application or software system. This is the second most important need to start work on any project.

**User Story** are requirements from the view of end user, why and how the user is going to use any particular functionality. It describes the user's details, and their expectations from the application. A user story aids to produce a basic explanation of a requirement.

This is the third most important need to start work on any project.

**Business Processes** are a gathering of correlated, arranged events that produce a precise real life business scenario for the end user. Most of the time, a business process is presented as a flow chart. Methodology and tools to this layer are widely applied in Amdocs<sup>[4]</sup>.

**Work Procedures** are used to describe the Business Process in detail. This allows clear documentation of how a particular activity should be performed. This can be an optional document to start the project work.

**Implicit Needs** means needs or requirements which are not mentioned in any specification documentation, like BRD/SRD/HLD/US/DD. There is more to test, apart from these Documents and that is called, "Implicit Needs of a Customer". Once all the stated/specified needs are implemented step by step, the Project team should think about implicit needs. One should start thinking like an end user of the application to know implicit needs better. Implicit testing has a very wide horizon, which includes various types of testing.

Currently, the IT world has become very competitive and Customer Satisfaction is the key to success. As an IT professional, One should always think to pleasantly surprise a customer with delivering something extra

(obviously useful) to them. Software quality may defined as explicit as well as implicit requirements and expectations; however some people tend to accept quality as compliance to only explicit requirements and not implicit requirements. This trend needs to change, and the tester needs to give more attention to cover implicit needs of the customer for a higher level of customer satisfaction. For example, a Telecom domain has many new fields apart from Voice and Text. The testers need to explore the new fields and think about the implicit needs of a new world, like better usability, accessibility of the telecom application, such as customer web sites and portals to see usage, pay bill, generate reports, etc.

Digitalization is occurring very quickly in developed countries and it is a need of time to use websites or a portal for day to day work. In India, the Government is promoting Digitalization for a better e-Governance model. In this scenario, there is a huge scope of implicit needs understanding and testing for better usability and accessibility of web applications.

Amdocs always pays more attention to their customer's implicit needs by setting up innovation labs and creates different useful tools/utilities to enhance the customer experience.

Amdocs introduced the BEAT-Testing framework for improved testing processes and customer satisfaction.

This paper discusses the different types to conduct implicit testing, as below:

### 3. DIFFERENT TYPES TO CONDUCT IMPLICIT TESTING

In the previous section, the implicit needs were presented as the tip of the testing needs. Although it is a new approach, there are several existing testing methods that are adequate to conduct implicit testing, including:

- A. Intuitive testing
- B. Exploratory testing
- C. Accessibility testing
- D. Heuristic testing
- E. Hypothesis testing
- F. Usability testing

**A. Intuitive Testing** Intuitive can be defined as "obtained by using your feelings rather than by considering the facts", OR "able to understand something by using feelings rather than by considering the facts"<sup>[3]</sup>. Now

one must have started correlating the word “Intuitive” and “Testing”. Intuitive testing is also known as Error Guessing. This cannot be used as a primary testing technique, however one can find more issues and errors unnoticed by organized testing. Intuitive testing can be used to support and complete the choice of test cases through systematic testing methods. Intuitive testing can be most effective when you have all the needed skills, experience and knowledge in that Domain for which you are testing an application.

Knowledgeable and expert testers are inspired to consider the conditions in which the software may not be able to perform. Testing is a science and an art; few testers are naturally good at it and other testers have good experiences or they have worked with a specific application or domain for a long time, therefore they are able to find many defects/issues. For this reason an error predicting/guessing approach, used after more formal testing methods have been used to some extent, can be very effective. It is also time effective as knowledgeable and expert testers use assumptions and guessing to find out the defects which otherwise they may not be able to find.

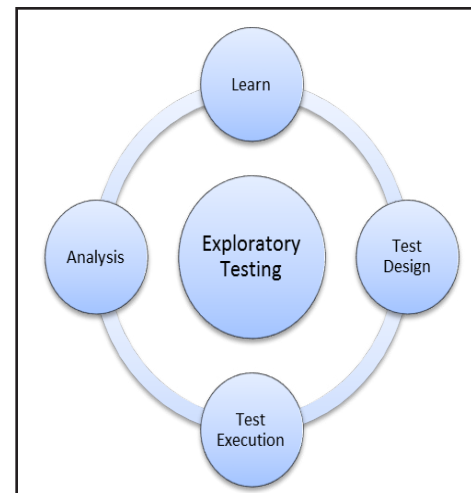
An expert tester will know which typical condition system may fail to perform or throw an exception, few conditions like division by 0, incorrect/blank input, blank files and the incorrect input data (these are special characters in input fields or alphabetical characters where digits are mandatory). They will always try to test a condition that is very unlikely to happen in the system/application.

The following factors can be used to guess the errors:

- Lessons learnt from past releases
- Historical learning
- Previous defects
- Production tickets
- Review checklist
- Application UI
- Previous test results
- Risk reports of the application
- Variety of data used for testing.

**B. Exploratory Testing** – Exploratory Testing is a testing method that permits to apply one’s capability and talent as a tester in an influential way. It is testing of software without any precise strategies nor timeframe. Dr. Cem Karner<sup>[7]</sup>, conceived the term exploratory testing. This is

a prescribed testing procedure where the tester does not need any test cases or test planning documents to start testing the system. The tester gets to know the functionality by exploring the system and by exploring and learning the system. Testers can design the test cases and at the same time execute it as well. Testers get to know the system first by exploring it, and based on this understanding, the tester can come up with the test cases/test planning and then start actual testing of the system. One can get better understanding from the below diagram



**Fig. 3: Exploratory Testing**

In exploratory testing, testers have to do the minutest effort for test design, however an extreme effort for execution to get to know the particular functionality of a system. This is helpful for the tester to decide what one can test next. This testing is a kind of on the job training; the tester learns the system behaviour during testing itself and creates a test plan or test cases. In this type of testing, testers have liberty in testing. The tester’s experience as well as skill will give the edge for finding more defects in a system/application.

Some tips for exploratory testing methods:

- Find out the scope of the project.
- Identify the requirements along with functionality of the software system/application.
- Check out the constraint of the software system/application.
- To validate stability of software system, tester should prepare test scenarios
- Comprehensive testing of the software as per the prepared test scenarios and identified requirements.

**C. Accessibility Testing** – day by day the web is becoming more important in everyone's lives; the web uses e-paper, social media, e-commerce, e-payments, Internet banking and many more. Therefore, the availability of information technology tools becomes important for everyone. Therefore, Accessibility testing is born.

Accessibility Testing can ensure that the system/application is usable by differently able people, like having impaired vision, having hearing problems, colour blindness, senior citizens and other differently able groups. One can also describe accessibility testing as type of systems testing intended to identify differently able individuals who can use the system, with ease. It can be software system or application, hardware, or some other type of system. Differently able people can have an extensive kind of physical difficulties, which can be learning or understanding issues, problems with vision, problem with hearing and difficulties in movement.

Section 508, an alteration to the United States Workforce Rehabilitation Act of 1973, is a federal law mandating that all electronic and information technology developed, procured, maintained, or used by the federal government be accessible to differently able people.<sup>[5]</sup>

Many Telecom Service providers have introduced accessibility testing to ensure that the differently able community has full access to modern telecommunications technology.

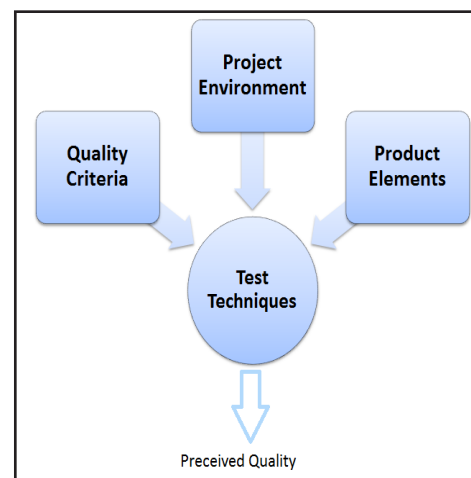
Differently able people use assistive technology.<sup>[6]</sup> It can help people in functioning/ using a software product in a better way. For example, products like:

- Speech Recognition Software – this software helps differently able people to convert the spoken word to text that can be given as input to the computer.
- Screen Reader Software – this is used to read out the written text which is displayed on the screen of the computer
- Screen Magnification Software - this is used to magnify/enlarge the monitor/screen to make reading easy for visually-impaired people.
- People having motor control difficulties or movement issues can use special keyboards for easy typing

**D. Heuristics Testing**-Heuristics testing includes testing of code components, algorithms and projects having testing strategies depend on historical data about possibilities. Heuristics testing mostly allows finding

where defects or issues can be found in the application by doing intellectual analysis.

Experts in the field can bring a closer focus on how one can do software testing to get better results of testing, therefore heuristics testing can also be called experience-based testing. Experts like developer and testers make decisions about how software testing can be performed to make the testing process more effective and result oriented. Please refer to the Heuristic model for better understanding. This model was designed by Mr James Bach.<sup>[2]</sup>



**Fig. 4: Heuristic Test Strategy Model**

**Heuristic Test Strategy Model** consists of components that can help in creating a better testing strategy. The ultimate use/purpose of this model is to make tester think about what is needed while creating test strategies. Also, it is proposed to be tailored and used to assist conversation and uninterrupted self-learning for expert testers.

**Project Environment** includes assets, limitations, restrictions, resources, team and other features in the project which may empower or restrict our testing. The tester should encounter restrictions or constraints, however sometimes the tester needs to agree to these restrictions or constraints. The tester's decision about constraints handling can depend on the situation and requirements.

**Product Elements** are software features that need to be tested. Software can be composite and indiscernible, so the tester needs to be very careful while creating a test strategy. The tester needs to plan to cover all easy as well as complex elements in a project.



**Quality Criteria** are the guidelines, standards, and procedures which can be used by the tester to identify issues in the product. Quality criteria can have many magnitudes and measurements.

**Test Techniques** are procedures for generating the tests. The test technique involves analysis of project environment, product elements, and quality criteria. This is a very important part of heuristic testing as results depend on the test technique used.

**Perceived Quality** is the outcome of testing. The tester can never know the “definite” quality of a software product, however one can do extensive range of tests for software product/application, to identify the well-versed evaluation of the software product quality.

**E. Hypothesis Testing-** is a statistical test which is used to identify whether there is sufficient confirmation in sample data to conclude that a particular circumstance/condition is factual for the complete population. A hypothesis test observes two contrasting hypotheses about a population: the null hypothesis and the alternative hypothesis. The null hypothesis is the declaration being tested. Typically the null hypothesis is a declaration of “no effect” or “no difference”. The alternative hypothesis is the declaration one wants to be able to determine is factual. From the sample data, the test concludes whether to discard the null hypothesis. One uses a p-value to conclude. If the p-value is less than or equal to the significant level (one can define the cut-off point) then one can discard the null hypothesis. For example, assume one want to conclude, if a coin is in good condition and proportionate. One flips the coin; it may result in half of the time Heads and other half of the time Tails. The alternative hypothesis can be the number of Heads and Tails will be very much dissimilar. Representatively, these hypotheses can be stated as

$H_0: P = 0.5$

$H_a: P \neq 0.5$

Assume one flipped the coin 100 times, resulting in 60 Heads and 40 Tails. Assuming this outcome, one may be prone to discard the null hypothesis. One would determine from these results that the coin was probably not in good condition and not proportionate.

**F. Usability testing-** Usability testing is used to identify up to what extent a desired software application can be understandable, how easy it is to learn, how easy it is to operate and is it user friendly.

The primary focus is on:

- User friendly –application should be easy to use
- Easy to learn – application should be easy to learn and user should get familiar to the system/application very easily.
- User satisfaction - user should be satisfied with the complete experience of using the application/system
- Result oriented - application should perform well and give the correct results to the end user.

The word “Usability” has various magnitudes. It is all about the user’s ‘experience’ during their interaction with an application and their ‘feeling’ towards it. A structured Usability Test translates this experience/feeling into a Validation Process. While doing usability testing, one should keep the following points in mind.

- **Easy to learn:** application/system should be easy to use for end users. The user should able to learn the application/system easily in the very first attempt.
- **Easy to memorize:** The user should able to remember and use functionality and navigations of the application/system even if the user does not use the application very frequently or has not used it after a long time.
- **Errors:** the application should have proper error handling and user friendly error messages. Even if the user makes an error, one should be able to recover from errors easily.
- **Contentment:** the user should like using the application/system. User experience should be satisfying.
- **Effectiveness:** the user should desire the performance and accuracy from application/system.

**G. Other ways to find out and test Implicit needs** –One should use different techniques to find out implicit needs, for example:

- Think like an End User
- Role Play
- Check User friendliness
- Check Error messages
- Use logical thinking/common sense
- Have futuristic view

- **Think like an End User** Start using an application forgetting that you are a software professional, try to do common mistakes while data entry, clicking on buttons, wrong navigation.
- **Role Play** –if an application has different types of users, then role play is the best way to validate implicit needs. One can act as if they are an end user with a particular role and start using the application. One may get authorization or role based access issues.
- **Check User friendliness** – Validate if application is user friendly. This means it should be easy to use. One can test Navigation, screen layout, font, colour. Please refer to the Usability testing mentioned above.
- **Check Error messages**- Validate all Error messages; they should be understandable to the end user. Each should not be similar to, “Technical Error”, “Error 404”, etc. Error messages should be in simple English and easy to understand.
- **Use logical thinking/common sense**- This is the most difficult part of implicit testing. As everyone knows “Common sense is very uncommon”. Try to use common sense and past experience to locate issues in the application. Please refer to the Intuitive Testing and Exploratory Testing mentioned above.

## 5. LIFE CYCLE OF SOFTWARE NEEDS

What is the Life Cycle of Needs – if one can see the pattern in Needs, one will know that all the implicit needs in early 90’s are becoming stated or specified needs. So one can say that at some point implicit needs become stated needs and a new set of implicit needs will be generated. Can we say it is as a Life Cycle of Needs? “Yes”, why not! The below diagram will explain it better

An example for a cycle of software needs can be seen in the development of usability testing.

This was never a stated need in the early 90’s. It was understood by the vendor and implemented in some projects, in production the end user liked this experience and the end user gave positive feedback to the client. This way the client was also happy, and for future projects, clients will like to have such functionalities. They start mentioning it in their business requirements documents. This is the life cycle of any implicit need.

After a certain time, all implicit needs become stated needs and a new set of implicit needs is generated.

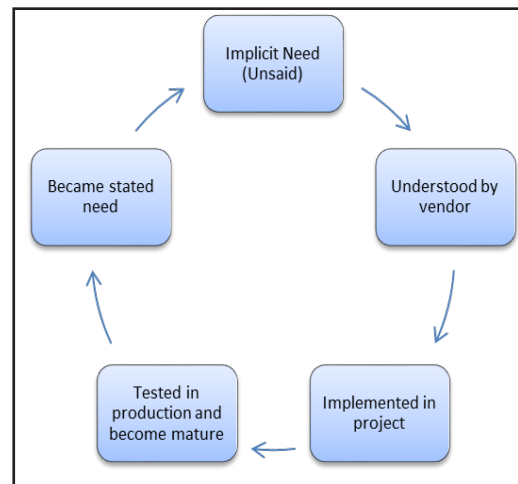


Fig. 5: Life Cycle of Software Needs

One can say that implicit needs are never ending; new sets of implicit needs will be generated as technology evolves.

## 6. SUMMARY AND CONCLUSION

This technical paper explained about implicit software needs as the top level of software requirements, similar to Maslow’s psychology hierarchy of Needs. One cannot avoid implicit needs identification and the testing of it to give a better customer experience. One should always think about implicit needs of the customer and try to fulfil them for a better customer experience.

There are many benefits for testing implicit software needs, including the following:

- Impressing the customer
- Less production defects
- Goodwill building for customer to end user
- Positive marketing for our brand
- Birth of new stated requirements/needs

Although implicit needs is a new concept, there is a large variety of testing methods to target implicit needs.

This paper explained that Implicit needs gives birth to new explicit needs in the software Life cycle, which creates more business for the vendor and a better customer

experience for end users and customers. Implicit needs and its testing is unavoidable and a very important part of today's software world.

Although there are advantages of testing implicit needs, there are also disadvantages in Testing Implicit needs; some are listed here:

- Extension of budget
- No Budget to fulfil customer's Implicit needs
- Misalignment between development and Testing teams
- Misunderstanding of implicit needs
- Limited or no enough time for testing.

## 7. ACKNOWLEDGMENT

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## REFERENCES

- Maslow, A. H. (1943). Maslow's hierarchy of needs. Originally Published in *Psychological Review*, 50, 370-396.
- James Bech (1996- 2015). Heuristic Test Strategy Model James Bach's Blog-, Satisfice, Inc. Version 5.2.2 Date 5/20/2015 Retrieved from <http://www.satisfice.com/>, <http://www.satisfice.com/tools/htsm.pdf>
- Intuitive -definition –An oxford dictionary
- Shama, G., & Szyk, I. (2015). Business oriented testing in the telecommunications Industry. *Test magazine*, p. 26. Retrieved from <http://issuu.com/31media/docs/>

test\_magazine\_september2015\_web

Section 508 – reference taken from <http://www.section508.gov/content/learn/laws-and-policies>

Assistive technology reference taken from <https://www.microsoft.com/enable/at/types.aspx>

Dr. Cem Kaner, J.D., Ph.D. reference taken from <http://www.kaner.com/pdfs/QAIEExploring.pdf>

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# Decoding DA-Vinci Code: TMMI Assessment Model Revisited

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## ABSTRACT

The majority of IT organizations face considerable challenges in tailoring their test process frameworks, since not every process applies to all types of testing projects in any one test organization. Regardless of whether an organization's testing process is CMM<sup>1</sup> compliant, CMMI<sup>2</sup> compliant, ISO 9001: 2008 Quality Management System compliant, or just internally compliant, a single process framework of an organization cannot be applicable for all types of project. After all, some projects are straightforward and have relatively short gestation periods, while others are huge transformation projects that include a high level of uncertainty and painstaking complexity.

Within this landscape where project composition, type, and nature are varied and diverse there is a need to define the context of each project. As test process leaders, Test Managers need to drive the definition of project context and implement processes that can be signed off as early as project kick-off and implemented diligently.

**Keywords:** Complexity, Uncertainty, TAM (Test Assessment Model) Testing, Multi Criteria Decision Making, Sheep Dogs, Cows, Bulls, Colt, TMMI

## 1. INTRODUCTION

In the TMMI Assessment Model, project complexity and uncertainty is the key problem to which the appropriate usage of processes can help provide a solution. Various dimensions and perspectives have been created to understand this.

This paper proposes a context-driven testing approach for ANY ORGANIZATION Testing projects. ANY ORGANIZATION Testing projects are profiled under four categories based on the testing types, and each of the project types is plotted under four quadrants based on project complexity and uncertainty. The model is based on the premise that the value of any practice depends on its context. This school of testing purports that there are good practices in context but there are no best practices. People working together are the most important part of such a project's context. Technically, this school maintains that the product is a solution and if the problem isn't solved, the product does not work. Each of the testing models does not address the project challenges

faced. The essence of the proposed TMMI Assessment Model is to do the best we can with what we get. Context actually means we improve effectiveness and reliability through situational specific strategies, processes and practices. This model proposes to manage uncertainty (market, technical, customers, duration, and change) and complexity (team size, team location, maturity, domain gaps, and dependencies). Context-driven testers start with requirements of stakeholders and are keen to understand projects' complexity, uncertainty, and constraints and are not context oblivious. Context-oblivious testers do not match the testing practices with testing problems. They do exploratory testing. Context-imperial testers<sup>3</sup> (that is to say, testers who consider context as king) insist on changing the project or business in order to fit the testers' own best practice or models. The context-driven testing school described in this paper is an approach and not a technique. The TMMI Assessment Model proposes and maps testing types of ANY ORGANIZATION Testing into four quadrants. The four quadrants are mapped based on project complexity and uncertainty.

<sup>1</sup> Weber

<sup>2</sup> S Shrum

<sup>2</sup> J Bach

Uncertainty		Complexity	
Attribute	Score	Attribute	Score
Market	■	Team Size	■■■■
Technical	■	Mission Critical	■■■■
# Customers	■■■■	Team Location	■■■■
Duration	■■■■	Team Maturity	■
Change	■	Domain Gaps	■
		Dependencies	■■■■
<b>Opportunities to Reduce Uncertainty:</b> <ul style="list-style-type: none"> <li>Use proven technologies</li> <li>Reduce project duration</li> </ul>		<b>Opportunities to Reduce Complexity:</b> <ul style="list-style-type: none"> <li>Collocate the team</li> <li>Break project into sub-projects</li> </ul>	

**Fig. 1. Uncertainty and Complexity Factors and Example of Scoring**

### A. Sheep Dogs

Relatively mature products of ANY ORGANIZATION should be tested in this quadrant where developers and testers are domain experts in ANY ORGANIZATION products. Project complexity and uncertainty are low, iterations are fewer, teams are collocated, and TAM Testing for Sheep Dogs entails clean and clear regression suite (automated). TMMI Assessment proposes test strategies for offloading and outsourcing. The guidance of the TMMI Assessment model is to perform multi-level regression testing and automated smoke testing of all key processes in the Software Testing Lifecycle and all major process areas of ANY ORGANIZATION standard methodology and tools.

### B. Colts

This quadrant signifies new product releases, weekly iterations, collocated teams, and very active product owners and projects of this type have high uncertainty and low project complexity. ANY ORGANIZATION B2B and Agile projects fall under this quadrant. TMMI Assessment proposes Ad-hoc testing, lightweight processes, and the creation of change components. The guidance of the TMMI Assessment model for these projects relates to discovering the context and inventing the processes to perform TAM Testing. ANY ORGANIZATION e-Business Digital Experience projects belong to this category and not all process areas of ANY ORGANIZATION Testing can be followed here. Agile projects with Test First Approach and Test Driven Development (TDD) will be applicable

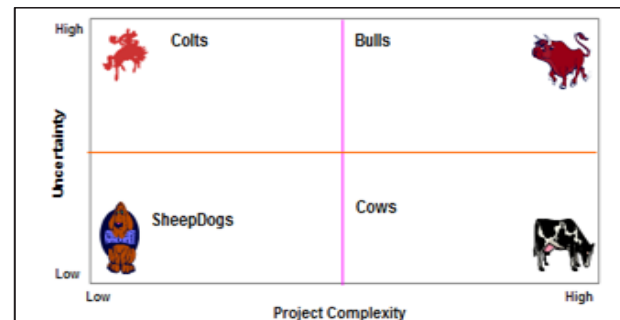
for this quadrant.

### C. Bulls

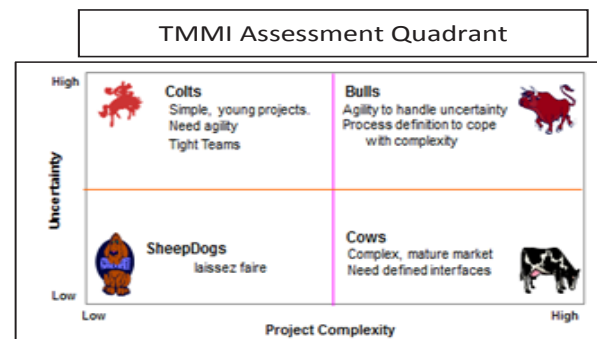
This quadrant signifies complete releases (E2E) with paired project management and frequent integration. ANY ORGANIZATION E2E projects are examples of this quadrant. The TMMI Assessment model proposes to use tight cohesion as project uncertainty and project complexity are very high. This model proposes a high degree of process management for these types of projects with adequate gates, reviews and control.

### D. Cows

This quadrant signifies high project complexity and low uncertainty. Testing where backend changes and a high level of interface management has to be done can be mapped to this quadrant. ANY ORGANIZATION Transformation projects fit into this category. The customers are dominant here and teams are distributed with a high amount of interface management and inter-project management. The TMMI Assessment model proposes frequent checkpoints for such projects.



**Fig. 2. Complexity – Uncertainty Grid**



**Fig. 3. Quadrant of Uncertainty –Complexity Grid**

An attempt has been made as part of this research paper to explore different kinds of companies and projects and tailor

and customize TMMI based on ANY ORGANIZATION process framework for TAM (TMMI Assessment Model). The 16 process areas of TMMI have been tailored and classified into each of the project quadrants as below.





TMMI Assessment Quadrant	
 <b>Colts</b>  Test Design, Test Execution, Peer review	 <b>Bulls</b>  Test Policy strategy, Test planning, Test Design, test Execution, TLCI, PR, AR, DP
Test Design, Test Execution   <b>Sheep Dogs</b>	Test Design, Configuration Management, Quality Control, Test Environment  <b>Cows</b> 

Fig. 4. TMMI mapping of Context Leadership Model

## 2. PROCESS TAILORING USING TMMI ASSESSMENT MODEL

This model includes:

### 2.1 Colt

Due to less complexity and high uncertainty, studies say that the uncertainty is manageable. Hence the focus is on Test Planning to define and / or redefine execution path. Peer Review is also considered to manage uncertainty. Defect Prediction is also considered to provide guidelines on expected defects. Test Monitoring and Control, Test Design and Execution are also considered for Colt-based projects. Here the focus is on MVQ (Minimum Viable Quality) rather than the possible quality or testing that can be done, since time constraints mar the usage of heavy processes here.

### 2.2 Bulls

This relates to projects of both high complexity and high uncertainty. To manage such projects Test Policy

and Strategy is needed more for the purpose of setting stakeholders' expectations. Test Planning, is also considered to manage both uncertainty and complexity. TDE (Test Design and Execution) and TMC (Test Monitoring & Control) are used to manage the project execution.

Peer Review and Advanced Peer Review are used as additional tools to manage uncertainty. Defect Prediction is also used to provide guidelines on expected defects

Test Environment is used to manage environments for test execution, Test Organization helps define the roles at different levels, and Test Lifecycle and Integration help manage the complexity of projects.

### 2.3 Sheep Dogs

These types of projects will have all key processes like TPS(Test Policy Strategy), TMC(Test Monitoring and Control), Defect Prevention, and Peer Reviews. A high degree of process optimization can be done for Sheep Dog type projects where mature products and rolling releases of ANY ORGANIZATION are tested.

### 2.4 Cows

These types of projects are applicable for transformation type projects in ANY ORGANIZATION that require huge interface management and are too complex but certainty is low. One can apply TPS, TMC, TLI (Test Lifecycle Integration), PR(Peer Review) and DP(Defect Prevention) for these types of projects.

## 3. USAGE OF TMMI ASSESSMENT MODEL FOR ANY ORGANIZATION TESTING PROJECTS

Each of the testing projects in ANY ORGANIZATION Testing will be classified into one of the four quadrants using the criteria of Project Complexity and Project Uncertainty. The entire project list (Group View) will be plotted into each of the four quadrants. Process sets will be created for Sheep Dogs, Colts, Bulls and Cows. During Kick Off, all the factors of the project - namely market, technical prowess, customer base, duration of project, change management, team size, criticality, team location, team maturity (experience/learning curve), domain gaps, and third-party dependencies - will be listed as variables.

TAM (TMMI Assessment Model) strategies will be applied to each of the project types. Each project type, based on the quadrant it belongs to, will have its own testing objective, which will alleviate uncertainty and reduce project complexity.

Processes listed for each of the quadrants will be followed right from Kick Off.

#### 4. VALIDATION OF TMMI ASSESSMENT MODEL

At the project Exit meeting, the usage of processes and their benefits will be assessed and a project quality score will be computed to take into account the uncertainty and complexity factors using variables and their weightages. This model will be suited to organizations like ANY ORGANIZATION and other organizations that have their own internal process frameworks. It provides guidance to process practitioners to pick and choose the right quadrant based on their project category. Agile projects at ANY ORGANIZATION Testing can use the processes listed for the Colt quadrant. Similarly, other types of project like E2E, Transformation, B2B or S2S, or any nine functional streams of ANY ORGANIZATION Testing can use this model.

#### 5. CONCLUSION

There is no need to kill a fly with a sledgehammer. The idea behind this paper is to bring about a customized and tailored view that is more relevant to the individual context of a project before we begin testing. TAM Testing and leadership models are becoming popular in organizations who have developed not only lightweight processes but also have used the concepts of project complexity and uncertainty as major drivers to determine the best process set that can be adopted and adapted for a specific context.

This paper highlights the need for bringing about a calibrated approach as we see in the four quadrants of the model. There is no such thing as a single best practice; practices that work for the organization and which are in alignment with their business goals will prove to be the best fit process set for companies to leverage in the coming years.

#### ACKNOWLEDGMENT

I acknowledge the vast experience of all the stakeholders whom I have worked with in helping me to arrive at this

model. The model is the result of my sincere and honest conversations with people who I have worked with and who have indicated a strong opinion on how they feel about processes that are heavy, complex, and serve no purpose other than satisfying the auditor and his narrow compliance criteria.

#### REFERENCES

- Bach, J. (2004). *Exploratory testing*, in: E. van Veenendaal, *The testing practitioner* (2<sup>nd</sup> Ed.). UTN Publishing.
- Paulk, M., Weber, C., Curtis, B., & Chrissis, M. B. (1995). *The capability maturity model, guidelines for improving the software process*, Addison –Wesley.
- Chrissis, M. B., Konrad, M., & Shrum, S. (2007). *CMMI Second edition, Guidelines for process integration and product improvement*, Addison Wesley.
- [ISO9001:2008] Quality Management Systems- Fundamentals and Vocabulary, International Organization for Standardization.
- CDTL(Context Driven Test Leadership Model) - Dr. Shankar Ramamoorthy, International Conference on Emerging Trends in Software Testing UNICOM 2014.
- Ramamoorthy, S. (2015). Agile Test Leadership Model – International Conference QAI –STCQAI.

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# Telecom – OTT Partnership – Generating New Revenue Sharing Models

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## ABSTRACT

This paper propounds revenue sharing models for mobile operators and over the top (OTT) players in an attempt to seek a solution to the complex challenge of falling voice average revenue per user (ARPU) rates for the operators due to emergence of OTT services and the need for monetization of services by OTT players. The paper to quantify this opportunity, and highlights three partnership models as a suggestive measure to revitalize the revenue growth for both operators and OTT players 1) Service-Bundling 2) Sponsored-Data 3) Collaboration-Platform-Model

Primary data was collected by means of online survey on 250 respondents in the age group of 16-25 in the city of Pune. Use case examples and secondary data was also referred to for the purpose of this study.

The paper specifically highlights why OTT players should partner and how the partnership will help both Telecom and OTT operators to augment their revenue potential.

**Keywords:** Revenue Sharing Models, Telecom- OTT- Partnership, Sponsored-Data, Service Bundle, API

## 1. INTRODUCTION

### 1.1 The Growing Smartphone Market : Global and Indian Figures

Telecommunications has evolved very rapidly making it a necessity of our day to day life. And the one thing that lies in the centre of all is the “smartphone”. Mobile devices are increasingly becoming the first go-to device for communications and content consumption. (Gartner, Inc., 2014)

Globally, there were 1.43 billion smartphone users in 2013 and was predicted to increase to 1.75 billion users in 2014 (an increase of 22.5%). The number of global smartphone users reached 2 billion in 2014 (Strategy Analytics’ WSS research, 2014). By the end of 2015, the company predicts the number of users will have grown to 2.5 billion.

Indian smartphones market is expected to further consolidate its position, before emerging as the world’s

second biggest market in 2016. India will exceed 200 million smartphone users, topping the US as the world’s second largest smartphone market by 2016 (marketer, 2014). Over 44 million smartphones were sold in 2013. Compared to this, handset makers sold over 59.3 million handsets in the January-September 2014 period.(IDC report year, 2014).

### 1.2 Rise of Data: Global and Indian Stats

The upsurge of smartphones has affected two sectors in particular in the telecom ecosystem: The operators (data providers) and Apps/OTT players (data consumers)

Global mobile data traffic grew 69 percent in 2014. It reached 2.5 exabytes per month at the end of 2014, up from 1.5 exabytes per month at the end of 2013. In 2014, the typical smartphone generated data traffic of 819 megabytes per month, globally. The reports predict that monthly global mobile data traffic will surpass 24.3 exabytes by 2019. (CISCO global mobile data traffic forecast report (2015)

Specific to Indian subcontinent, the mobile data traffic generated by 2G and 3G services has risen by 74 percent during the course of 2014 (Mbit Index study, 2014). According to the study, 3G data traffic increased by 146%, surpassing the world average. The amount of mobile data consumed in India grew from 49 petabyte at the end of 2013 to 85 petabyte by end of 2014, out of which 52 percent came from 3G usage. Indian operators have focused on expanding the 3G services in the last 2 years. Today there are about 80,000 mobile towers that transmit 3G signals, accounting for 30-40 percent of coverage in the country. It has led to three times increase in the average data consumption by a 3G subscriber in India. 3G consumers, consume 688 MB of 3G data on an average every month, an increase of 29% during the year. The industry not only aims to achieve 70-80 percent 3G coverage but also it is pitching for the 4G services quite aggressively. The reports on the same are yet to come but it is worth a mention that the gadget freaks in the country already have purchased 5.5 million devices capable of supporting 4G networks.

### 1.3 Rise of OTT Services and Apps

The other sector that we argued earlier that has seen a consequential change is the App/OTT service industry. Over-the-top content (OTT) has emerged as a dominating determinant in the foundation of new age telecommunication ecosystem. It refers to delivery of audio, video and other media over the Internet without the involvement of a multiple-system operator in the control or distribution of the content. The popularity of smartphone apps is growing constantly. Starting with just over 2.5 million downloads in 2009, in 2014 the app store boasts over 138 million downloads. The estimated number of app downloads for the upcoming year is enormous, reaching 268 million for 2017. The data from on mobile media time (Nielsen, 2014) reveals the consumer preference for mobile apps which account for 89% of media time in mobile is from the use of the most popular social network, email and OTT service apps. More than the definition its orientation as the channelizing factor is monumental. Globally, smartphone-based OTT users will total to 2.89 billion by 2018, an increase of 130% over the forecast period with 1.26 billion by the end of 2014. (Mobile squared forecast 2014)

India in particular will have 56.8 million smartphone-based OTT users by the end of 2014 and 216.9 million by 2018, when it will be the third largest smartphone-based OTT market, behind China and the US and ahead of

Brazil (185.6 million smartphone-based OTT users) and Germany (97 million). (Asianfo, 2014)

## 2. LITERATURE REVIEW

The research supports a necessary change in the approach operators have towards OTT partnerships. If telecom operators are to develop a successful strategic response from OTT competitors then they will have to first analyse their assets and capabilities. According to our research operators and OTT players should work on more strategic partnerships and work symbiotically.

### 2.1 Challenges Faced by Operators and OTT Players

The telecommunications marketplace is changing rapidly and both operators as well as the OTT players have their own set of challenges. We now highlight the challenges faced by these players in this fast changing scenario.

*From Operators point of view*

- *Rise of OTT players:* Over the last 2 years there has been an exponential growth of OTT communications. WhatsApp is leading the field by adding 8, 00,000 new users per day. It is expected to join the Billionaire's club by 2016. At present WhatsApp is leading with 660 million users followed by Line with 510 million users, WeChat with 440 million users and Snapchat with 100 million users (Mobile squared, 2014).
- *Data a priority:* Customers want to access data more than they do voice. Operators are expected to provide superior service by providing additional bandwidth. According to a report (GSMA, 2014) 75% of data traffic is video and browsing. So to deal with this operator needs to expand their data carrying capacity so that superior service can be provided.
- *Decreasing Revenue:* Despite high investment levels and the strong growth in data traffic, revenue growth has been slowing for operators across the globe due to fierce competition, decline in voice ARPU and regulatory tariffs. Growth over the last five years has been at a still healthy rate of over 5% per annum, though this is under half the rate in the preceding six years from the year 2002 (GSMA, 2014). In 2014 the reduction in revenue was be-

tween 16% and 20% for 5% of respondents. More mobile operators (33% of total respondents) are now being impacted by up to a 10% revenue decline, up from 21% of mobile operators in 2013, which does confirm the impact of OTT communications on mobile operators is becoming more far-reaching. Concern (Mobile squared, 2014).

- *Costs:* Mobile operators have invested more than US\$ 1 trillion over the last six years across the globe. Investment has been done to improve network coverage, to increase network capacity to deal with both the growth in connections and the even greater growth in data traffic, and to deploy higher speed mobile broadband networks (GSMA, 2014).

From OTT point of view

- *Quality of Services:* Poor speech quality and dropped calls disappoint paying subscribers who are used to high quality of service in circuit switched telephony. The unstable bandwidth associated with OTT can cause unwanted buffering, long start-up times and video/audio stuttering and poor video quality on full screen view.
- *Need for Monetization:* The greatest challenge OTT providers face will be monetization of their service. Most players, including Skype, have yet to substantially monetize their large user base, as conversion rates to paying users have to date been very low. In response, OTT players have applied a variety of revenue models, from ad-based, pre- and post-paid to freemium and customized.

## 2.2 Why should OTT and Operators Agree for Revenue Sharing?

There is a need of synergism to survive and retain value both for operator and OTT players.

**Cost Pressure:** Telecom operators want to charge bandwidth hogging. This poses cost pressure on OTT. For video two major cost pressures are bandwidth consumption and content rights. To reduce operational costs some OTT players may cut bandwidth costs by compromising on video quality. The result of this is low customer satisfaction and increase in churn which directly hurts the revenue.

**Better service quality:** Facing the same cost pressure, telecom operators and OTT content providers can partner to deliver quality services at lower bandwidth costs. The Open Connect model adopted between Netflix and operators is one such success. Netflix moves its content delivery network (CDN) edge servers into operator data centres (DCs) to speed up content delivery.

**Revenue:** The global mobile operator opportunity for OTT communication will increase to \$42.9 billion in 2018 from \$4.2 billion in revenues in 2014 while OTT will leap to \$30 billion in 2018 from \$4.2 billion in 2014 by this partnership. This will be a win-win partnership for both operators as well as the OTT players.(Mobile squared, 2014)

**Service Innovation:** Besides cost reduction and revenue generation telecom operators and OTT can collaborate for service innovation. Operators have a large subscriber base with subscribers paying monthly bills. Content providers can strengthen market position by leveraging the operator billing channel and distribution channel, and operators can earn more through innovative broadband services. China Unicom Tianjin (Tianjin Unicom) and Galaxy Internet Television illustrate this perfectly.

Telecom operators should collaborate with OTTs to enhance user experience, reduce operation costs, and even increase profits because OTT content plays an important role to drive traffic. Both Operators and OTT players should have a collaborative partnership to bolster of sustainable growth.

## 3. OBJECTIVE OF THE RESEARCH

The paper attempts to see the above challenges as a genesis of new opportunities for both operators and OTT players to converge and integrate with the purpose of increasing their revenues. We believe that operators and the OTT players need to capitalize in a co-existential fashion to grow together in terms of revenue generation. Concentrating on this approach, the objective of this paper is to discuss three partnership models as a suggestive measure to revitalize the revenue growth for both operators and OTT players: 1) Service bundling 2) Sponsored data 3) API resource sharing

These solutions will help operators and OTT players to collaborate more effectively, ensuring that operators will see increase in their ARPU rates and subscriber base by attracting and retaining customers through OTT services while OTT players will see reduction in the complexities by opening up to the operator's IT systems to provide



faster and quality services. Together the operators and OTT players will be able to operate more flexibly creating better and differentiated content while contextualizing on increased revenues from the users.

#### 4. RESEARCH METHODOLOGY

For the progress of the paper and devising revenue sharing models for operators and OTT players we collected quantitative primary data by means of online survey. Responses of 250 respondents in the age group of 16-25 were recorded in the city Pune. The purpose of the primary data was to record the usage patterns of data services, quantifying it on monthly basis. Then to analyse the exact wants and needs of the consumers. And finally to construct revenue sharing models that could fulfil the needs for OTT players and operators describing customer as one of the prime elements. Furthermore, we have used case examples and secondary data for the purpose of our study. We have also made use of qualitative data to study current and emerging market trends to support our arguments.

#### 5. TAKING THE NEXT STEP: MODELLING FOR REVENUE SHARING

The following section explains the three revenue sharing models for operators and OTT players namely 5.1) Service Bundling 5.2) Sponsored Data 5.3) Collaboration Platform Model. The models have been explained by providing a descriptive background which includes requisite definitions. Cases have been used where necessary. Primary data has been examined in support of establishing the arguments.

##### 5.1 Service Bundling

###### 5.1.1 The Concept

In this model we refer to bundling as a “mash-up” of similar purpose app or OTT services. In a service bundling partnership model we see collaboration arrangements of operators and OTT players where OTT players provide rich content for their services and operators create provisions of specific data and its quality delivery, to be used for similar services of different OTT players grouped together in a distinguished bundle

###### 5.1.2 The Essence of Bundling

Bundling - the strategy of marketing two or more products or services as a specially priced package (Venkatesh &

Mahajan, 2009, p. 232). It is persuading the customers to buy all the goods and services in a package rather than on one item. What is worth realizing is that the bundled proportions help all the goods or services in a bundle to generate adequate revenues.

Table 1:

Advantages of service bundling		
OPERATORS	OTT PLAYERS	CONSUMERS
Decrease in data ARPU sensitivity	Focused target on commercial aspects	Convenience
Extraction of more consumer surplus at equal sales level of data	Improved functionality perception of product when bundled with existing compliments	Benefits of incentives and better offers at reduced rates
Consumer convergence	Increase visibility and trial of new product	Reduction of transaction cost
Cost reduction	Enhanced knowledge on consumer behaviour	Enhanced choice making
Fully exploit willingness to pay	Competitive advantages	Increased customer satisfaction and loyalty
↓	↓	↓
Increase in revenue and profits	Commercial actualization	Value proposition

The strategy has been widely used in industries ranging from fast foods to high-technology (Chung & Rao, 2003, pp. 115-130). Authors like Smith, Armstrong and Kotler have argued upon the decisive nature of the price of the bundle. Price bundling means combining several products and offering the bundle at a reduced price. The price of the bundle should be lower than the sum price of the independently priced products to encourage different customers with different independent product valuations to purchase all products in a single bundle. At the same time this price should be higher than the price of any specific product within the bundle (Smith, 2012, p. 216). Price bundling can promote the sales of products, consumers might not otherwise buy, only when the combined price is low enough it can convince them to buy the bundle (Armstrong & Kotler, 2011). In the context of our model specific to OTT players and operators we define the price in terms of data usage charges. This gives us the advantage to evaluate the benefits reaped by the operators, OTT players and customers given in table 1

It is here we would like to highlight the importance of size of a bundle. On one hand, Smith claims that the larger the number of goods in a bundle, the greater the reduction in disparity in willingness to pay (Smith, 2012, p. 216). But on the other hand, we would like to argue

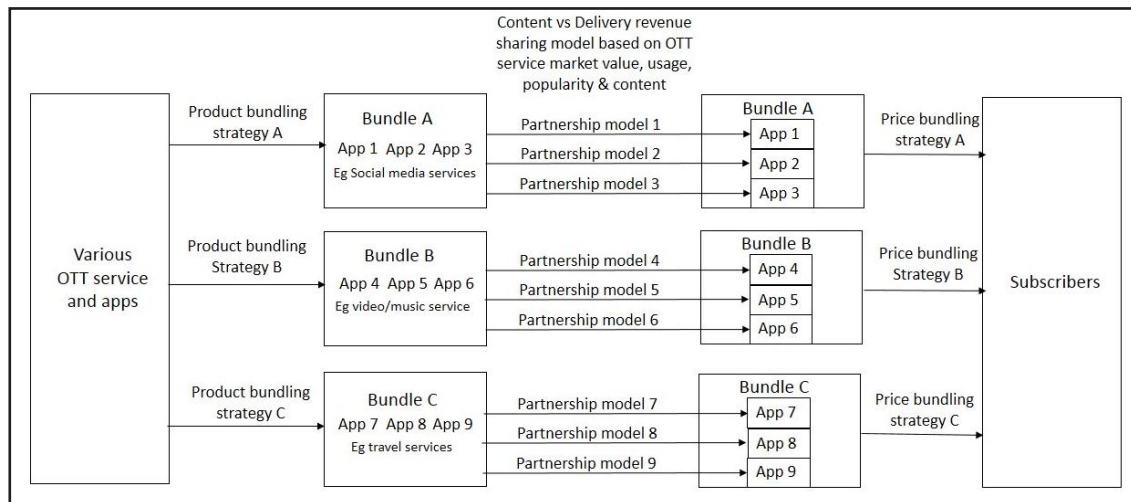
that increase in constituents of a bundle, increases anxiety and fear thus decreasing the popularity of a bundle. Thus it is important for the operators to adopt optimal product bundling strategy defined as offering several products for sale as one combined product (Wikipedia), based on the type of the service offered, in the creation of a “mash-up” service bundle.

### 5.1.3 Essence of Model

Based on the explanations and importance of price bundling and product bundling and the need for revenue generation we establish the service bundling model as a three stage process.

*First stage* of the model suggests a partnership between various OTT players offering similar services and an

operator to create an exclusive bundle of homogeneous services using a product bundling strategy. Collaboration arrangements may include mash up of music/video providers, social media services, educational services, travel services etc. The bundle would be perceived as ‘unique’ for the consumers based on their taste and choice. This becomes beneficial for the OTT players to have a focused approach on consumers and create competitive differentiated tactic. For the new OTT players in the market it gives a chance to piggybank on the established OTT players and have their presence known thus enjoying faster “time to market” and visibility. For the operators it helps them to generate increased revenue on the popularity of the OTT services by exploiting the consumer’s willingness to pay for the usage of their favorite apps.



**Fig. 1: Framework of Service Bundling Model**

*Second stage* of the model suggests the partnership based on revenue sharing by OTT players and operators from the offered bundle. In smartphone ecosystem the providers of content and applications contribute value to services, but rely on the network operators to charge the enduser (Jonason, 2002). The content providers bring the richness while the operators bring the reach (Jonason & Eliasson 2001). Hence, operators should generate revenue on its delivering capabilities by providing technical and data environment for the use of OTT services or bundles and OTT players should generate revenue on the usage of their services. As an example, an operator can charge the subscriber a monthly payment of video service bundle. For a particular video service provider in a bundle an operator can bill 40% of the price per packet for providing seamless streaming for the provider’s video while pay the remaining 60% to the

content provider. (Example constructed for the purpose of explanation). Such proportionate share of revenue could be engineered during partnership deals based upon market share of the OTT players, richness and exclusivity of the player’s content, popularity of the service etc.

*According to the model the revenue sharing could be done through the following*

- Usage based charging, in which OTT players can generate revenue according to quality and quantity of content delivered. The measuring metrics could be devised during partnership deals
- Fixed price charging, that does not change according to the usage. Operators can generate revenue by bundle offerings at fixed rate to the subscribers and charge fixed rate to OTT players for its presence in the bundle

The advantage of this approach is two-fold. For operators it provides an opportunity to earn from their content. Paid OTT services which charge on monthly basis can use operator's real-time charging capabilities to offer day passes may attract to pre-paid consumers. The operator might also monetize on its subscriber intelligence to help OTT service providers create context-aware marketing offers and also promote themselves in a better and effective way to increase their target market and subscriber base.

*Third stage* of the model suggests a price bundling strategy discussed in Fig 1 to adequately price the offer bundle. This is critical to the model as it will not only help create attractive bundles for the consumers but effective price will lead to customer satisfaction and customer loyalty. Price bundling is also critical in a way to establish an ideal partnership model between operators and respective OTT players based on maximizing returns on their respective functions of delivering and providing the data. OTT players and operators should be able to leverage on their own strengths to generate increased revenues while using each other as a productive resource.

#### 5.1.4 Inferences from Primary Data

For the purpose of conceptualizing the above model it is necessary that we validate the core idea of acceptance of service bundles in the first place. We surveyed 250 respondents online, in the city of Pune, India in the age group of 16-25. We consider this demographic group because of the 80% penetration of smartphone (Deloitte Global mobile User Survey, 2013) in this particular group. Firstly we found the popularity of social media services like Facebook, WhatsApp, Viber, WeChat, is on the rise (figure 2). They spent on an average 5.5 hours a day on social services and chat services compared to 0.5 hour on video services, and 1 hour on music services. A considerable amount of time is spent on e-commerce sites, a new trend. Average monthly consumption of data by the respondents is calculated to be 600 mb.

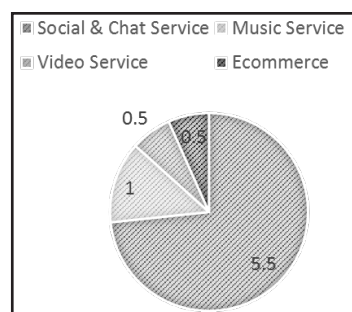


Fig. 2: Time Spent on Services Per Day

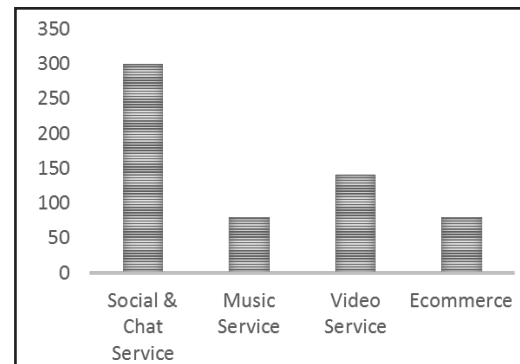


Fig. 3: Monthly Consumption of Data

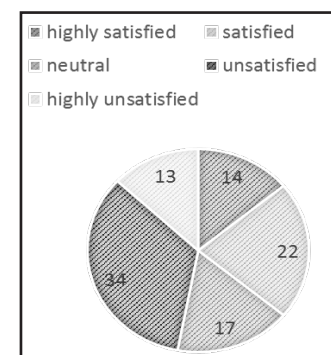


Fig. 4: Satisfaction Levels

Rather than directly asking for the acceptance of the service bundle we tested on the psychographic trend in the way respondents used the social service apps. The survey resulted in two major findings. Rather than being loyal to one social service provider the respondents used different providers for the same basic need but consumed different features of different providers. We found a conglomerate of Facebook chat service, WhatsApp, Viber and WeChat on the same mobile with equal percentage of usage per day (figure 5). Respondents used Facebook to chat with their Facebook friends, WhatsApp for the purpose quick and group chats. Viber was used more for the purpose of sending videos while WeChat for the purpose of over the top voice messaging.

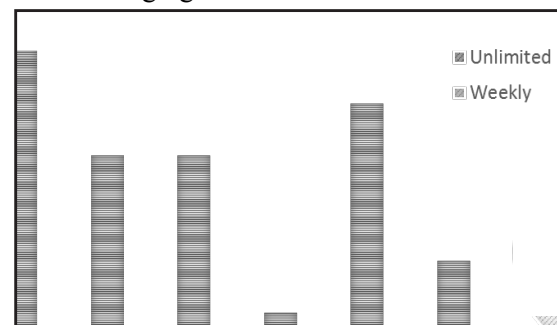
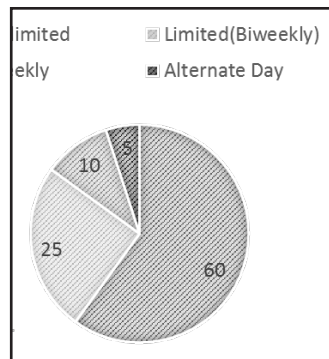


Fig. 5: Time Spent on Services per Day



**Fig. 6: Recharge Type**

The other major finding is that Indian Community is price sensitive. We found that most of the respondents opted for unlimited data packs at higher price while showing an unsatisfactory behavior in its complete utilization (figure 4).

This is a concrete evidence of greater perceived value of the service in relation to pricing. From the two findings we are able to conclude that there is a prevalent need of better and optimal offers at reduced price which could warrant the subscribers to use similar but many apps at the same time. It is here we suggest a service bundling model an appropriate diffusion advancement that brings benefits to the operators, OTT players and consumers while including charges from all parties based on sharing revenues and creating value proposition.

## 5.2 Sponsored Data (B2B approach)

### 5.2.1 The Concept

Sponsored Data a business to business partnership approach is a service that entitles the content providers to sponsor data for their services or content in return of priority data traffic and guaranteed quality of service. The consumer in return enjoys the free data usage for the services without being charged on his data allowance.

Benefits to the content providers are

- Promotion of their services
- Enhanced consumer engagement
- Possibility of monetization of service through enhanced customer engagement
- Possibility of customer loyalty program
- Creation of cross selling opportunities by guaranteeing better quality of service
- Increase consumer stickiness leading to new revenue generation opportunities

- Benefits to the operators are
- Transformation of data delivery channels into revenue generation assets
- Increased ARPU's & enhanced perceived consumer value
- Data charges resulting from direct billing to sponsored OTT players
- Enhanced engagements translated to subscriber satisfaction and retention
- Pre-paid to post-paid conversion by premium sponsored data offer on post-paid subscription

### 5.2.2 The AT&T Case

AT&T, in Jan 2014 introduced a new service of sponsored data for its 4G customers to enjoy mobile content and apps over its wireless networks without impacting their data plans. As per the program the AT&T would partner with the content providers who would pay to exempt their content or parts of services from consumer's data plan. In return the content providers would be able to allure AT&T consumers onto their services. How did it work exactly? If a customer while accessing an application come across an educational video with AT&T Sponsored Data name, he identifies that the video as sponsored. When the customer clicks to play the video, the data usage incurred while streaming the video is not applied to the customer's monthly data allowance, but is billed directly to the sponsored company that provided the video.

From the AT&T point of view sponsored data service was a potential innovation. Ralph de la Vega, president and CEO, AT&T Mobility said "This is an exciting new opportunity for us and, most importantly, our customers. In its functionality it's a win-win for customers and businesses". Even though AT&T tried to persuade the world that this is the need of the hour the model flawed as discussed below

- It failed to attract big OTT/app players and companies AT&T had hoped and for whom the model was basically devised
- For the consumers a sponsored video seemed to be nothing more than "yet another advertisement"
- It actually placed more burden on the content providers by forcing them to incur an additional cost just to get the content to people

AT&T did not actually prioritize traffic, basing the model on the principal foundation of internet that is, its neutral- "no content can be prioritized over other"



### 5.2.2 Possible Revenue Models

The existing models for sponsored data are

*Zero rated content* - operator partners with OTT service providers to offer their content to users free of charge. The OTT service partner pays for any data used while accessing their content on the operator's network. OTT partners can also build loyalty programs for its high net worth customers by paying for data used by them.

*Ad inserted Partial data subsidy* - OTT partners can opt to pay for a fraction of data for consumers accessing their services while the rest of the revenue is accrued through inserting focused advertisements or other third party content which is viewed in the course of the browsing session.

The above models lack in revenue generation schemes and are mostly designed for promotion activities. We see sponsored data model as a collaboration arrangements of operators and OTT players based on three principles

- Flexibility in prioritizing traffic and enhancing quality of service (for OTT players) through exclusive content delivery channels provided by operators
- Sponsored data partnership model as revenue generation centric than promotion and advertising centric
- Revenue sharing partnership based on content rather than on data consumption

Based on the above principles we suggest following possible revenue models highlighting the respective roles of operators and OTT players.

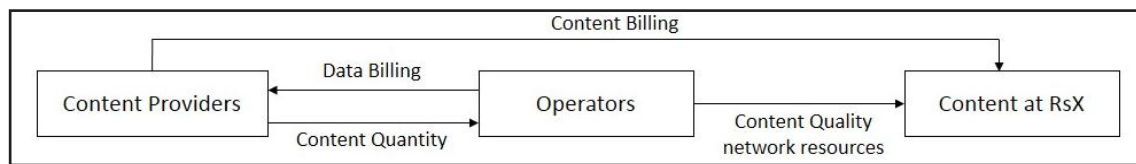


Fig. 7: Framework of Model 1

*Model 1: Operator-OTT player partnership model* where revenues are first generated by the sale of rich content to subscribers offered at high quality of service. The sales revenue thus generated is then shared between OTT players and operators based on the OTT player's role of offering content and operator's role of offering exclusive and prioritized data. Best suited for bandwidth-hungry OTT services like video calling services, movie on demand, music services. In this model operators agree to offer their network resources and dedicated data channels to provide enhance quality and fast streaming of OTT player's content. In return the OTT player gets an advantage to sell their content to the consumer who distinguishes it as a value added product at a cheaper rate. The subscriber in this model does not pay for the data usage but for the content. The operators bill the OTT service for the data at a subsidized rate while OTT players

bill the subscribers directly for the content through billing capabilities of the operators. For e.g. a three hour movie could be offered for sale at Rs100 on a smartphone. To access the movie the consumer pays a onetime payment of Rs100 for the movie. By doing so the consumer is provided high quality dedicated streaming for the movie, the data usage for which is not charged on his/her data plan. In terms of revenue sharing the operator could earn Rs40 for delivering high quality service while video provider could earn Rs60 as movie subscription charges. The model focuses more on revenue sharing through content while data is sponsored at lower rates. We see this model as win-win for both operators and OTT players that bring to light all the benefits they could have discussed in table 1 while monetizing on the partnership. This model can also help OTT players generate customized content for its subscribers offering a fraction of it as free and commercializing on the rest.

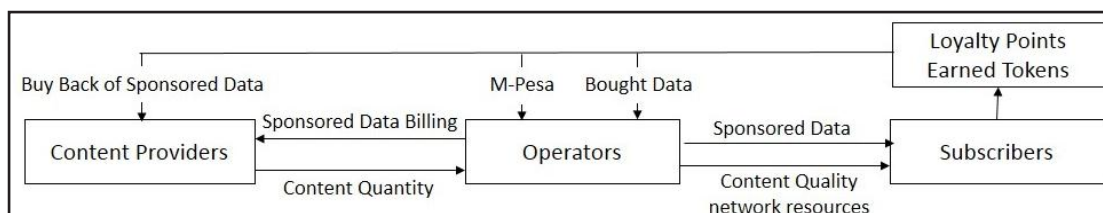


Fig. 8: Framework of Model 2

Model 2: This revenue generation partnership model is based on OTT player's loyalty programs and services that enable consumers to win in the form of some token or coins.

Fundamental principal on which revenue could be generated and latter shared is the enhanced quality of service provided as sponsored data by the operators. This enhances consumer experience on the OTT service that entice him to spend more time on the service which could be translated into earning and buying more loyalty points by the consumers. Through advanced billing capabilities of the operator, the loyalty points could be converted into usable data or mobile phone based money (mobile-pesa) which consumers could use for trading purposes directly thus building a revenue generation scheme for operators as well as OTT players. Based on the above model we see a suitable collaboration between e-commerce players and operators. Operators could provide dedicated sponsored data usage for shopping, separated from consumer's data plan. The consumer earn loyalty tokens on shopping which he/she then trades off to buy data or trades it to receive mobile-pesa, a revenue generation for operators. In return the operator gets to offer exclusive high quality data for its customers at a subsidized rate. In lieu of the increasing consumer penetration on e-commerce apps Fig 5 we see this model a beneficial option for the OTT players and operators to attract consumers while generating revenue.

Key differentiator of the models is that they would help in developing long term partnerships and hedging investments against sustained sources of revenue which is based on sharing.

## 5.3 Collaboration Platform Model

### 5.3.1 The Concept

The collaboration platform works on the concept of APIs. API (Application Program Interface) is a set of routines, protocols and tools for building software applications. In a collaboration platform model we see collaboration arrangements where in operators and OTT players pool in network resources and software tools respectively to first create new APIs and then use the same APIs to develop application services for the consumers.

### 5.3.2 Outline of the Model

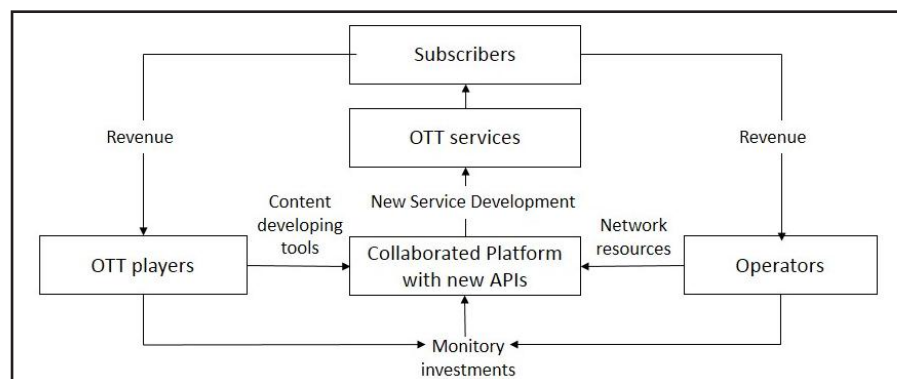
*Stage 1:* investment (monetary implications) and resource sharing by operators and OTT players to deploy collaborated platform for application development

*Stage 2:* building the applications and services

*Stage 3:* sharing of revenue generated by the app

This model helps the operator to give more value to the partnership with OTT player by giving them access to APIs so that new services can be developed which will help to increase the subscriber base and help to generate more revenue. By implementing this model OTT players can build the service app faster and integrate it faster saving significant time as well as cost. Cost of developments of services on Collaborated platform is just 10% of the cost associated with the non-platform approach. (Asiainfo, 2014)

The need for collaboration platform can be better explained by highlighting the following benefits:



**Fig. 9: Framework of Collaboration Platform Model**

- Operators can have significant control of the OTT service ecosystem. They get a chance to have their hands on the OTT service market.
- OTT players can have access to advanced BSS, OSS and network capabilities which brings operational efficiency.
- It helps creation of better products through analytics of subscriber behavior provided by operators and used by OTT players
- The end product ultimately lead to generation of more revenue by giving value added product or service to the consumers

### 5.3.3 Scope of Collaboration Platform Approach:

*Multiple Partnerships:* After the collaboration platform is integrated into the IT architecture of the operator then operators can partner with multiple OTT players and digital service providers. Each partner can access the standardized APIs through the platform. It helps to bring innovation in products, pricing and therefore increase in revenue and customer loyalty.

*Mini Offers:* Operators can launch mini offers for different market segments. In the current scenario most OTT paid services are billed by monthly subscription. To attract Pre-paid customers offer of the day can be done which is more appealing. The operator can leverage the subscriber intelligence and promote the right mini-offer to different customers.

*Service scale:* The platform gives the operator to have different types of partnerships such as bundling and sponsored data. *So the other models suggested above can be implemented by implementing collaboration platform.*

Thus this API collaboration platform model will help to bring innovation, increase subscriber base which in turn will increase the revenue.

## 7. MANAGERIAL IMPLICATIONS AND LIMITATION OF THE RESEARCH

The research reveals enough insights for operators and OTT players to adopt partnership approach in current and future scenarios if they look forward to generate increased revenues. Our research has been able to successfully design the revenue sharing models to assist operators and OTT players in their demanding needs to not survive but to establish a paradigm shift to growth. Most importantly,

readers need to remember that we considered only clearly determined population and sampling settings; the extent to which our findings can be generalized certainly requires further investigation. Further research on the models will add to the understanding about the impact and provide a feedback mechanism that will allow future efforts to more fully meet the intended goals and objectives.

## 8. REFERENCES

- Armstrong, G. (2014). *Marketing: An introduction*. Harlow: Pearson/Education
- Gartner Inc. (2014). Market Share Analysis: Mobile Phones, Worldwide, 4Q13 and 2013. Retrieved from <http://www.gartner.com/newsroom/id/2807017>
- GSMA (2014). The Mobile Economy 2014. Retrieved from [http://www.gsamobileeconomy.com/GSMA\\_ME\\_Report\\_2014\\_R2\\_WEB.pdf](http://www.gsamobileeconomy.com/GSMA_ME_Report_2014_R2_WEB.pdf)
- IDC report (2014). Smartphone vendor market share report. Retrieved from <http://www.idc.com/getdoc.jsp?containerId=prIN25045514>
- Jonason, A. (2002). Innovative pricing effects: theory and practice in mobile Internet networks. *European Journal of Innovation Management*, 5(4), 185-193
- Jonason, A., & Eliasson, G. (2001). Mobile internet revenues: An empirical study of the Imode portal. *Journal of Internet Research Electronic Networking Applications and Policy*, 11(4), 341-348.
- Matthews, K. (2014). Quantity & Quality: The business case for a profitable operator / OTT partnership model". Asianfo. Version 1.0, September 2014. Retrieved from [https://www.asiainfo.com/Portals/0/New\\_Branded\\_Collateral/White\\_Papers/2014.09.19\\_AsiaInfo\\_Northstream\\_WP.pdf](https://www.asiainfo.com/Portals/0/New_Branded_Collateral/White_Papers/2014.09.19_AsiaInfo_Northstream_WP.pdf)
- Marketer. (2014). E-marketer roundup: Global media trends. Retrieved from <http://www.emarketer.com/Article/2-Billion-Consumers-Worldwide-Smartphones-by-2016/1011694>
- MBit Index. (2014). MBit Index report, Nokia solutions. Retrieved from <http://networks.nokia.com/file/30596/mbit-index-report-2014>
- Mobile squared. (2014). From Resistance to Partnership Operators shift into monetizing OTT. Retrieved from [http://tyntec.swhosting11.de/sites/default/files/uploads/2014-11\\_executive\\_summary\\_from\\_resistance\\_to\\_partnership\\_mobilesquared.pdf](http://tyntec.swhosting11.de/sites/default/files/uploads/2014-11_executive_summary_from_resistance_to_partnership_mobilesquared.pdf)
- Nielsen (report). (2014). Unstoppable! Smartphone surge in India continues. Retrieved from <http://www.nielsen.com/in/en/insights/reports/2014/unstoppable-smartphone-surge-in-india-continues.html>



- Lin, E. (2014). Global Smartphone User Penetration Forecast by 88 Countries: 2007 to 2020. Strategy Analytics, WSS report
- Smith, T. J. (2012). *Pricing Strategy*, Mason: South-Western Cengage Learning. Retrieved from <http://www.toknowpress.net/ISBN/978-961-6914-09-3/papers/ML14-566.pdf>
- Spirit DSP. (2012). The Future of Voice. Retrieved from <http://www.spiritdsp.com/industry-news/read-more-industry-news/article/ott-voip-to-cost-telcos-479b-to-2020/>
- Venkatesh, R., & Mahajan, V. (2009). Design and pricing of product bundles: A review of normative guidelines and practical approaches, pp. 232-257, Handbook of Pricing Research in Marketing, Vithala R. Rao (editor). Northampton, MA: Edward Elgar Publishing Company
- Visual Networking Index. (2015). Global Mobile Data Traffic Forecast Update 2014–2019 White Paper. Retrieved from [http://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/white\\_paper\\_c11-520862.html](http://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/white_paper_c11-520862.html)

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# Valuation Techniques in Telecommunication Industry – An Alternative Approach based on Operating Cash Flow and Number of Subscribers

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## ABSTRACT

The Indian economy has witnessed tremendous growth after liberalization. The valuation of telecom companies has gained specific importance after 2010. The government has received revenue of more than Rs. 1.06 lac crores through 3G/BWA spectrum auction from telecom operators. The operators raised debt to finance acquisition of spectrum in the above auction. Due to this almost all the operators had to raise debt and now it is impacting their profits, cash flow and valuation. Apart from this the telecom operators are highly regulated. There are various issues due to which the valuation of the telecom companies prior to 2010 (i.e. before auction) and post 2010 shows a huge difference.

The valuation of telecom operators is very crucial and has invited special attention in the recent past. This article attempts to evaluate some special aspects of telecom valuation like valuation based on subscriber, per subscriber EV, PE ratios (EV ratios) etc. which may not be used while valuing other types of industries.

This paper evaluates existing valuation techniques, assesses limitations of these techniques in the light of 3G auction. The valuation of the telecom companies under the conventional techniques may not depict fair results, considering the fact that the telecom sector witnessed an increase in number of subscribers, increase in revenue however a reduction in profits & valuation and heavy cost of debt involved in acquiring spectrum and upgrading technology during 2009 to 2015. The paper attempts to find out an alternative basis to arrive at valuation based upon operating cash flows and the number of subscribers.

**Keywords:** Valuation, Number of subscribers, Operating Cash Flows, Telecom Industry

## 1. INTRODUCTION

Telecommunications sector has witnessed structural, regulatory, technological and institutional reforms since 1991. National Telecom Policy in 1994, 1999 and 2012 laid basic foundation for growth in terms of private sector participation in this area. It has thus attracted private & foreign investors. Wireless service provider is the most widely deployed mobile communications technology in India. There are many players offering wireless service provider in India. The business models of the operators

are also changing due to various reasons such as change in regulations, technology, opportunities for convergence etc.

Telecommunications industry is one of the most profitable and rapidly developing industries in the world and leading to overall economic growth. In the recent past, telecom has become backbone of various other industries and very useful in convergence with these industries. The industries include banking, healthcare, media, entertainment etc. Due to such convergence the business model is also affected. The regulations play an important role in telecom sector. Similarly the growth opportunities

are also increasing due to changes in technology and relevant business opportunities such as payment banks. The industry has in the past and is likely to have mergers and acquisitions in the years to come.

The research involves studying the key trends in valuations in Indian telecom industry. It involves a study of current happenings in telecom industry, regulatory environment, valuation of each telecom operator based on different parameters like Enterprise value, ARPU, Discounted cash flow method. Finally it constitutes detailed valuation of some of top telecom operators of India based on some new parameters like Average Cash margin per user, Enterprise value/EBITDA or cash flow per subscriber and analyzing their future prospects for mergers and acquisitions.

### 1.1 Objectives of the Study

The basic objective of the paper is to study present valuation practices and approaches and explore a new approach to valuation for Indian telecom operators. The paper evaluates various approaches in light of auction in 2010, 2014 and its impact on valuation. The study does not discard any of the existing methods however explores a new approach which might be useful in arriving at a fair value. The objectives of valuation are manyfolds which includes mergers and acquisitions, divestment, strategic purpose etc.

### 1.2 Valuation in Indian Telecom Industry

One of the basic objectives of financial management is to maximize the value of the business. In finance, there are three decisions i.e. starting from investment, how to finance investment and pay dividend out of profits. These decisions are taken with a view to maximize valuation of the companies. The above decisions are believed to be within the control of the organization. However in a few cases, these decisions are affected due to Government policies and regulations. In case of Indian Telecom Operators, all the operators had to invest a huge amount due to 3G / BWA auction process. The investment in spectrum auction was more than one lakh crores rupees, for all operators. In a few countries like Japan, Korea the spectrum was free of cost so there was no investment from the companies' point of view. In case of India, the operators had to invest in spectrum and for this they had to raise debt from the market. The debt they raised was due to spectrum auction. The spectrum auction took place in European countries where the operators in those countries had to raise funds / debts which impacted their profit margin and valuation. The similar issue happened

in case of Indian operators also.

Any financial activity leading to positive NPV creates value. In case of operators the investment (cost) of spectrum auction is not left as the decision purely at the discretion of the operators. The amount of investment although was market driven, it was regulated and bound with a policy decisions.

### 1.3 Valuation Drivers for Telecom Industry

According to the study conducted in 2009(E & Y report), the intangible assets represent on an average 30% of the telecommunication industry's target Enterprise Value. These intangible assets include brand, technology, customer contract / relationships etc. It is important to note that out of all intangible assets highest percentage of impact on EV is represented by customer contracts / relationships, i.e. almost 1/3rd of all intangible assets. It shows the importance of customer / subscriber base in terms of valuation i.e. EV – Enterprise Value. There are three main aspects i.e. number of subscribers, extent of regulations and ARPU (i.e. average revenue per user)

### 1.4 Importance of Subscriber in Valuation

For a few industries, customer directly fetches value and income. The capacity of a customer base to give excess earning is also important. Customer and customer relationship is definitely treated as an asset. To arrive at fair value of asset, excess earnings method is useful. Thus customers / relationship will generate cash flows over a period of time. In case of telecom operators, the quality of customers, retention of customers (by reducing churn rate), offering quality of services and fair pricing will lead to excess earnings. The excess earning is thus attributable to the subscribers. These excess earnings are further discounted to arrive at fair value.

To value customer base for telecom industry needs attention to various factors such as multiple SIM customers, non-active cards, the nature of customer base (segmental revenue - mobile, fixed, internet etc.), growth trends, margin levels, useful customer life and churn rates, bundled services, possibilities of new technologies and its impact on acquisition of new customers or retention of existing one, regulatory issues like switching from one company to other, new competitors affecting business model of operators. Thus the useful life of customer is significant along with how much cash flow it would generate for company.

### 1.5 Spectrum Auction in 2010 and 2014

The telecom industry has also contributed large amount to Government exchequer in the past. As against the expectation of a total Rs. 35,000 crores, the Government earned more than Rs 1.06 lakh crores through this auction. At present, there seems to be uncertainty in revenues due to competition and MNP, delay in 3G launching, changing regulations and such related issues. One of the major concerns of industry is declining ARPU and with 3G it is likely to increase. Post 3G auction the situation has resulted into 'Winning Curse' for most of the operators.

For spectrum allocation, auctions could be a mechanism to decide entry, maximize social efficiency, revenue maximization or price discovery. The objectives for Government of India as mentioned on DoT website, include maximizing revenue for the government, efficient use of spectrum, stimulate competition, and promote 3G roll-out and help resolve 2G congestion Issues. However these revenues for auction depend upon number of subscriber and ARPU.

### 1.6 Impact of 3G Auction on Operators

The telecom operators had to invest in spectrum auction which is a huge investment for all operators. These investments were funded out of debts and the debt burden was increased to a large extent. (Expected to be around Rs 3, 00,000 crore). This increasing debt load will place increasing margin pressures on operators due to higher interest expenses. Idea Cellular raised about \$740 million, Tata Teleservices raised about \$973 million, Airtel, had raised 85 billion rupees. Telecommunications companies have raised around \$4 billion rupees via short-term debt and syndicated loans, a large chunk of it this week, to help fund their 3G spectrum purchases.

The major concern was the debt amount raised by telecom operators. This industry has loan of around Rs. 2.5 trillion. One of the major reasons of debt was tariff war along with huge investments in 3G, BWA auction. An average net debt to EBITDA was around 2-3 times.

**Table 1: Cost of Debt for Telecom Operators Post 3G Auction (in %)**

2007-08	2008-09	2009-10	2010-11	2011-12
6.04	7.88	4.8	5.95	10.24

Cost of Debt: Finance Charges / Total debt x 100. It indicates pressure on cost of debt and cost of capital also

which is subsequently used in discounting rate. It would affect the valuation of operators.

### 1.7 Sample Selection

The purpose of the study is to study the impact of investment in spectrum auction and its impact on valuation. Due to these investments, established methods of valuations are not useful to arrive at valuation of Indian Telecom Industry. Thus the study is related to Telecom Industry and the sector of Indian Telecom Operators only. There are 16 operators in India namely Bharat Sanchar Nigam Ltd., Mahanagar Telephone Nigam Ltd., Reliance Communication Ltd., TATA Teleservices Ltd., Idea Cellular Ltd., Videocon Communications Ltd., Quadrant Tele ventures Ltd., BharatiAirtel Ltd., Vodafone Ltd., Aircel, Loop Mobile Ltd., Spice Communication Ltd., S Tel Ltd., Unitech Wireless Ltd., Etisalat DB Telecom Pvt. Ltd., Sistema Shyam Teleservices. Thus out of 16 companies, only 8 companies have invested in 3G / BWA auction. The auction took place in 2010 and 2014. The lists of companies who have invested in either of these auctions are Vodafone Essar Limited., Bharti Airtel Limited., Reliance Telecom Limited., Idea Cellular Limited., Tata Teleservices Limited., Aircel Limited., S Tel Private Limited., and Reliance JIO. Out of the above eight companies, the data required for the purpose of study is a financial data and is available of those companies which are listed on a stock exchange. Thus for the purpose of our study we have selected three listed companies as follows;

1. Bharti Airtel Limited
2. Reliance Communication Limited
3. Idea Cellular Limited

### 1.8 Approaches to Valuation

There are various methods of valuations and the methods include are;

- Book Value
- Market Capitalization
- Enterprise Value
- Discounted Cash flow
- Free Cash Flow

There are various advantages and limitations of the same and these methods can be applied to valuation of telecom service providers.



The main features of Telecom Service Providers

1. It is a capital intensive industry;
2. Huge investment in spectrum auction driven by market forces and Government regulations;
3. The investment are made out of huge debts;
4. The revenue depends upon number of subscribers;
5. The industry is highly regulated so predicting future profits or cash flows is difficult;
6. The capitalization rate which is based upon weighted cost of capital is also driven by huge debts due to 3G auction

### 1.9 Methods of Valuations for Telecom Operators

There are various approaches to valuation. Although most of the approaches can be directly applicable to telecom operators, in view of above issue i.e. 3G and BWA auction and its subsequent impact on company's financial statement, valuation need to be analyzed from different perspective. According to Prof. Ashwath Damodaran, in general terms, there are four approaches to valuation i.e. discounted cash flow valuation, liquidation and accounting valuation, relative valuation, contingent claim valuation uses option pricing models. Out of the stated available methods, most commonly and widely used methods are enterprise value and valuation based on cash flows.

In discounted cash flows valuation, the value of an asset is the present value of the expected cash flows on the asset, discounted at a rate which represents the riskiness of these cash flows. Assets with high and predictable cash flows should have higher values than assets with low and volatile cash flows. In case of telecom operators if we treat customers as asset which generates cash flows and profits, then the valuation of customers is crucial. In this context, we need to analyze cash flows generated out of subscribers / customers, whether they are high and predictable in relation to a telecom operator.

A few findings from E & Y study for telecom operators indicate that key performance indicators are ARPU, Enterprise value to number of subscribers, Enterprise value to Line Installed; subscriber acquisition cost and subscriber retention cost. The finding from the report says that large Telco's that operate in emerging markets have higher valuation multiples than their peers in mature markets. The operators in emerging markets face additional risk and thus are reflected by higher betas. The higher betas convert into higher costs of capital for operators in emerging markets.

So in case of Indian operators, they had taken debt for spectrum auction resulting into more risk and beta affecting their valuation. Since the risks of operators have increased, it is reflected in beta coefficient and ultimately affects discount rates used in valuation of companies.

### 1.10 Other Approaches

In EV to EBITDA approach, EV is arrived at as market capitalization plus debt and preference share capital as reduced by cash and cash equivalents. To put it simply, it is the price you will pay if you want full control of the firm. By paying off all shareholders and bondholders you can enjoy full control of the firm and quite understandably you can enjoy the cash the way you want. Hence, EV consists of all types of capital but deducts cash and cash equivalents. The denominator is EBITDA. In a profit and loss statement, an investor can simply deduct cost of goods sold from net sales. In plain terms, EBITDA represents operating profit. It talks about the profit a company makes by being in the business. It does not take into account various factors like the cost of financing, rate of tax and non-cash expenditure such as depreciation. Many a time companies in sectors such as airlines, infrastructure and other capital-intensive businesses which earn more revenues due to high debt, the EV/Sales financial parameter is more useful.

### 1.11 Various Approaches to Valuation and Their Limitations in View of Auctions

Value maximization is the central theme or objective of financial management. Thus the crucial issue is to arrive at fair valuation for a company. Although main approaches are applicable to all companies, the changes are required considering the nature of industry and its environment such as government policies, regulation, industry growth etc. The following approaches describe the method of valuation and its discussion on 3G auction and its impact on operator's valuations:

**Adjusted book value approach:** It is a balance sheet approach. The assets as reduced by liabilities will reflect this valuation. Due to 3G auction, all the operators had invested huge amount in 3G auction. So the valuation based on adjusted book value may not reflect the correct valuation. This valuation ignores the importance of organizational capital i.e. employees and mainly the customers which brings value to business. This approach is suitable in case of industries which are highly regulated and derives value mainly from owning natural resources. In case of telecom operators this valuation is partially



applicable. However the operators are not the owners so valuation has its own limitations. In our opinion, in absence of ownership of spectrum and ignoring the value to customers this valuation is not relevant.

**Stock and Debt Approach:** Under this approach when the securities of the company are publicly traded then the valuation is arrived at by adding value of equity and debt. In case of operators, all operators are not listed on stock exchange and their debts are not traded on exchanges. Similarly for those operators who had raised huge debt for subscribing to 3G auction, this approach would give huge valuation due to debt structure which is not fair. The valuation will be meaningless when we compare pre-auction value and post – auction valuation. Similarly it pre supposes efficient market hypothesis.

**Direct Comparison Approach:** One of the fundamental principles is that similar assets should sell at similar price. The valuation is based on detailed analysis including identification of multiples. There are various multiplies and the value indicator must be consistent with the financial variable chosen. The multiplies include firm value to sales, book value of assets, PBDIT, PBIT etc. This approach is not suitable for operators. However a few ratios are very useful such as EV / Sales or subscribers.

**Market Capitalization and Enterprise Value:** The market capitalization is relevant however most of the operators are not listed. The enterprise valuation of operators is high due to debt component. So these criteria may not be directly relevant to operators. In our opinion, instead of ARPU, average cash margin per user is more important. And we suggest one more multiplier i.e. EV / Average cash margin per user which is discussed subsequently.

**Discounted Cash flow approach:** This approach is most suitable to operators since it is based on cash flows of the company. Here the value of the firm is present value of cash flow during explicit forecast period plus present value of cash flow after explicit forecast period. However in a discounted cash flow method, for discounting purpose we need to calculate discounting rate which is based upon weighted cost of capital from all sources. Thus it includes cost of equity and cost of debt. In case of operators who have paid huge amount for auction and raised the debt, cost of debt would be high along with weighted cost of capital. Even due to these debts the proportion of debt to equity will be high resulting into high discounting rate. For DCF method, more thrust is on revenue and which is derived from subscribers. Valuation is done to guide certain management decisions such as acquiring company, divestment decisions or similar strategic decisions.

**Free cash flow to equity valuation:** In the entire valuation considering the scope of debt, this valuation may give an appropriate result. Arriving at cash flow is difficult due to various reasons such as changing subscriber base (due to mobile number portability), changing business models (due to integration of businesses i.e. payment banks), changing regulations related to rates and taxes etc.

### 1.12 Alternate Valuation Approach for Telecom Operators

Telecom companies can be valued based on market capitalization and Enterprise value. However considering the impact of debt driven by Government policy of spectrum auction which is more than Rs. 2 lacs crores, these two valuation methods may not represent a true valuation. Considering the importance of subscribers, we propose another approach i.e. valuation based on customers to Indian telecom operators. The German telecommunication company Deutsche Telekom (2001) acquired US wireless carrier Voice Stream resulting into acquiring 2.3 million customers. In this deal, Deutsche Telekom acquired it for \$35 billion. Thus it has paid \$15,200 were paid per customer. This is arrived at by dividing total annual EBITDA-margin by the total number of customers at the end of that year (Skiera and Wiesel, 2002). This approach employs disaggregated cash flows on the level of individual customers.

If we observe similar business valuations such as CATV valuations they are valued based upon multiple of cable cash flow and value per subscriber. Cable cash flow is defined as operating income before depreciation, amortization, interest and taxes. Cable acquisition prices in Canada and US were based on multiplication of next years' cable cashflow.

### 1.13 Enterprise Value / Operating Cash Flow Method of Valuation

One method of valuation is Enterprise Value to operating cash flow. Operating cash flow in which one can understand pure cash flows. In EBITDA there is likely to have accounting distortions. So operating cash flows are more meaningful than EBITDA as valuation multiples. EV/OpCF is preferable to EV/EBITDA for comparing companies within a sector, or for comparing companies across sectors or markets where companies have widely varying degrees of capital intensity. For example, the UBS Warburg European telecom team favors using EV to operating free cash flow over EV/EBITDA and is more useful in predicting future

performance of telecom operators.

### 1.14 Enterprise Value to Cash Flow Per Subscriber

After reviewing various methods of valuations, we arrive at conclusion that subscribers are the most important element which drives valuation of telecom operators. The milestones in valuation were earlier based on number of subscribers, then average revenue per user, average margin per user. In the current situation, we propose average cash flow per subscriber which is linked to enterprise

value. Thus we recommend average cash margin per user (ACMPU) or operating cash flow per subscriber due to two reasons i.e. subscriber is most important asset and cash flow are superior to profits. In finding out the better method, we have compiled data of three operators' enterprise value as of 31<sup>st</sup> March of every year from 2009 to 2015. The data was related to enterprise value, EV to EBITDA per subscriber and EV to cash flow per subscriber. The data was gathered for seven years and of three operators resulting into 21 samples. After analyzing the data, following correlation was arrived at. The result of correlation is as follows;

**Table 2: Correlations**

		<i>EV</i>	<i>EBIDTA</i>	<i>Operating Cash Flow</i>	<i>Subscribers</i>	<i>EBIDTA/Subscriber</i>	<i>Cash flow/Subscriber</i>
EV	Pearson Correlation	1	.940**	.926**	.724**	.577**	.730**
	Sig. (2-tailed)		.000	.000	.000	.006	.000
	N	21	21	21	21	21	21
EBIDTA	Pearson Correlation		1	.935**	.700**	.662**	.716**
	Sig. (2-tailed)			.000	.000	.001	.000
	N		21	21	21	21	21
Operating Cash Flow	Pearson Correlation			1	.754**	.511*	.821**
	Sig. (2-tailed)				.000	.018	.000
	N			21	21	21	21
Subscribers	Pearson Correlation				1	-.032	.284
	Sig. (2-tailed)					.891	.213
	N				21	21	21
EBIDTA/Subscriber	Pearson Correlation					1	.694**
	Sig. (2-tailed)						.000
	N					21	21
Cash flow/Subscriber	Pearson Correlation						1
	Sig. (2-tailed)						
	N						21

\*\* . Correlation is significant at the 0.01 level (2-tailed).

\* . Correlation is significant at the 0.05 level (2-tailed).

Relationship between EV to EBIDTA per subscriber (0.577 ); and cash flow per Subscriber EV (0.730) is checked using correlation significance. Both correlations are significant at 0.01 levels. Since correlation between Cash flow/ Subscriber with EV of 0.730 is stronger; it is better indicator of strength of relationship. Thus while valuing Telecom companies it is better to consider cash flow per subscriber to arrive at valuation.

## REFERENCES

- Mishra, M., Varshney, G., & Karandikar, A. (n.d.) Analysis of the 3G and BWA Auctions in India.
- Abbas, M. (2014, 25 Oct). ET Bureau.
- Article on 3G Spectrum auction in India. Retrieved from [www.cci.in/pdfs/articles/3G-Spectrum-Auction-in-India](http://www.cci.in/pdfs/articles/3G-Spectrum-Auction-in-India).
- Pavri, Z. (198). *Valuation of a cable television system*. Price Waterhouse, Toronto Cable Communications Magazine.

Study Paper No 50 / 2013, Telecom Regulatory Authority of India, Study paper on Shareholding pattern, Financing pattern, and capital structure of Indian Private Telecom Access Service Providers).

[http://www.trai.gov.in/Content/PerformanceIndicatorsReports/1\\_1\\_PerformanceIndicatorsReports.aspx](http://www.trai.gov.in/Content/PerformanceIndicatorsReports/1_1_PerformanceIndicatorsReports.aspx)

Kulkarni, P., & Abhijit, C. (2011). Valuation Techniques for M & A in Telecommunication Industry. In: *Proceedings of International Finance on Infrastructural Development*, pp: 499-512 (ISBN: 978-81-924302-3-2).

[www.stern.nyu.edu](http://www.stern.nyu.edu)

[www.hollandlaw.nl](http://www.hollandlaw.nl)

[Qcpages.qc.edu](http://Qcpages.qc.edu)

[Bauer.bwl.uni.mannheim.de](http://Bauer.bwl.uni.mannheim.de)

[www.eoy.dk](http://www.eoy.dk)

[www.scribd.com](http://www.scribd.com)

[www.readbag.com](http://www.readbag.com)

[www.Bvstrategy.com](http://www.Bvstrategy.com)

[www.economywatch.com](http://www.economywatch.com)

[Bauer.bwl.uni.mannheim.de](http://Bauer.bwl.uni.mannheim.de)

[www.cci.in](http://www.cci.in)

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# Literature Review of Service Failure, Service Recovery and their Effects on Consumers and Service Employees

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## ABSTRACT

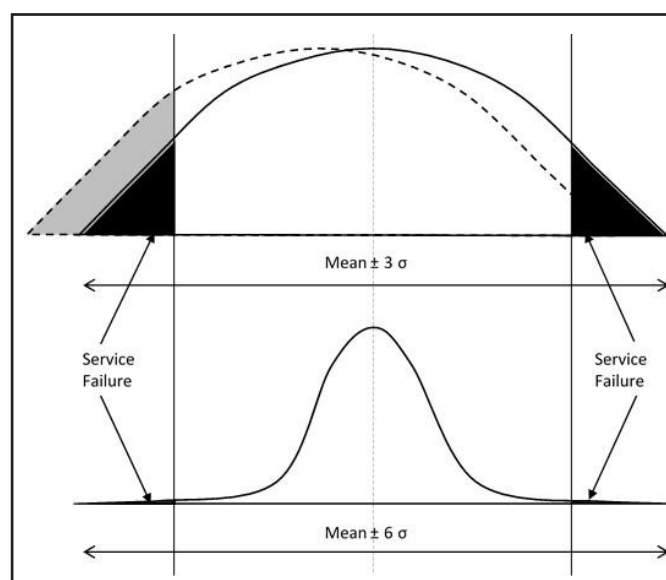
This review aims to analyze literature related to service failure; firm's attempted service recovery; and effects of failure & recovery on consumer and employees. The study identifies important themes emerging in the topic. Chronologically arranged literature is studied for themes, using relevance to the topic. The study identifies three important themes related to; service failure, service recovery and its effects on consumer and employees. First theme is about effect of service failure on consumer value & experience through; negative emotions, emotional labor, and emotion contagion. Second theme is emerged as customer reactions to service failure in terms of; justice & fairness, consumer forgiveness, consumer revenge, opportunistic claiming, recovery satisfaction, and switching behavior. Third theme is about managing service recovery using; compensation & apology, speed of response & positive ending, and customer relationship management. Services being simultaneous processes involving consumer and employees, control of service failures and subsequent service recovery are important functions of managers. Lastly, this study lists failure & recovery management methods for effective use by service manager.

**Keywords:** Service Failure, Service Recovery, Emotion, Consumer Behavior, Services Marketing

## 1. INTRODUCTION

Service failure is a situation when a service provider delivers the service performance far below the adequate service expectations of the consumer; and service recovery is a subsequent act of service provider to improve upon the failure. Service management literature extensively discusses service failures and its effects and reactions from the consumer as well as the service employee. The literature also extensively discusses service recovery mechanisms for effective handling of complaints.

The first step to service failure management is avoiding failures itself by operational improvements. Continuous incremental or radical change strategies like; total quality management, implementation of six-sigma process, reengineering of business processes, lean thinking, improvements using benchmarking, are recommended for avoiding service failures (Johnston & Clark, 2001). Figure 1 indicates, process improvement to improve service operations and reduce failures.



**Fig. 1. Service Failure, Controlling for Service Process**



## 2. OBJECTIVES

The objectives of this review of service management literature is to identify themes in; service failure, its effects on, and reactions from service consumers & service employee; and identify effective measures of service recovery.

## 3. METHODOLOGY

The study adopts systematic literature review of the themes in service failure and recovery; by using chronologically organized literature. Later the literature is reorganized on topic relevance and then on citation counts. The study uses SCOPUS literature database to identify research articles, relevant themes developed in the area of service failure and recovery. ("Scopus," 2016).

## 4. DISCUSSION

Literature discusses three broad areas; first, related to service failure and its effect on customer value & experience; second related to customer reactions to incidence of service failure; and lastly about, managing service failure using effective service recovery.

### 4.1 Service Failure and Customer Value & Experience

First theme arising out of review is effect of service failure on customer value and customer experience. On incidence of service failure, emotions play negative role in customer experience. Depending upon customer's perception of cause of service failure, customer experiences negative emotions, thus affecting consumer behavior directly by negative emotions and indirectly by perception of the cause (Harrison-Walker, 2012). Emotions are an important ingredient of individual personality, and acts to create customer value, which in turn affects behavioral response. Service recovery is an important activity, as customer value is also created during service recovery process (Chang & Hsiao, 2008) through perceived risk and perceived justice based on emotional value. In a situation where the firm fails to respond to customer's complaint, then the situation is described as double deviation situation (initial service failure then a failed service recovery). Under incidence of double deviation;—size of service failure,— recovery plans,— justice system,— emotions associated with recovery, and— recovery satisfaction; are

important factors affecting customers response (Nicolau-gonza & Casado-dí, 2009).

Socio-emotional selectivity theory, suggests that intensity of negative emotions has a reciprocal relationship with demographic factor of age. People tend to regulate their negative emotions better as they grow old. Young customers are likely to express stronger negative emotions than the older lot. Satisfaction through service recovery strategies (compensation, apology, and speed of service recovery) can also affect negative emotions. Thus effective recovery strategies are important for consumer recovery satisfaction (Concepcion Varela-Neira & Vazquez-Casielles, 2010). People from different culture may react differently to negative service encounters. In general, a negative service encounter is viewed with anger. Compared to others, people from African origin reported sadness and feeling of 'being let down' and humiliated at the hands of service employees during negative service encounters (Smith, 2006). The difference in emotions across cultures is a result of variance in the interpretation of appraisal of situations. In collectivist Asian cultures; showing of dissatisfaction is discouraged, in order to maintain harmony and protection of interpersonal relationships. Such harmony discourages open display of negative emotions (Laroche, Ueltschy, Abe, Cleveland, & Yannopoulos. Peter P., 2004). Service failure leads to generation of range of negative emotions in service consumer, service employee; and causes emotional contagion between them. Under this theme literature is grouped in three subthemes; negative emotions of service consumer, emotional labor of service employee, and emotion contagion between service employee & consumer.

### 4.2 Negative Emotions of Service Consumer

The service management literature lists, various emotions generated during service encounters as; anger, fear, sadness, happiness, disgust, and surprise (Robbins & Judge, 2013). Early research work identifies eight types of emotional episodes; classified in four groups;—positive emotions: happiness & delight;—situation-attributed negative emotions: anxiety & fear;—other attributed negative emotions: anger & frustration; and— self-attributed negative emotions of: guilt & shame (Menon & Dubé, 1999). During service failure, anger of the customer is found to be important predictor of consumer behavior than satisfaction (Bougie, Pieters, & Zeelenberg, 2003). Delays in service delivery negatively affect service evaluation; mediated by affective reactions to delay.



Control exercised by the service provider, and efforts to fill in the time of delay also has effect on evaluation; mediated through affective reactions of uncertainty and anger (Taylor, 1994). Researchers has also identified a regret emotion as a negative cognitive based emotion experienced by customer when the alternative approach is thought better than the one selected by him—this happens when selection consequences in an unexpected result (Liao, Liu, Liu, To, & Lin Hong-Nan, 2011).

### 4.3 Emotional Labor of Service Employee

Employee empowerment, emotional dissonance, service quality, and customer satisfaction are interconnected concepts. While employee empowerment influences emotional dissonance; a positive relationship is expressed in empowerment, service quality, and satisfaction (Aziz, 2008). The concept of emotional labor though mainly discussed in relation to employee; is equally applicable to the customer. Emotional labor is conceptualized as the effort, planning, and control required to express expected emotions during interactions. Authenticity of employee labor display is found to affect customer emotions & perceptions (Hennig-Thurau & Groth, 2006). Effect of emotional labor in case of frontline employees and customers is extensive. They are required to alter their behavior to perform to the designed emotion-display by internalizing elements of the value positioning (Sirianni, Bitner, Brown, & Mandel, 2013). Similarly customers are also required to display self-control during service encounters, especially during service failure situation. Emotional labor can create stress in employees and customers.

Continued episodes of multiple work-related stressors during customer interaction can cause employee burnout making him emotionally drained with lack of energy. Literature proposes burnout structured as; — emotional exhaustion, — de-personalization, and— perceived reduced personal accomplishment. Personality traits are said to impact burnout dimensions (Harris & Lee, 2004).

Continued emotional stresses during service encounters may lead to hostile behavior between the customer and the service employee. Hostile behavior is detrimental to service quality; especially during poor technical performance of high utility interaction service (Doucet, 2004).

### 4.4 Emotion Contagion between Service Employee & Consumer

Under situation of service failure and subsequent recovery process; consumer and employees exchange multiple

contagion; a sequential incidences of negative and positive emotions. This series of emotions called multiple sequential emotional displays; also effects consumer emotions. More intense the display of employees' negative emotions; more are subsequent increase in customer's negative emotions. If employee displays positive emotions, customer adopts positive emotions; if employee display negative emotions, customer adopts negative emotions (Du, Fan, & Feng, 2011).

### 4.5 Customer Reactions to Service Failure

Extensive literature discusses customer reactions to service failure and deliberates on; expectations of justice & fairness, consumer forgiveness, consumer revenge, opportunistic claiming, recovery satisfaction, and switching behavior. Literature reflect on series of consumer reactions under condition of service failures and recovery as; justice & fairness expectations, consumer forgiveness, consumer revenge, opportunistic claiming, recovery satisfaction, and switching behavior.

### 4.6 Expectations of Justice & Fairness

Emotions during service failure may not directly, but indirectly affect overall customer satisfaction through—cognitive evaluation of distributive justice (outcome equity),—procedural justice (policy & procedure equity), and—interactional justice (treatment justice). (Concepcion Varela-Neira, Vazquez-Casielles, & Iglesias-Arguelles, 2008). Various fairness aspects (price, procedure, outcome, interaction) effects positive & negative states of emotions, and eventually effects purchase behavior as well (Namkung & Jang, 2010). One of the factors affecting service recovery satisfaction is recovery justice and emotions (Wen & Chi, 2013). Preferential treatment after service failure has important connect with customer satisfaction-dissatisfaction (Concepción Varela-Neira, Vázquez-Casielles, & Iglesias, 2010).

### 4.7 Consumer Forgiveness

Under the situation of service failure and subsequent service recovery; literature conceptualizes forgiveness as customer coping strategy under incidence of service failure. Situational factors of; novelty, outcome uncertainty, time;— and contingent factors of history of relationship, social influence, competitor density, switching cost facilitates forgiveness process (Tsarenko & Tojib, 2011).

#### 4.8 Consumer Revenge

Literature discusses; when service failure occurs, customer develops a tendency to revenge against firm. Customer perception of the firm's greed (opportunistic intent); may generate feeling of customer revenge. Customer revenge can be direct (face to face) act of aggression and vindictive complaining, or indirect (behind the back) acts (Grégoire, Laufer, & Tripp, 2010). Customer delight & outrage emotions are considered to more intense and dynamic than satisfaction & dissatisfaction (Schneider & Bowen, 1999).

#### 4.9 Opportunistic Claiming

An interesting first of a kind article Wirtz & McColl-Kennedy (2010), theorized perceived fairness or justice, as playing a key role in opportunistic claiming behavior of customers. Justice worked as a trigger and justification of opportunistic claiming. Even the claim size was found to have direct relation with the size of the firm. Deeper customer-firm relations are said to prevent customers from opportunistic claiming, but opportunistic claim cannot build service recovery satisfaction.

#### 4.10 Recovery Satisfaction

Customer experiences negative emotion on service failure which further affects consumer satisfaction. Efforts taken for attempted service recovery positively affect recovery satisfaction (Concepcion Varela-Neira & Vazquez-Casielles, 2010). Failure emotions indirectly affect customer satisfaction through distributive, procedural, and interactional justice. Lack of preferential treatment explains customer dissatisfaction and resulting negative emotions mediates relationship of cognitive antecedents and dissatisfaction (Concepcion Varela-Neira et al., 2008). While quality of the past service performance develops causal attributes, emotions generated after the service failure mediate the relationship between causal attributes (stability & control) and overall customer satisfaction (Vázquez-Casielles, Rio-Lanza, & Diaz-Martin, 2007).

#### 4.11 Switching Behavior

Emotionally taxing customer switch can also affect current satisfaction significantly. More than uncontrollable service failure, customer expects proactive improvement in controllable service failures. Consumer is more likely to be

affected by strong negative emotions; if consumer believes that service provider has control over situation; and could have prevented the failure (Lin, 2012). Customers, who have switched service providers and taken up new provider on account of dissatisfaction, differ from other customers in their satisfaction and loyalty behaviors. The most recent switch and mere a presence of an emotionally taxing dissatisfied switch in the past, also affect current satisfaction. (Ganesh, Arnold, & Reynolds, 2000).

#### 4.12 Managing Service Recovery

The third group of literature is about management of service recovery; three subgroups are identified as compensation, apology, speed of response & positive ending, customer relationship. The most important part of service provider's responsibilities during situation of service failure is to effectively handle customers angered because of incidence of service failure. This anger can be effectively managed by sincere attempt of service recovery, specifically through pre-service recovery and during phases of service recovery (Nguyen & McColl-Kennedy, 2003). Preferential treatment after service failure can explain customer satisfaction or dissatisfaction. Negative emotions during service failure affects relationship of cognition and dissatisfaction (Concepción Varela-Neira et al., 2010). These encounters consists of acts, also called as moments of truth like; pre-sales, in-sales, and post-sales interactions which may include; phone calls, plant visits, service calls, service failures, service recovery (Grönroos, 2007).

#### 4.13 Compensation, Apology

Service recovery using financial compensation and social comparison with others positively improves satisfaction and behavioral intentions (Vazquez-Casielles, Iglesias, & Varela-Neira, 2012). Customers experience negative emotions after service failure, and it may affect customer satisfaction significantly. Service recovery efforts of; Compensation, apology, and speed of recovery has significant positive relation with; recovery satisfaction. In a situation of negative emotion during service failures a free gift or an apology can convert a negative emotion into a positive emotion (Golder, Mitra, & Moorman, 2012). Research in customer's "nasty" negative emotional retail shopping experiences like shoplifting accusation violates implicit trust, distrust provoked moral emotions, damages identities, and fuels retaliations (Friend, Costley, & Brown, 2010).

#### 4.14 Speed of Response & Positive Ending

Speed of response compensation process also affects customer satisfaction, but speed of response to apology may not contribute to satisfaction. Thus the effective recovery strategies should be used to check negative emotions caused by service failures (Concepcion Varela-Neira & Vazquez-Casielles, 2010). Within the sequence of various emotions during service encounter, a positive emotion at the end of the encounter is considered as a better predictor of satisfaction (Dalakas, 2006).

#### 4.15 Customer Relationship

On the incident of service failure; customer relationships and post-consumption behavior is affected by perceived justice as well as emotions related to consumption. Recovery justice and emotions (positive or negative) influences service recovery satisfaction, trust, intentions to repurchase, and spread of word-of-mouth (Wen & Chi, 2013). During service failures; angry and frustrated customers have to cop up with feeling of helplessness. Providing informational support and retrospective explanation can mitigate the feeling (Gelbrich, 2010).

### 5. CONCLUSION

One of the extensively discussed literature topic in services marketing is service failure, and service recovery as a proactive measure. Three service failure effects are identified as; negative emotions generated in service consumer, the effect of emotional labor faced by service employees, and emotion contagion exchanges between service employees and consumers. The literature also suggests customer reactions to service failure like; expectations of justice & fairness, consumer forgiveness, possibility of consumer revenge, opportunistic claiming, recovery satisfaction, and switching behavior of consumers. Lastly, literature themed around management of service recovery is discussed as; compensation & apology speed of response & positive ending, and customer relationship.

### REFERENCE

- Aziz, Y. A. B. (2008). The Effects of Emotional Dissonance and Employee's Empowerment on Service Quality and Customer Satisfaction Perception: Customer Level Analysis. *International Journal of Economics and Management*, 2(2), 237–258.
- Bougie, R., Pieters, R., & Zeelenberg, M. (2003). Angry customers don't come back, they get back: the experience and behavioral implications of anger and dissatisfaction in services. *Journal of the Academy of Marketing Science*, 31(4), 377–393.
- Chang, H.-S., & Hsiao, H.-L. (2008). Examining the causal relationship among service recovery, perceived justice, perceived risk, and customer value in the hotel industry. *The Service Industries Journal*, 28(4), 513–528.
- Dalakas, V. (2006). The importance of a good ending in a service encounter. *Services Marketing Quarterly*, 28(1), 35–53. <http://doi.org/10.1300/J396v28n01>
- Doucet, L. (2004). Service provider hostility and service quality. *Academy of Management Journal*, 47(5), 761–771. <http://doi.org/10.2307/20159617>
- Du, J., Fan, X., & Feng, T. (2011). Multiple emotional contagions in service encounters. *Journal of the Academy of Marketing Science*, 39, 449–466. <http://doi.org/10.1007/s11747-010-0210-9>
- Friend, L. a., Costley, C. L., & Brown, C. (2010). Spirals of distrust vs spirals of trust in retail customer service: consumers as victims or allies. *Journal of Services Marketing*, 24(6), 458–467. <http://doi.org/10.1108/08876041011072573>
- Ganesh, J., Arnold, M. J., & Reynolds, K. E. (2000). Understanding the customer base of service providers: an examination of the differences between switchers and stayers. *Journal of Marketing*, 64(July), 65–87.
- Gelbrich, K. (2010). Anger, frustration, and helplessness after service failure: coping strategies and effective informational support. *Journal of the Academy of Marketing Science*, 38(5), 567–585. <http://doi.org/10.1007/s11747-009-0169-6>
- Golder, P. N., Mitra, D., & Moorman, C. (2012). What is quality? an integrative framework of processes and states. *Journal of Marketing*, 76(July), 1–23.
- Grégoire, Y., Laufer, D., & Tripp, T. M. (2010). A comprehensive model of customer direct and indirect revenge: understanding the effects of perceived greed and customer power. *Journal of the Academy of Marketing Science*, 38(6), 738–758. <http://doi.org/10.1007/s11747-009-0186-5>
- Grönroos, C. (2007). *Service Management and Marketing: Customer Management in Service Competition* (Third). Wiley India (P.) Ltd.
- Harris, E., & Lee, J. (2004). The Customer, Co-Worker, and Management Burnout. Distinction in Service Settings: Personality Influencers and Outcomes. *Services Marketing Quarterly*, 25(4), 13–32.



- Harrison-Walker, L. J. (2012). The role of cause and affect in service failure. *Journal of Services Marketing*, 26(2), 115–123. <http://doi.org/10.1108/08876041211215275>
- Hennig-Thurau, T., & Groth, M. (2006). Are all smiles created equal? How emotional contagion and emotional labor affect service relationships. *Journal of Marketing*, 70(July), 58–73.
- Johnston, R., & Clark, G. (2001). *Service Operations Management Improving Service Delivery* (2nd ed.).
- Laroche, M., Ueltschy, L. C., Abe, S., Cleveland, M., & Yannopoulos, P. (2004). Service quality perceptions and customer satisfaction: evaluating the role of culture. *Journal of International Marketing*, 12(3), 58–85. <http://doi.org/10.1509/jimk.12.3.58.38100>
- Liao, C., Liu, C.-C., Liu, Y.-P., To, P.-L., & Lin Hong-Nan. (2011). Applying the expectancy disconfirmation and regret theories to online consumer behavior. *Cyberpsychology, Behavior, and Social Networking*, 14(4), 241–246. <http://doi.org/10.1089/cyber.2009.0236>
- Lin, W.-B. (2012). The determinants of consumers' switching intentions after service failure. *Total Quality Management*, 23(July), 837–854. <http://doi.org/10.1080/14783363.2011.637808>
- Menon, K., & Dubé, L. (1999). Scripting Consumer Emotions in Extended Service Transactions: A Prerequisite for Successful Adaptation in Provider Performance. *Advances in Consumer Research*, 26, 18–24.
- Namkung, Y., & Jang, S. C. (Shawn). (2010). Effects of perceived service fairness on emotions, and behavioral intentions in restaurants. *European Journal of Marketing*, 44(9/10), 1233–1259. <http://doi.org/10.1108/03090561011062826>
- Nguyen, D. T., & McColl-Kennedy, J. R. (2003). Diffusing Customer Anger in Service Recovery: A Conceptual Framework. *Australasian Marketing Journal*, 11(2), 46–55. [http://doi.org/10.1016/S1441-3582\(03\)70128-1](http://doi.org/10.1016/S1441-3582(03)70128-1)
- Nicolau-gonza, J. L., & Casado-di, A. B. (2009). Explaining consumer complaining behaviour in double deviation scenarios : the banking services. *The Service Industries Journal*, 29(12), 1659–1668. <http://doi.org/10.1080/02642060902793524>
- Robbins, S. P., & Judge, T. A. (2013). *Organisational behavior* (15th ed.). Pearson Education.
- Schneider, B., & Bowen, D. (1999). Understanding customer delight and outrage. *Sloan Management Review*, (Fall), 35–45.
- Scopus. (2016). Retrieved March 13, 2015, from <http://www.scopus.com>
- Sirianni, N. J., Bitner, M. J., Brown, S. W., & Mandel, N. (2013). Branded Service Encounters: Strategically Aligning Employee Behavior with the Brand Positioning. *Journal of Marketing*, 77(November), 108–123.
- Smith, A. M. (2006). A cross-cultural perspective on the role of emotion in negative service encounters. *The Service Industries Journal*, 26(7), 709–726. <http://doi.org/10.1080/02642060600898203>
- Taylor, S. (1994). Waiting for Service: The Relationship Between Delays and Evaluations of Service. *Journal of Marketing*, 58(April), 56–69.
- Tsarenko, Y., & Tojib, D. R. (2011). A transactional model of forgiveness in the service failure context: a customer-driven approach. *Journal of Services Marketing*, 25(5), 381–392. <http://doi.org/10.1108/08876041111149739>
- Varela-Neira, C., & Vazquez-Casielles, R. (2010). The effects of customer age and recovery strategies in a service failure setting. *Journal of Financial Services Marketing*, 15(1), 32–48. <http://doi.org/10.1057/fsm.2010.2>
- Varela-Neira, C., Vázquez-Casielles, R., & Iglesias, V. (2010). Lack of preferential treatment: effects on dissatisfaction after a service failure. *Journal of Service Management*, 21(1), 45–68. <http://doi.org/10.1108/09564231011025119>
- Varela-Neira, C., Vazquez-Casielles, R., & Iglesias-Arguelles, V. (2008). The influence of emotions on customer's cognitive evaluations and satisfaction in a service failure and recovery context. *The Service Industries Journal*, 28(4), 497–512.
- Vazquez-Casielles, R., Iglesias, V., & Varela-Neira, C. (2012). Service recovery, satisfaction and behaviour intentions: analysis of compensation and social comparison communication strategies. *The Service Industries Journal*, 32(1), 83–103.
- Vázquez-Casielles, R., Rio-Lanza, A. B. del, & Diaz-Martin, A. M. (2007). Quality of past performance: Impact on consumers' responses to service failure. *Marketing Letters*, 18(4), 249–264. <http://doi.org/10.1007/s11002-007-9018-x>
- Wen, B., & Chi, C. G. (2013). Examine the cognitive and affective antecedents to service recovery satisfaction: A field study of delayed airline passengers. *International Journal of Contemporary Hospitality Management*, 25(3), 306–327. <http://doi.org/10.1108/09596111311310991>

Wirtz, J., & McColl-Kennedy, J. (2010). Opportunistic customer claiming during service recovery. *Journal of the Academy of Marketing Science*, 38, 654–675. <http://doi.org/10.1007/s11747-009-0177-6>

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7. Figures, text or tables are not colored or shaded.
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(Annual Journal)

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