W.P.No. EC-11-09
November 2011

INDIAN INSTITUTE OF FOREIGN TRADE

Working Paper

A Study of Open Innovation in Telecommunication services: A Review of Literature & Trends

Sriram Birudavolu
Biswajit Nag

Working Paper Series

Aim

The main aim of the working paper series of IIFT is to help faculty members share their research findings with professional colleagues in the pre publication stage.

Submission

All faculty members of IIFT are eligible to submit working papers. Additionally any scholar who has presented her/his paper in any of the IIFT campuses in a seminar/conference will also be eligible to submit the paper as a working paper of IIFT.

Review Process

All working papers are refereed

Copyright Issues

Keys to the first two digits of the working paper numbers

GM: General Management
MA: Marketing Management
FI: Finance
IT: Information and Technology
QT: Quantitative Techniques
EC: Economics
LD: Trade Logistics and Documentation

Disclaimer

Printed and published by

Indian Institute of Foreign Trade

Delhi Centre

IIFT Bhawan, B-21, Qutab Institutional Area, New Delhi – 110016

Kolkata Centre

J1/14, EP & GP Block, Sector –V, Salt Lake, Kolkata - 700091

Contact

workingpapers@iift.ac.in

List of working papers of IIFT

See end of the document

Series Editor

Ranajoy Bhattacharyya

A Study of Open Innovation in Telecommunication Services: A Review of Literature & Trends

Sriram Birudavolu*
Biswajit Nag**

Abstract

This paper examines the trends, the research and studies done globally on open innovation and open business models in the field of Telecommunication Services. These include value added services pertaining to communications, online, web and media, mobile, triple/quad play, etc. on both consumer and enterprise side. In the face of severe competition, and commoditization, the current traditional Telco business models and services like Voice and Broadband are losing value rapidly causing the ARPUs of Telcos to drop, leading to a crisis in the Telecom industry. New business models based on Open Innovation & Open Business Models can help the Telcos survive and thrive through transformation.

Keywords: Telecommunication, Open sourcing and innovation, technological change

* Doctoral Candidate, Oracle India Private Ltd, E-mail: Sriram.Birudavolu@oracle.com

**Indian Institute of Foreign Trade, Delhi Campus, IIFT Bhawan, B-21, Qutab Institutional Area, New Delhi-110016, India. E-mail: Biswajit.Nag@iift.ac.in

A Study of Open Innovation in Telecommunication Services: A Review of Literature & Trends

1. Introduction

The Telecom Industry world-wide has evolved & transformed rapidly and radically from plain voice & messaging to rich media & complex services. With over five billion people owning mobile phones, and the number of global 3G mobile internet subscribers reaching a billion by 2012, there is little doubt left that we live in a highly interconnected world. As the total cost of computing processor power, bandwidth and storage drop (roughly halving each year), a number of new trends gain force:

- End-User Mobility e. g. mobile banking, Location Based Services, etc
- M2M (Machine-to-Machine) communications rising, smart devices being used in every sector - health, energy, automotive, manufacturing, logistics etc.
- Cloud Services (IaaS, SaaS, PaaS, KaaS, etc., i.e. Infrastructure / Software / Process / Knowledge as a Service – collectively known as XaaS - spending on this is set to grow by 28% in 2011 as per Gartner Report, June 2011)
- Enterprise Mobility e. g. Field sales force enablement, logistics
- Telco Mobility (smart phones, smart applications – e.g. voice assistants, messaging, task & calendar management, mobile money, gaming, music downloads, video-conferencing, etc.)
- Social Networking
- Convergence (VoIP, Triple Play, Quad Play, etc.)

Globally, the various forces and challenges that Telcos need to deal with are: High competition, Telecom regulation, falling costs, expectations of excellence in service delivery, ROI for stakeholders, etc. (TM Forum). Innovation and creating value-webs at every level will be key to survival and growth for organizations - right from service delivery to building new business models. About half a decade ago, (Kelen A., 2005) urges wireless

operators to get into the Services space immediately. Browsing the classical literature on telecommunication regulation, this study on business policy argues that instead of waiting for legislation that may be slow and too late to orient companies to imminent new market situation, wireless carriers should rather be building new, value-added services. Such a change of emphasis turning away from the basic provision of connectivity alone can help them achieve added value and remain in business. "Otherwise, they may soon follow the path of a slow corporate funeral following their wired brethren" (Kelen A., 2005). Currently, with the conventional business models rapidly losing value, i.e. falling prices of voice call & broadband, innovation in telecom services is key to survival and growth. The global telecom services market is dominated by mobile/wireless services. KPMG India Telecom Report of December 2010 estimates that by 2014 mobile/wireless will account for 45% of the $2.3 Trillion global telecom services market. With the major growth in telecom happening in developing countries – e.g. India and China accounting for 30% of the subscriber base and India adding 15-17 million subscribers every month, currently adding up to 636 million mobile subscribers, etc. - a fierce war has broken out among the Telcos for the control of lucrative markets. This was evident, for example, from the 3G Spectrum auctions held in India in 2010. A similar trend was reported in different parts of the world, e.g. in Europe (Bouwman, 2008), (Scharer, 2009), (Yrjo Raivio, 2011), and the Americas (e.g. breakup of AT&T and the aftermath). The battlefield is being shaped by several factors, notably:

- Lower Tariffs – e.g. per second billing instead of per-minute billing
- Regulation – e.g. Spectrum Allocation among the players
- Outsourcing that have enabled lower entry costs (includes network outsourcing as well as OSS/BSS play)
- Brand new players entering the market – e.g. MVNOs and non-conventional players (hence a crowded market)
- Capex & Opex of the Telecom-setups.
- The relentless pressure of upgrading infrastructure (both hardware & software) constantly owing to addition of large numbers of subscribers each month, with varied

needs. For e.g. India will need Rs. 35,000 – 50,000 Crores worth of telecom equipment by 2015.

- Consolidation of Players (M&A, collaborations, etc.)
- These pressures and the fierce competition have caused revenues and stocks of the telecom service providers to decline (drop in ARPU - Average Revenue Per User, and
- AMPU – Average Margin Per User).

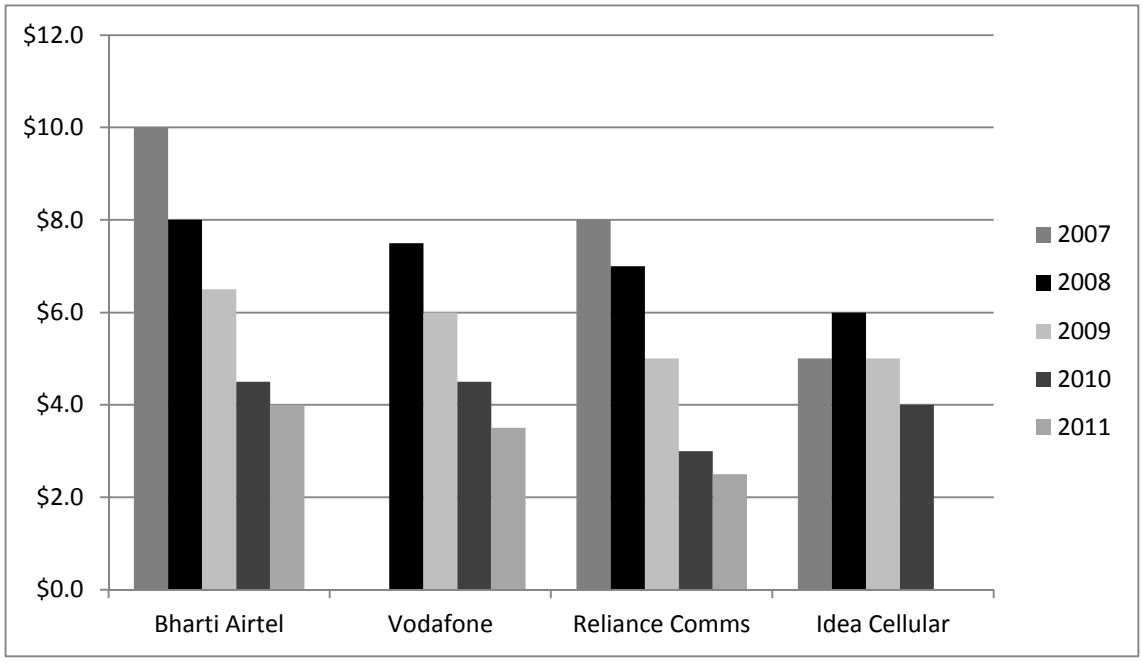

Fig.1: The Dropping ARPU of Indian Telcos for FY ending March 31, 2011 (Wall Street Journal)

It is clear that with shrinking top-line and pressure on the bottom-line, the current business models will need to undergo a metamorphosis. While the market will see a lot of consolidation of businesses (Telco players), the real sustainable strategy lies in innovation of Telecom Services. For example in Finland the MVNOs disappeared as the incumbent operators made acquisitions and the tariffs started stabilizing, but then the "walled gardens" model started breaking down because of Telecom deregulation and the Internet. Open Innovation and Open Business Models provide an excellent leveraging power for

Telecom Services (Yrjo Raivio, 2011). The increase in connectivity, computing & storage power has given birth to entirely new online web/internet/ media/entertainment industry, which complement, compete, or partner with Telcos and other online & offline businesses. Value Added Services are the key to the revival and growth of the Telecom sector (Kelen A., 2005). This paper examines how Communication Service Providers can leverage the power of Open Innovation & Open Business Models for providing Telecom Services (Y. Raivio, S. Luukkainen, 2009), (Per J. Nesse, 2009), (Carlos Y. Sato, 2008). Raivio notes that: "The literature review supports the trend in increasing the number of open APIs. Moreover, industry trends prove that openness is becoming a de facto in the telecommunications sector. The internet API management providers bring useful insights to the Open Telco initiative". The scope of the study is global in context.

2. Open Innovation and Open Business Models

Chesbrough defines Open Innovation as follows: "*The use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively.Open innovation is a paradigm that assumes that firms can and should use external ideas, as well as internal ideas, and external and internal paths to market, as they look to advance to technology".*

Open Innovation means that companies should make much greater use of external ideas and technologies in their own business, while letting their unused ideas be used by other companies. The benefits of Open Innovation are: lower costs for innovation, faster times to market, and de-risking the business model. Open Business Models is about applying Open Innovation to Business Models themselves.

2a. Open Innovation and Open Business Models – The Chesborough Approach

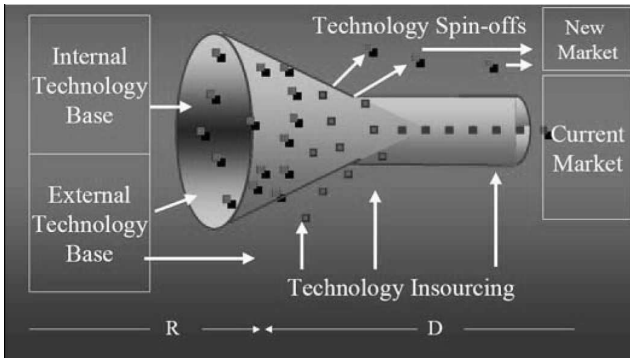

Fig.2:The Chesborough Approach

Open Innovation, as shown in the figure above, depicts the process in a company, from the Research stage on the left side (Internal Technology Base and External Technology Base), through the Filtering and Development stages in the middle and finally the Marketing on the right side. In the older, traditional model, the funnel is very solid with inflow at one end and outflow through the other, wherein ideas are generated by largely internal R&D departments, and filtered for viability, patented, developed, and finally marketed to capture the value for the firm. In Open Innovation, the funnel is porous at every stage, allowing for inflows & outflows. This is a more non-linear and dynamic model, wherein companies look both Inside-Out and Outside-In across the three phases of Research, Development and Commercialization. This model, when applied to Telecommunication Services, can result in transforming the Communications industry and moving each player up in the value chain, to enable them not only to survive but to thrive and build new economies. This is explained in more detail in the subsequent sections of this paper.

2b. Open Innovation and Open Business Models – The Nambisan Approach – Network Centric Innovation

Advocating the concept of Network Centric Innovation, (Nambisan) defines Network Centricity: "network as the focal point and the associated opportunity to extend, optimize, and/or enhance the value of a stand-alone entity or activity". To apply the concept of Network Centricity to Network Centric Innovation: An externally-focused approach to innovation that relies on harnessing the power of *networks and communities* to amplify

innovation reach, accelerate innovation speed, and improve the quality of innovation outcomes. Nambisan outlines the principles of Network Centric Innovation as follows:

Table 1: Principles of Network-Centric Innovation (Nambisan)

Principles of Network Centric Innovation	**Description**	**Examples**
Shared Goals & Objectives	One or more goals that help bring the network members together and channel their diverse resources and activities	*Customer Community*: Identify product flaws and contribute to product enhancement
Shared "World View"	Common assumptions, and mental models related to the innovation and its external environment	*Open Source Community:* Shared understanding about the software product's ties with other technologies and products
"Social" Knowledge creation	Places the emphasis on interactions among the network members as the basis for value creation and on the cumulative nature of knowledge creation	*Inventor Networks:* Interactions among individual inventor, innomediary and large firms for development of new product concepts
Architecture of participation	Defines a set of systems, mechanisms and processes to facilitate participation in value creation and value appropriation	*Open Source Software Community:* Modular Product Architecture and GNU General Public License scheme.

For applying the concept of Network Centric Innovation, the landscape is viewed along two dimensions: Network Leadership and Innovation Space. Network Leadership determines how centralized or diffused or centralized the leadership (organizing force) is, whereas the other dimension Innovation Space defines how well-defined or loosely defined the "script" or content of innovation is. (Nambisan) defines the 4 quadrants and gives them evocative names of – Orchestra, Mod-Station, Jam-Central and Creative Bazaar, as shown in the figure below.

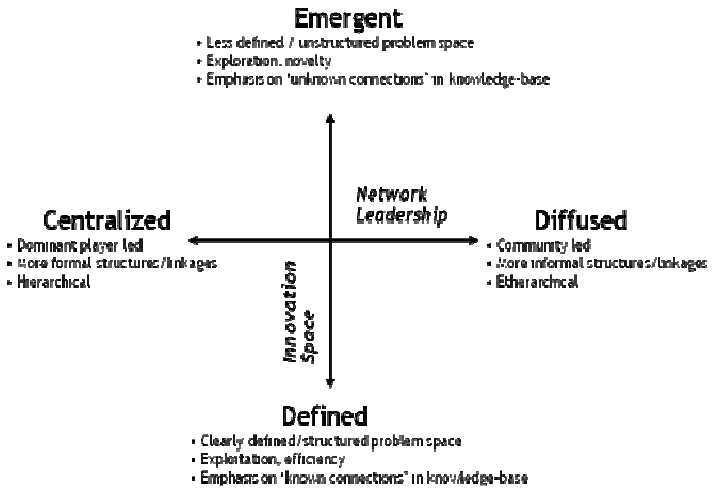

Fig.3:The Landscape of Network-Centric Innovation (Nambisan)

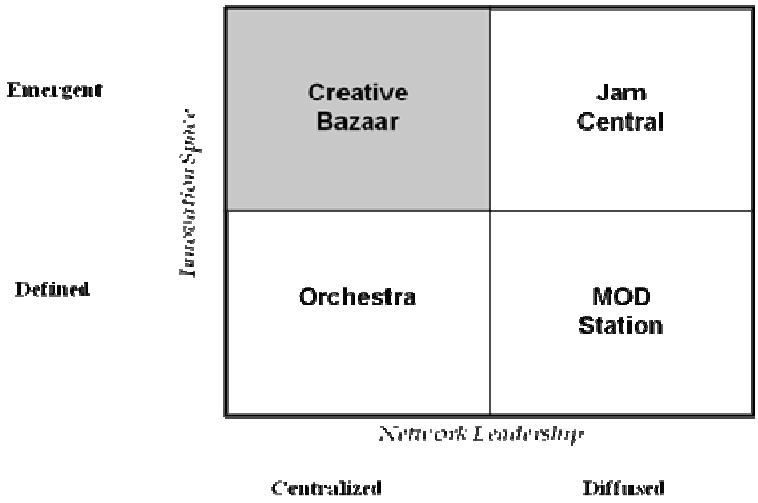

Fig.4:The Four Models of Network Centric Innovation (Nambisan)

3. The Telco Industry Model

While it is very hard to describe the Telco industry in a short space, in this brief sub-section, two figures are given to show how IP (Internet Protocol) has transformed the Telcos. The Telecom industry was impacted by the Internet, and the layers of the traditional Telco were transformed by it.

Table 2: The Infocomm Industry – A Layer Model (Fransmann, 2002)

Layer 3: Service Layer (Voice, Fax, 0800 Services)
Layer 2: Network Layer (circuit-switched network)
Layer 1: Equipment Layer (switches, transmission systems, customer premises equipment)

The current (transformed) model is depicted in the next figure. This figure adapted by (Sato) from Fransmann (2002) for the purpose of comparison. We note how IP-dominant the model is becoming.

Table 3:The Infocomm Industry – A Layer Model (Adapted from Fransmann, by Sato)

Layer	**Activity**	**Example Companies**
VI	*Consumers*	--
V	*Applications Layer, including Contents Packaging* (e.g. Web design, on-line information services, broadcasting services, etc.)	Bloomberg, Reuters, eBay, AOL-Time Warner, MSN, Newscorp, FaceBook, LinkedIn, etc.
IV	*Navigation and Middleware Layer* (e.g. Browsers, Portals, Search Engines, Directory Assistance, Security, Electronic Payment, etc.)	Yahoo, Google, Oracle, Microsoft, VeriSign, PayPal, etc.
III	*Connectivity Layer* (e.g. Internet Access, Web Hosting)	IAPs, ISPs
IP Interface		
II	*Network Layer* (e.g. Optical Fiber Network, DSL, Local Network, Radio Access Network, Ethernet, Frame Relay, ISDN, ATM, etc.)	AT&T, BTT, NTT, WorldCom, Qwest, Colt, C&W, Etisalat, Telstra, BSNL, etc.
I	*Equipment & Software* Layer e.g. switches, transmission equipment, routers, servers, CPE, Billing Software, etc.	Alcatel-Lucent, Nokia-Siemens, Ericsson, Cisco, Juniper, Huawei, Fujitsu

4. Open Innovation in Services

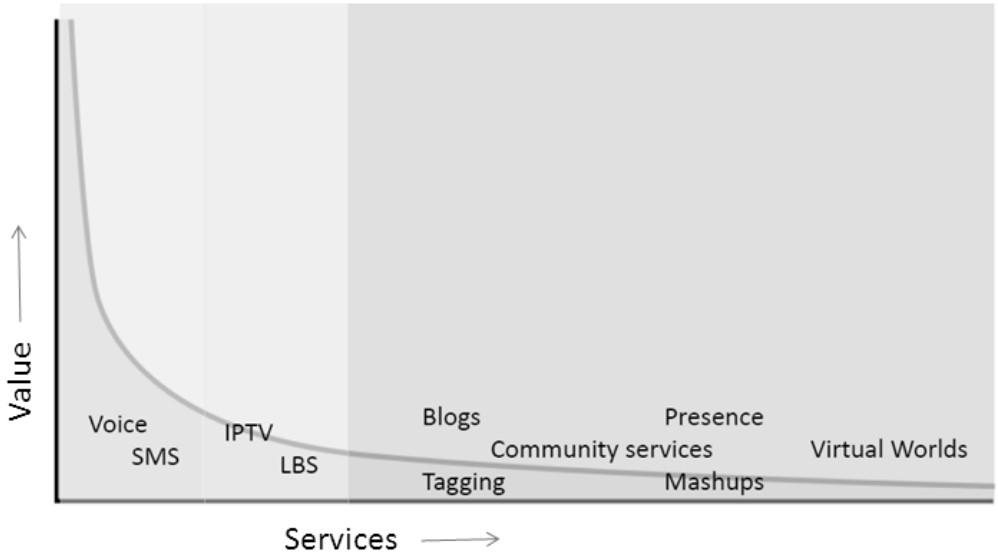

Fig.5: Unlocking the Long Tail of Services (Adapted from Fransmann, 2002)

Services today comprise roughly 80% of economic activity in the United States, and 60% of economic activity in the top forty economies of the world (source OECD). In developing economies also, the service sector is increasing fast. In India, services sector, as a whole, contributed as much as 68.6 per cent of the overall average growth in gross domestic product (GDP) between the years 2002-03 and 2006-07 (Service Sector in India – government of India website); the share of the GDP being 55.1% in the Financial Year 2006-2007. (Barry Eichengreen and Poonam Gupta, ICRIER, 2010) point out that Service Sector can be the road to India's economic growth. The Service Industry in India grew by 8.7% in 2009-10 (Economic Survey 2009-10) accounting for 57.2% of the GDP.

Much of the service industry world-wide stands to benefit from IT and the Web – such as moving services online, and onto the Cloud, more integrated solutions with connected devices, mobility, field workforce enablement, business process re-engineering, business intelligence, etc. This will lead to a stronger and deeper interdependence with Communications Services – enabled by technologies of Internet Protocol, Mobile Communication, Telecom Networks, Storage Technologies, etc. The Open Group (Open Group), which is a consortium of 350 member organizations that span all diverse sectors of the IT community, leads the development of Open, Vendor Neutral IT Standards and

Certifications. It helps vendors deploy cloud Computing Technology for greater scalability and ROI. Its stated aim is also to provide objective reliable assurance of conformance to open standards. The Open Group Enterprise Architecture Framework (TOGAF) is designed to cater to and transform every industry and domain – manufacturing, retail, finance, insurance, defense, e-governance, healthcare, education, mining, supply-chain & logistics, transportation, entertainment, tourism, sports, etc. TOGAF offers in-built features for Open Innovation – in its Architecture Development Method (ADM), Enterprise Continuum, and Architecture Content Framework. The TOGAF Reference Models also provide a foundation of generic services & functions on which specific architectures can be built. It is specifically aimed at helping the design of architectures that enable Open Group's vision of Boundary less Information Flow.

(Barros and Dumas, 2006) track the rise of the web-service ecosystems, and describe a web-service model comprising of five actors: Provider, User, Broker, Mediator and Specialist Intermediaries. As (Yrjo Raivio, 2011) notes "bringing real world products onto the internet will inevitably increase the need for new intermediate layers".

Service economy can benefit immensely from Open Innovation & Open Business Models (Chesbrough, January 2011). This is for the following reasons:

- The pure-product era is over. Today products thrive in a Service-centric ecosystem. All Products ultimately provide Services – as the popular saying goes - The customer buys a ¼ " hole, not a ¼ " drill. The drill is only a means of getting him the hole. Complex enterprise software products for Telecom need a lot of product consulting expertise, customization and system-integration to enable them to be finally deployed at the Telco's production site in order to derive business value out of them. Ultimately they help enable Telco services for enterprises and end-customers.
- The dominant economic activity of the society is Services as given in the beginning of this section. Organizations need to reconnect to this to unlock the real potential for competitive differentiation & growth.
- As products get commoditized, the competitive advantages diminish, profitability suffers, and Open Services Innovation is a way out of this mess.

The main message from (Chesbrough January 2011) is to rethink the entire paradigm of business innovation from a service perspective – with a focus on "Creating Customer Experience". Companies can do this by adopting the following measures: This can be done by adopting the following:

- Move away from Linear Thinking of 20th Century (such as Porter's Value Chain)
- Use Open iterative process, and integrate the customer more centrally into the network of collaborators.
- Move away from the R&D Labs lead Market "Push" Approach to an Open Innovation approach that gives a deeper understanding of what "Pulls and Connects" with the customers.
- Engage the Customers in the web of Co-Creation along with suppliers and partners, etc. Focus on the "unfulfilled" customers, unmet or unarticulated demand, white spaces, blue oceans, and the like.

As per (Chesbrough, 2011), the transformation to Open Services and Business Models are driven by the following four concepts:

- Think of business as an open services business in order to create and sustain differentiation in a commodity trap world.
- Invite customers to co-create innovation to generate (new) experiences they will value and reward.
- Use Open Service Innovation to help turn the business into a platform for others to build on.
- Transform the business model with Open Services Innovation to profit from building a platform business model to gain from others' innovation activities as well.

Following the line of thinking of (Chris Anderson), there is a lot of value in the long tail of Services waiting to be unlocked.

See the figure below. All this is made possible by embracing Open Innovation Models. For example, (Yrjo Raivio, 2011) explore an Open Telco model that is a hybrid of Open and Closed Innovation Telco Model.

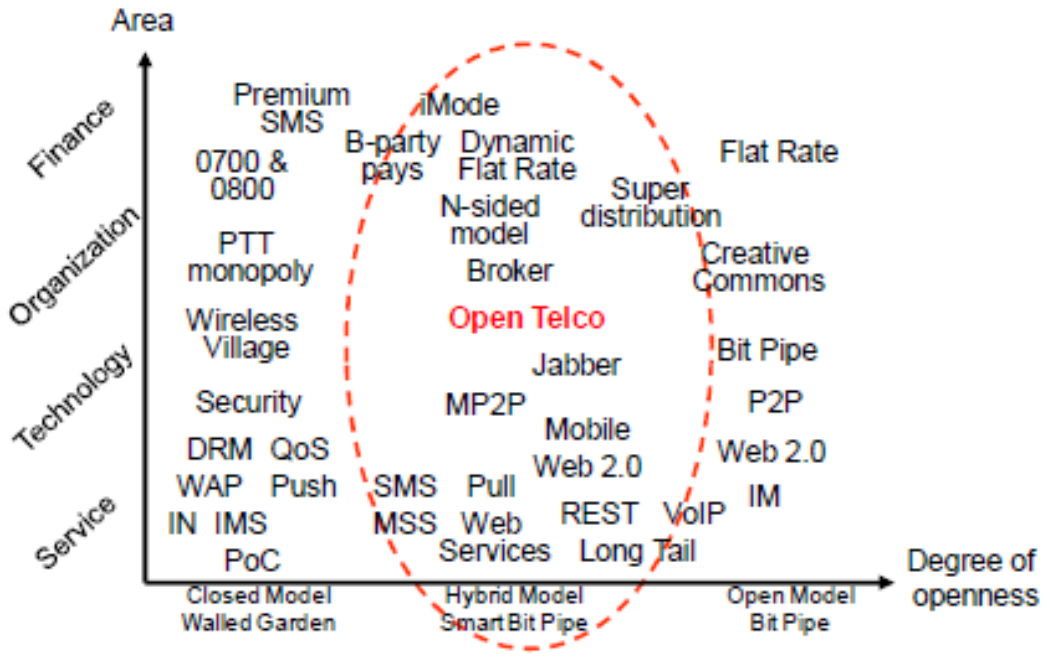

Fig.6: The Hybrid Model of Open & Closed Innovation Telco Model, Yrjo Raivio, 2011

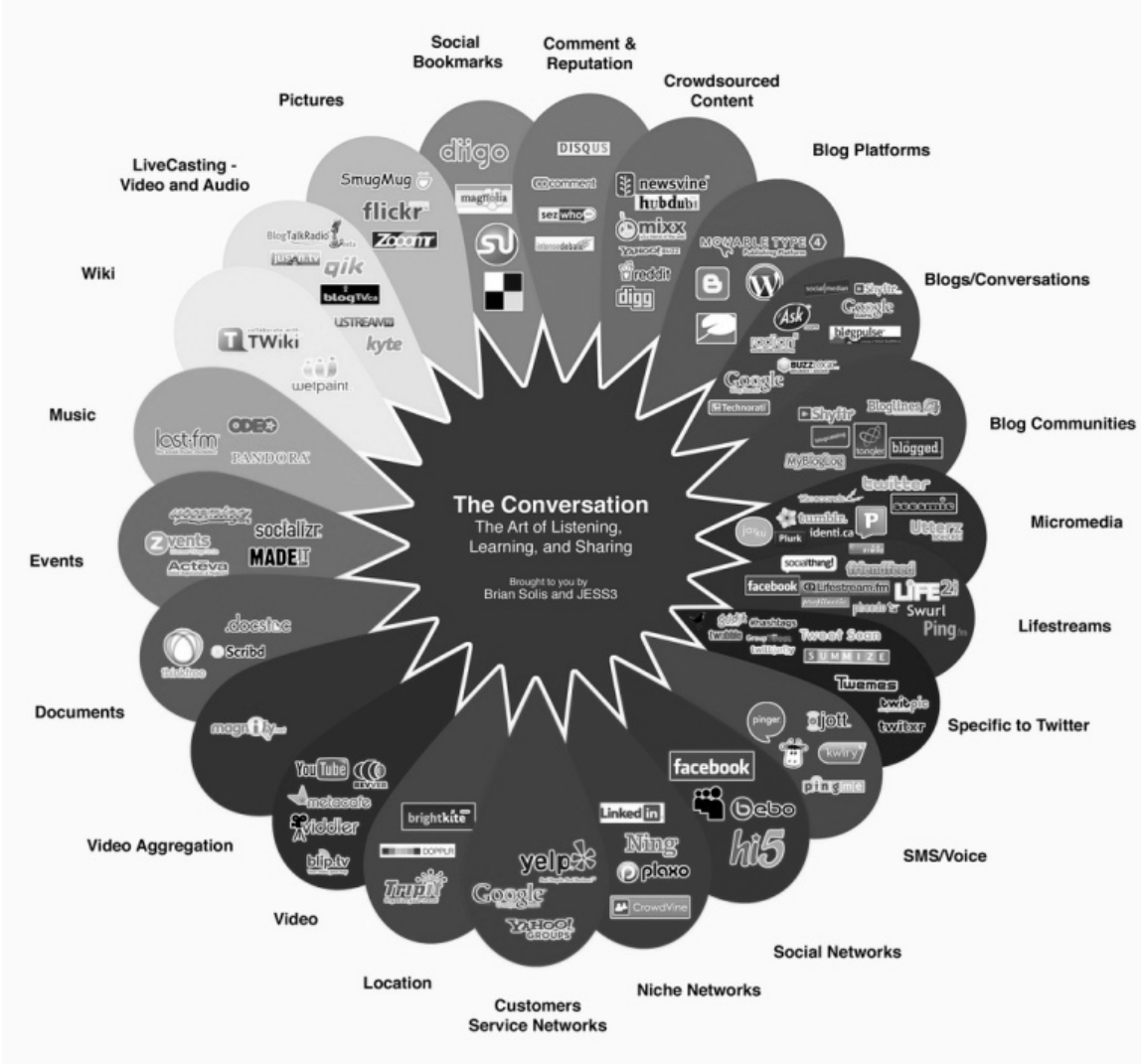

Fig.7: The Web 2.0 Array of Services Source: Solis, 2009

Web 2.0 is a concept which enables websites to turn into platforms for providing services. This energizes services to move up the value chain, engage an entire supply-chain of information and agent-based interactions to happen. SOA has been made feasible on the web with Web 2.0. The nature and kind of services that are possible with Web 2.0 is given in the figure. They cover a wide spectrum of possibilities. As Open Innovation increases and platform based systems increase, one can expect the Services to move further up the value chain.

5. Three Major Innovation Phases

In Open Business Models, organizations use both the approaches: "Outside-In" and "Inside-Out" across three major innovation process phases: Fuzzy front-end, Development and Commercialization (Docherty, 2006). In the Fuzzy front-end phase, the company looks externally for problems, solutions, resources, technologies, processes, expertise, etc. – everything that can become a basis for internal development and for external collaboration. The Development Phase deals with the acquisition of external innovations for further development, or spin-offs of non-core technology and Intellectual Property, external development and possible commercialization. The Commercialization Phase consists of acquisition of already commercialized and productized innovations or businesses, so that value can be realized immediately by adding these product lines, or on the other hand this phase consists of spinning off already commercialized technologies, where value can be better multiplied externally rather than internally.

6. Efficiency in the Open Business Model

Applying the New Trade Theory of the economist and Nobel Laureate, Paul Krugman in the context of Open Innovation, both Returns to Scale economics and Network Effect economics show promise. The Returns to Scale economic model shows an IRS (Increasing Returns to Scale) for a Firm's Production Function. With the downward pressure on Costs & Prices as described in Section I, the solution that Open Business Models provide in terms of an Efficiency Model can be described as follows.

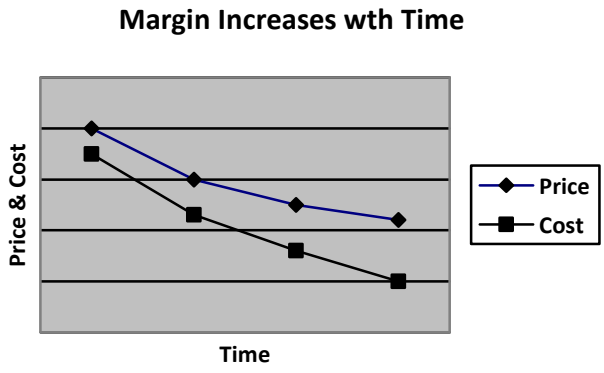

Fig.8:The Efficiency Model in Open Innovation

The Price and Cost of Services fall at different rates, owing to Innovations still keeping the prices viable and competitive for the Telecom Services able and competitive for the Telecom Services. This causes the margin to remain constant or even restructures the equation again. As (Yrjo Raivio, 2011) notes about the Telecom Operators in Finland – "In 2004 ARPU decreased significantly from 40 Euro to less than 30 Euro. All operators had a similar service offering. But on the other hand, the introduction of flat rate data subscriptions and new smart phones turned the data curve in a positive direction. Parallel to that the incumbent operators started to make acquisitions - MVNOs disappeared, price competition settled down, and incumbent operators started to increase prices." This stability was again challenged – "the Internet and telecommunication deregulation has started to disrupt the walled garden approach, leading towards more open models. Continuous experimentation is one of the secrets of the Internet success stories. Open APIs enable open innovation by attracting developers to work on the core assets. New services are created, tested and verified within short cycles. Service innovation is essential for mobile industry, too. New mobile services are needed to increase market segmentation based on open innovation and the Open Telco approach". The Network Effect economics increase slightly for a period of time, after which further innovation in the current day telecom industry are driven by new demands like Social Networking, Cloud Computing, Location Based Services, Mobile Money, etc. which provide positive network externalities. (Corina Pascu, 2009) argues that user-led innovation could be a significant paradigm shift for innovating products and services, particularly in the specific context of NGNs. (Nirmali Sivapragasam, et al, 2010) in their study of emerging Asia find that mobile money remittance services have the potential to extend services to those with limited access to traditional bank accounts and services, particularly those at the bottom of the pyramid, while also reducing transaction costs in terms of commission fees and transport costs.

There is convergence happening at the different levels – right from Infrastructure to end-user devices (smartphones, tablets, M2M devices, etc.) – (Sato, 2009). However if the Telco provider does not gear up to challenges, then the same Network Effect may work against the firm's interests in terms of negative network externalities, e.g. congestion, security problems, etc. These challenges and standards based frameworks & solutions are elaborated by the Tele-Management Forum (TMF). Open Standards based frameworks &

interfaces such as TMF Frameworx (earlier known as NGOSS – for Next Generation Operations Support System) have been evolved to address these. Enterprise software vendors such as Oracle (www.oracle.com) have developed TMF standards based OSS/BSS products which are deployed with Telcos worldwide and which interoperate with other software in the Telco's ecosystem. The problem is also being addressed at the Network Infrastructure level (Juniper, 2011). Juniper's PTX series Converged Aggregation/Supercore MPLS Switch and MobileNext Gateway gear up the infrastructure to enable Telcos to provide scalable, high valued, and platform based services. It is important that companies leverage the bandwagon effect (or positive feedback loop effect) by using all its resources and innovation capability as well as outside resources & capabilities. Peer-to-Peer computing & networks are a good technological example of this. With increase in Mobility, Cloud Computing and SOA, a lot of services will move online to the back-end (A. Barros and M. Dumas, 2006), and due to the Service-centric architecture, high-value services can be provided at a lower cost to the subscribers, who will not mind paying more to derive the higher value, for e.g. Enterprise Customers who wish to enable their Field work-force with Enterprise Mobility Applications, upscale smartphone users who wish to use mobile-money on the go. For Mobile Communications Services, the different business models are elaborated in (H. Bouwman, H. De Vos and T. Haaker, 2008), using the STOF Model (Service, Technology, Organization, Finance). In (Sato, 2009), the thesis is concerned with the business renewal and growth of the incumbent telecom operators after the downturn in the beginning of the 21st century. It investigates how traditional telecom operators such as British Telecom, France Telecom and Deutsche Telekom are developing capabilities and innovation processes to create and deliver new services. By decoupling the infrastructure layer from the service layer through adoption of Open Standards (Internet Protocol, NGN, Open APIs, Platform based approach), adoption of Customer Dominant & Service Dominant approach, and through Open Innovation/Co-Creation, these Telcos could provide a much better Value Proposition of Services in the market. They could unlock much more value from their infrastructure and alliances. This has been studied by (Sato, 2009) for 179 Telcos covering Europe, USA, Asia, Latin America, and the Middle-East. Enterprise Software products such as Communications Service Delivery Platform from Oracle greatly enhance a Telco's ability to provide new, scalable Services rapidly. It also helps in co-creation of

services with multiple parties, including partners, end-users, media, software and other Telcos. Apple's iCloud and iTunes are an example of this phenomenon.

7. Literature on Innovation in Telecom Services

Literature on Open Innovation for Services is still picking up as compared to Open innovation for physical products. Telecommunication is an area rich in services innovation. A telecom case study for the Norwegian Telecom Operator, Telenor (Per J. Nesse, 2009) describes Telenor's collaborations with external parties. (Carlos E. Y. Sato, DPhil thesis, Sussex, 2009) in his doctoral thesis explores how European Telecom Operators in general, and British Telecommunications (BT) in particular are changing, re-organizing themselves, and developing capabilities in order to remain competitive. In a related paper, (Carlos E. Y. Sato, IEEE, 2008) analyzes how innovation in services is being organized in the telecommunication industry after the bubble burst in the beginning of the 2000's and how incumbent European Operators like Deutsche Telekom, France Telecom and British Telecom are applying the concept of Open Innovation. This is more challenging for incumbent players when compared to the mobile operators and cable companies. The IP (Internet Protocol) is transforming telecommunications industry from its traditional PSTN (Public Switched Telecommunications Network) infrastructure. While this infrastructure transformation is in progress, another major challenge is service innovation: to change the way the traditional telecommunications operators create, integrate and deliver new services. Sato's paper finds that incumbent telecommunications firms will increasingly extract value from platform and software sharing, exposing its capabilities to third parties and developing business models to interoperate with other companies. Hence the ability to expose their services capabilities will determine an Operator's success. Therefore the concept of open innovation and value innovation will play a vital role in services in the communication industry. It is argued that platform innovation leads and facilitates service innovation in the telecom industry, and why it is necessary to build a platform-centric organization. There are major changes at the Communications infrastructure layer level too. The major Network Equipment Vendors such as Juniper, Cisco, Huawei, etc. have realized the value of Telcos' need to provide rich, value added services and platform based Services. Juniper's MobileNext Broadband Gateway, Control Gateway, and Policy Manager provides IP services including Deep Packet Inspection, Traffic Direct for Internet off-load, Carrier Grade NAT/Firewall, MPLS and Mobile Video

Optimization. Other important dynamic capabilities identified in this context, by the paper, are strategic planning, project management, new product/service development (especially software development), supported by systems integration. The evolution of the Partner Industry has been studied in various industry forums and some research papers. TeleManagement Forum (TMF) is a Telecom industry consortium that publishes industry standards for Telecom Operations Support Systems and reports on the evolution of the industry, both on the Operators side and the supplier's side. Collaboration for providing services is a key theme in the NGOSS/Frameworx (Next Generation OSS) architecture promoted by TMF, described briefly in a later section. The future of the telecom industry as envisioned by TMF is given in the next figure below.

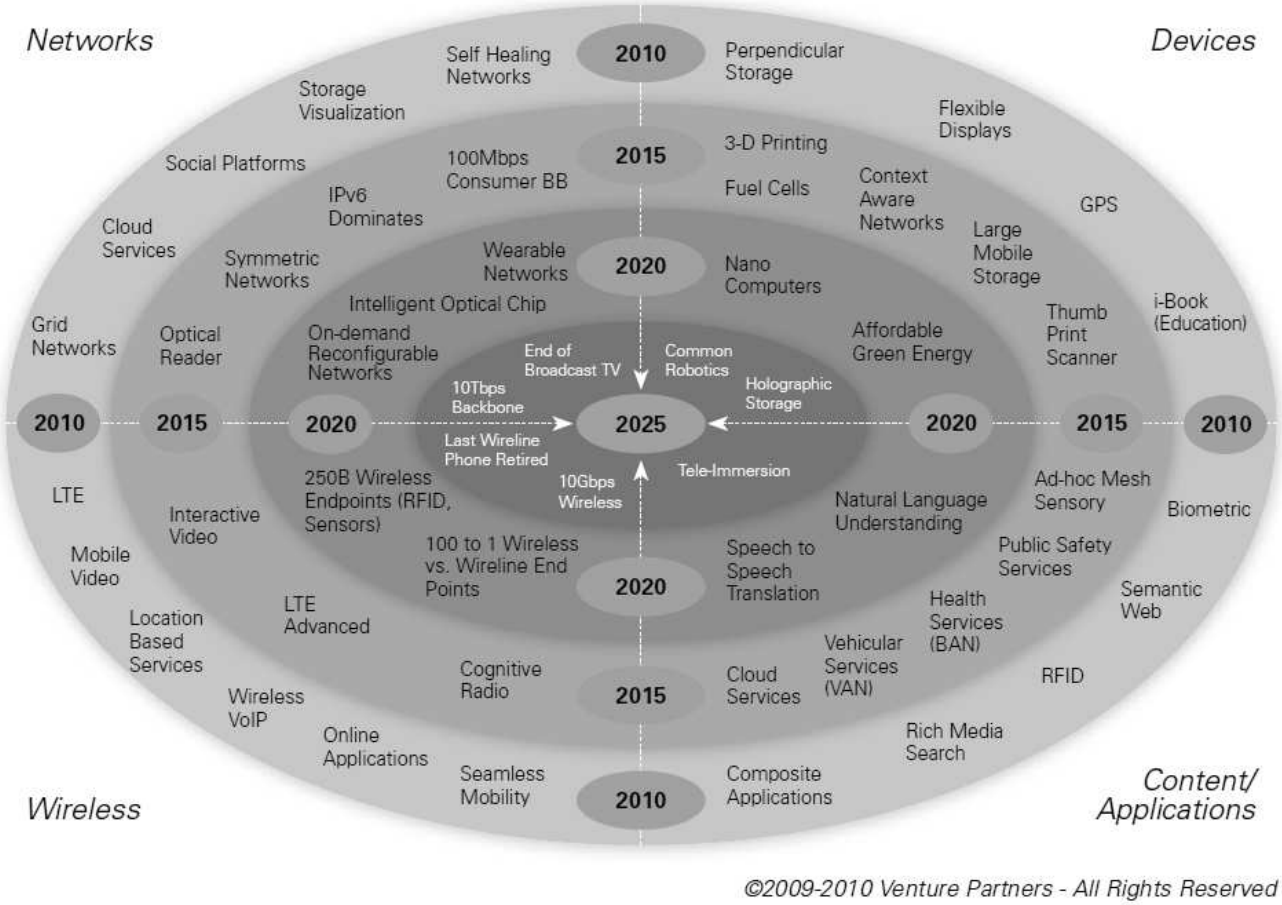

Fig.9: The 21st Century InfoComm ecosystem

8. The Telenor Case Study

In (Per J. Nesse, 2009), Telenor's case study is taken up. For Mobile Services, Telenor had already established 3rd Party Partnerships with several industries – Transport, Public, M2M, etc. Telenor played the role of an enabler and used the "Telenor Inside" approach to provide its telecom technologies and assets (GPRS, UMTS, EGDE, etc.) to enable 3rd Parties to develop innovative solutions for the industry. Nesse describes in his paper two examples of "Outside-In" approach that Telenor successfully adopted to tap the technology and creativity from outside partners to develop novel mobile service innovations: CPA (Content Provider Access) and the Playground model.

A. The CPA Model

The CPA model in Telenor involved standardizing the business model based on transparent revenue-sharing & incentives, and providing a services platform with standard software & configuration interfaces to the Content Providers. CPA provides access to all mobile end-users in Norway through horizontal cooperation of Telenor with other Telecom Operators. The CPA model generated $100 Million in revenue for Telenor alone (Per J. Nesse, 2009).

B. The Playground Model

To develop a wider array of innovative services to the international market, Telenor developed the Playground Model. This model offers an entire virtual Lab setup with a wide range of assets to all the 3rd Party service providers, all external developers and to all the groups in the Operating Companies in Telenor. It's a more loosely structured model compared to CPA. The innovations from Playground are lab tested and field tested before being taken up by the Operating Companies. The business model is then put together. There is no standard business model like CPA provides. The Playground primarily consists of a Showroom and a Lab. The Showroom allows partners to showcase their mobile services, and the Lab provides technologies, assets & tools to internal & external partners to develop & enrich innovative services. It also allows different parties to launch & test new services.

The successfully piloted ideas are then taken up seriously by the company, either on its own, or by exploring collaborations.

9. The British Telecom Case Study

In (Carlos E. Y. Sato, 2008), the paper explains the BT Case Study on how the organization transformed itself through innovation from a large traditional player to a platform-centric organization providing a variety of services & solutions. BT was an incumbent player. Post-Internet bubble of 2001 and the Telecom boom & bust scenarios of 1996-2002, the company had to transform itself. It had to innovate through the value chain and move to NGN standards (Next Generation Networks) of ITU-T.

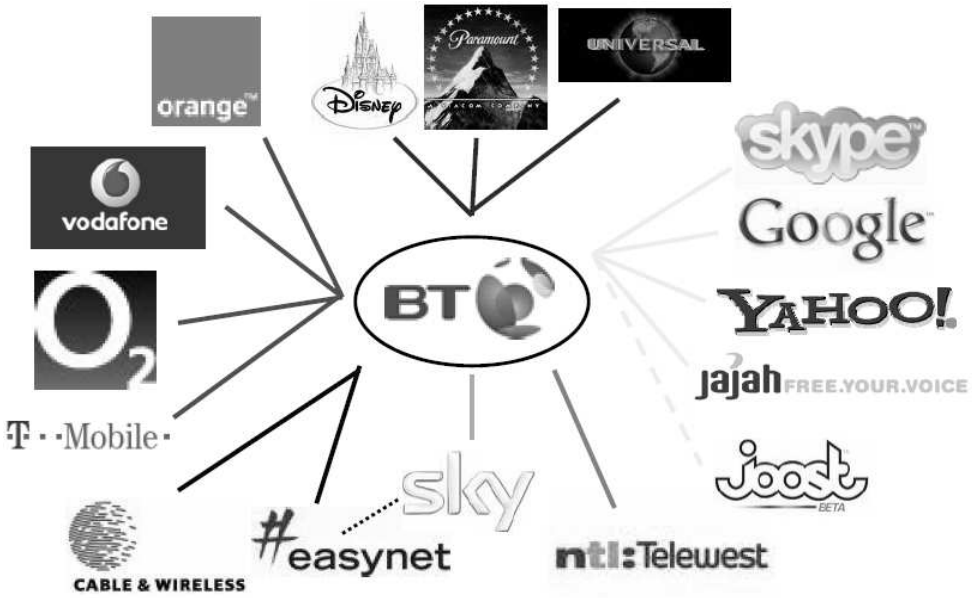

Fig 10: Incumbent Player - British Telecom

The paper describes how BT transformed itself into a platform centric organization by taking two major steps (Technological Changes):

- Adoption of IP (Internet Protocol) to be able to partner with, interface and provide services to Cable TV companies (like NTL, TeleWest), ISPs (Internet Service Providers like Yahoo, Google, Skype, etc.), Mobile Telecom Operators, Media Firms (like Disney, Paramount, Universal, etc.).
- Move from PSTN to NGN (Next Generation Networks), as per ITU-T.
- Move from Narrowband to Broadband

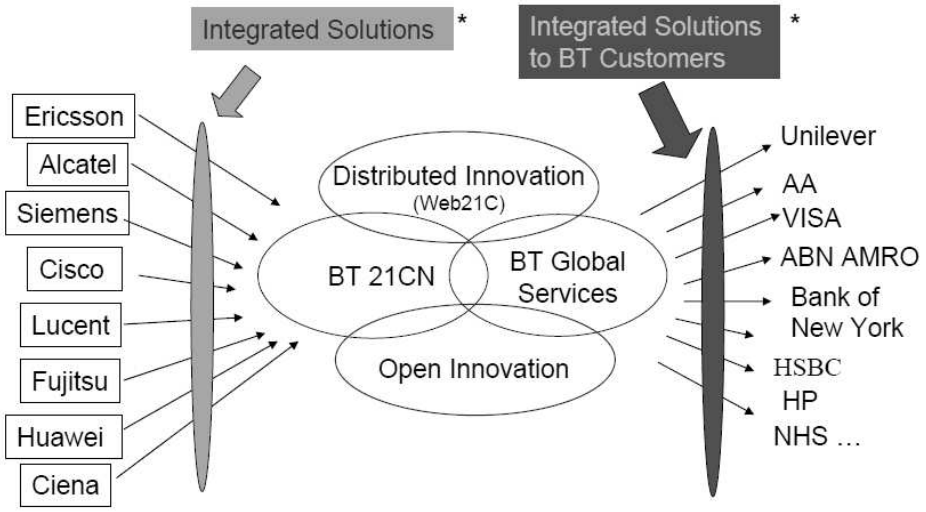

Fig.11 Organizing Innovattion at British Telecom

This approach is applicable to many large, incumbent Telecom Operators like AT&T, Telstra, BSNL, Etisalat, Deutsche Telekom, etc. The theoretical framework laid down in the paper shows how Services Innovation is at the top of the pyramid of a Telco Operator, and the innovation at the various levels serve to produce the outcomes listed on the right-hand side.

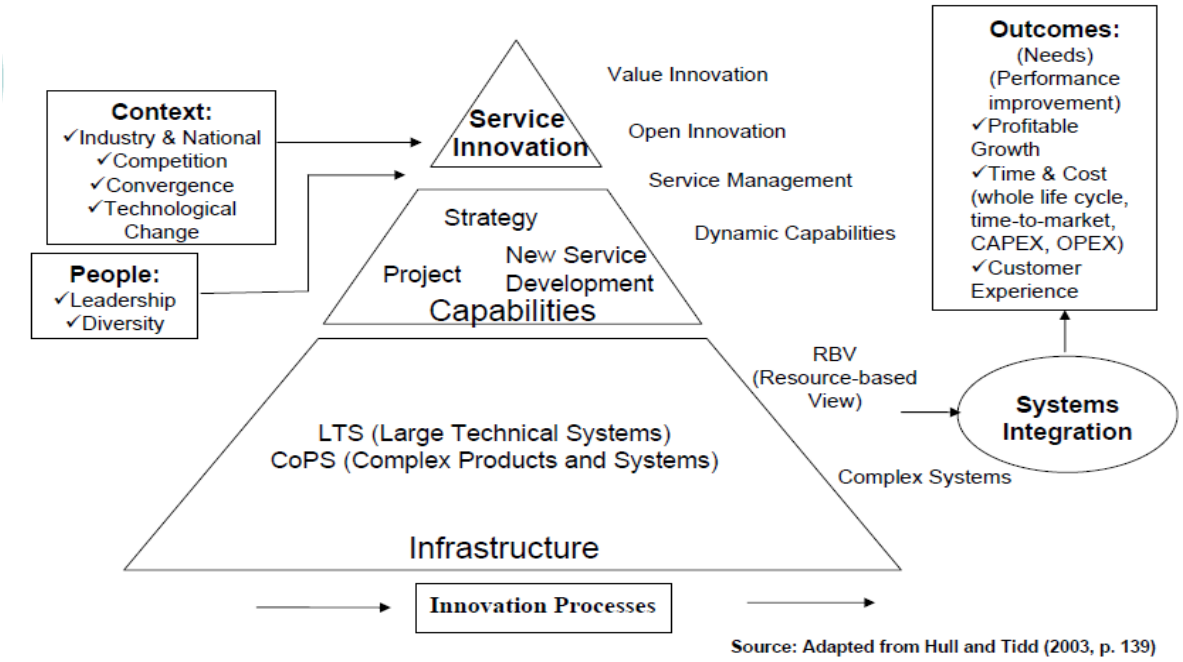

Fig.12 The Theoretical Framework for Telco Transformation towards its Next Generation Network

10. The Evolution of The Partner-Industry

With the rapid growth & evolution of Telecom infrastructure & technologies, we move from a world of voice and messaging to a world of content: apps, cloud, social media, connected homes, and the 'rise of the machine' (e.g. M2M – Machine-to-Machine). With onset of M2M even a simple, inexpensive communications devices can be put to use for providing very rich & wide array of services, when these services embedded in regular, familiar products. With the increase in the number of these smart devices, the unit price drops – meaning that as more and more smart devices become commercially viable, so the market undergoes an explosive growth (TMF Perspective – Innovation Revolution, 2011). Markets and opportunities increase in cloud services, mobile advertising, mobile banking, social networking, video content, e-books, mobile apps, e-retailing, and so on, will all push the fast expansion of the digital economy that shifts money and investment from traditional bricks and mortar to a communications-based world. Innovation will be the key to success at every level: Providing superior customer experience, service excellence, driving down costs, and innovation in developing new revenue streams & business models. Every Communications Company will need to reach out and partner externally to be able to do that. It simply cannot rely on its internal resources.

In a study done on partner companies producing Mobile Games (Rajala et al.), they analyzed the revenue logics and related product distribution models of four companies producing mobile games to the international market. The results indicate that the Telecom operators stand to benefit the most from the revenue models, even though the fast growing market offers a plethora of opportunities to agile software companies, the revenue models are governed by telecom-operators, who are currently reaping the largest benefits from the business. This is certainly a positive development for the Telcos, different from a scenario in which they were either locked into commoditized services, and were serving as mere pipelines for serving content and content specialists skimmed off most of the value.

11. TELCO 2.0

Telco 2.0 is an initiative by STL Partner Labs and is a collection of research, brainstorming and consulting services designed to catalyze change in the Telecoms-Media-Technology

sector. It is supported by the GSM Association and other organizations. They work on the following key strategy challenges in the Telecom industry:

- Overall Strategy: How is the digital economy evolving, what are the best strategic responses and the most profitable market opportunities?
- Voice and Messaging: How best to innovate core service offerings to add value and grow revenues?
- Data and Broadband: How to ensure incentives and rewards are better aligned across the digital content value chain?
- New Communications Services: How can latent telecoms capabilities be better exploited to address new market opportunities?

They recognize all the challenges that Telcos are facing, as outlined in this paper earlier, and believe that the future lies in unlocking value through innovation. The manner in which this is to be done is by adopting a 2-sided business model. Telecom's companies possess a whole host of assets that could be exploited much more to support new, sustainable market growth. The key, as they say, is for Telcos to create open platforms that help other service providers (enterprises, SMEs and government) interact with end-users in more efficient ways than they can today.

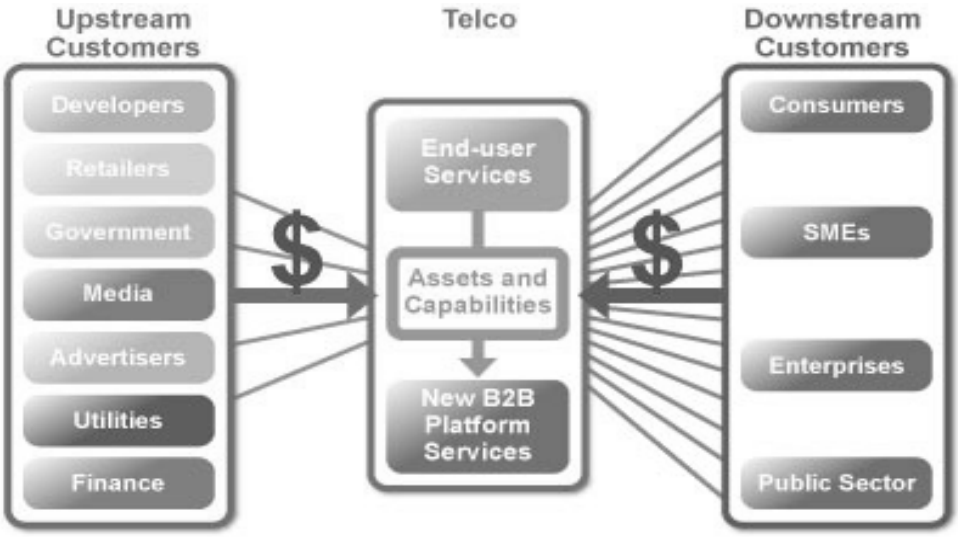

Fig.13 Telco 2.0 Model

Open innovation plays a vital role in making Telco 2.0 a success. Raivio concludes in his paper that that "The literature review supports the trend in increasing the number of open

APIs. Moreover, industry trends prove that openness is becoming a de facto in the telecommunications sector." (Yrjo Raivio et al., 2011). In the same paper they observe based on the case studies that "standardized APIs lower the integration costs". The GSMA OneAPI is an initiative in Canada to define a commonly supported API to allow mobile (and other network) operators to expose useful network information and capabilities to a Web application developers. It aims to reduce the effort and time needed to create applications and content that is portable across mobile operators. The Canadian OneAPI Pilot provides a single gateway for Web application developers to be able to use the OneAPI with all 3 of the major Canadian Operators in a commercial pilot. Currently APIs for Messaging, Location and Payment are available.Telco 2.0 calls this the 'two-sided' telecoms business model, delivering value to and generating revenue from 3rd party service providers as well as end-users. The 'two-sided' business model has consequences for the design of existing services such as conventional voice, messaging and data/broadband products and also creates opportunities to create new revenues and B2B Platform Services (Telco2.0 website). (D. S. Evans and R. Schmalensee, 2008) explores two-sided business models in detail, listing five critical factors for the size of the two-sided platforms: network effects, scale economies, congestion, platform differentiation and multi-homing. In general, Telco 2.0 also relies on collaborations, partnerships and Open Innovation.

12. GDL, SDL & CDL

In the process of value creation, customers are more interested in the solutions rather than isolated products which they need to integrate into their business on their own (Brady, 2005). Suppliers offer services in the form of integrated solutions and customization, combining their own products/ goods and services with others from 3rd Party suppliers (Davies et al, 2001, 2003, 2004).

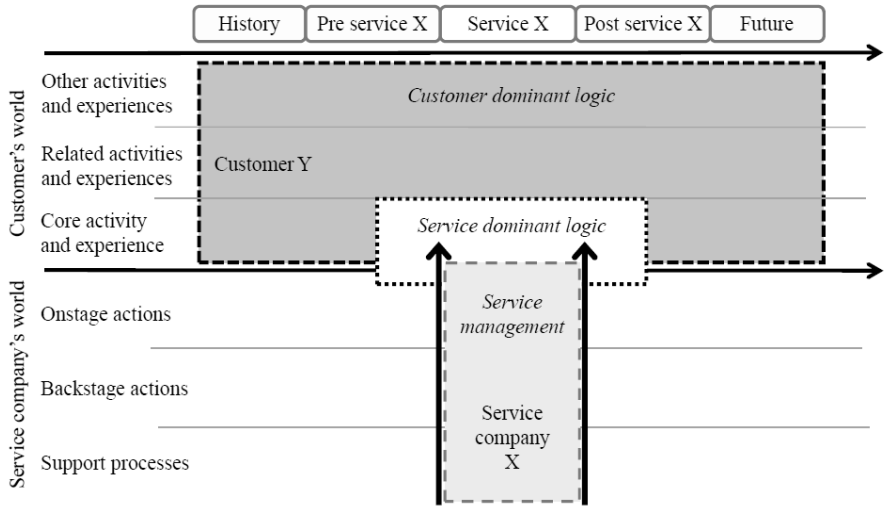

Fig.14 CD logic of service contrasted with service management and SD logic (Heinonen, 2010)

Hence the focus of the firms and suppliers is on the Services as the dominant activity supported by goods & products rather than the other way round. This is the essential difference between Service Dominant Logic (SDL) and Goods Dominant Logic (GDL). In Open Services Innovation, in the driving framework offered (Chesbrough, 2011), the first foundational concept is to think of business (whether a product or a service) as an open services business in order to create and sustain differentiation in a commodity trap world. In (Heinonen, 2010), they go further and propose that Customer Dominant Logic (CDL), i.e. rather than Provider Dominant Logic is the main key to making the business customer centric. "The customer's logic is proposed as the foundation of a CD marketing and business logic. Consequently, the centers of interest are not exchange and service as such, but how a company's service is and becomes embedded in the customer's contexts, activities, practices, and experiences, and what implications this has for service companies". They note that from the customer's point of view, service contains three elements:

- Outcome of service provider's internal activities
- Co-creation processes & their outcome elements
- Process & outcome elements of the customer's own activities

Co-creation is considered as an element of service by creating part of the customer's experience. They analyze the nature of co-creation of service relative to three issues – value creation, involvement and control. The other aspects examined are the Value-in-Use especially relative to Visibility. The Customer Experience is studied from many perspectives. They suggest that a broader perspective is needed of Customer Experience, and argue that "one should not study only one company, because the customer may be linked to several companies". Hence customer experience is examined from the angles of scope and character.

Table 4: The Provider Vs. CD Logic of Service (Heinonen, 2010)

	Provider Dominant Logic	**CD Logic**
Co-Creation		
Involvement	Customer involved in Co-Creation	Company involved in Customer Activities
Control	Company controls Co-Creation	Customer controls value creation
Value-In-Use		
Visibility	Focus on visible interactions	Also considers invisible and mental activities
Customer Experience		
Scope	Formed within the services	Emerges in the customer's life
Character	Extraordinary and special	Also mundane and everyday

Applying these concepts to Telecom Service Providers, they need to get engaged and involved with the subscribers (both end-users and enterprises) and move towards lifestyle management, business management, e-governance, etc. as the case may be. With the advent of smart phones, rich applications, unprecedented access and computing power in the hands of 4 billion consumers, communication infrastructure, bandwidth, and cloud services, it is possible to touch and transform every aspect of the lives of people and of businesses. These will also necessitate innovative collaborations. For example, mobile money will bring together Telcos, banks and merchants to create value propositions for users and stakeholders. The emphasis for Telcos is on delivering personalized services. "In the miasma of all the technological jargon, people often lose sight of a fundamental consequence of the march of mobile money. At stake is nothing less than the future of money as we have understood it for centuries" (Pitroda, 2010). Ranging from fundamental

services of e-governance – such as food, sanitation, education, healthcare to advanced ones like global facilitation of micro-loans and micropayments, Telcos have abundant opportunities to transform lives and businesses. Cloud Computing facilitates provision of Software as a Service (SaaS), Knowledge as a Service (KaaS), Process as a Service (PaaS), Infrastructure as a Service (IaaS), etc. collectively known as XaaS. Oracle's Elastic Cloud is a very successful example of this. The power of all technological advances made in developing intelligent computing, enterprise computing, information & communications technology, storage, and end-user devices are all now available for use by the end-subscriber. SDL and CDL come into play in a very powerful & intelligent manner. (Sato, 2008) adapted Klingman-Brundage, 1995 model pertaining to theoretical framework for Data Collection and Analysis for a Platform-driven strategy described earlier. It's described in the figure below.

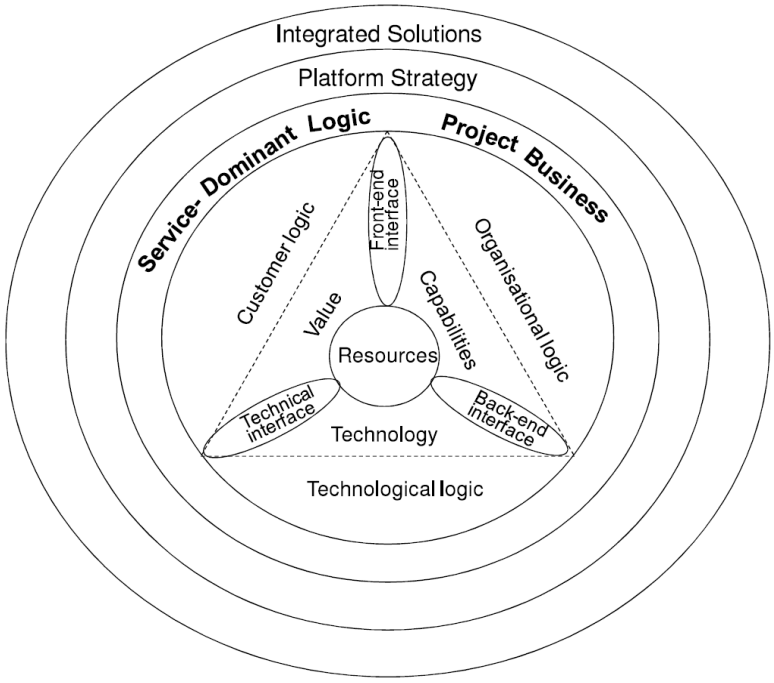

Fig.15 Towards the Theoretical Framework for Data Collection & Analysis Including Integrated Solutions (Adapted by Sato, 2008 from Kingman-Brundage, 1995)

(Sato, 2008) elaborates on the above approach in which firms need to collaborate with third-parties to achieve the goal of providing integrated solutions for the customer's needs. Thus integrated solutions can be considered as Open Business Models where value is

created, captured and leveraged through the combination of external and internal resources (Chesbrough, 2006). "The construct of integrated solutions is offered as a higher-order service strategy supported by platforms (rather than individual goods & services), which can be built on or further deployed (in integrated solutions) through projects acting on resources and capabilities in a Service Logic dominant environment to promote service innovation" (Sato, 2008). This combines the concepts of SDL and the platform strategy outlined in Telco 2.0. However this does not fully take into account the CDL described in (Heinonen), or fully the Open Innovation in Services published by Chesbrough later in 2011. These are potential areas for further study.

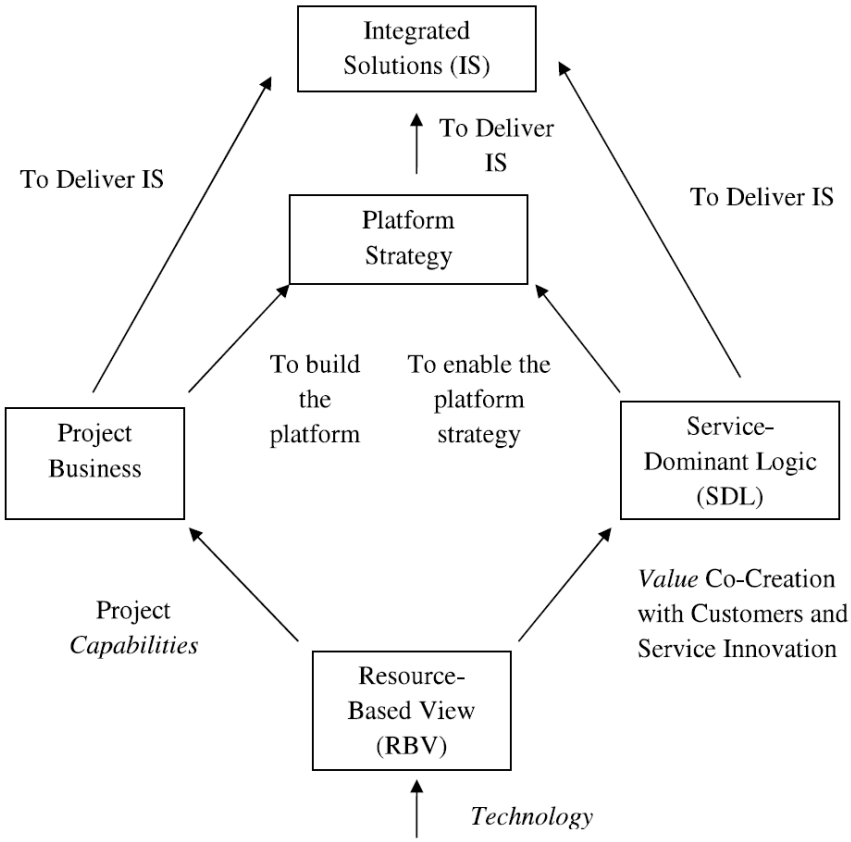

Fig.16 Elaboration of the Framework given in earlier figure (Sato).

13. Enablers, Catalysts and Differentiators

Until a few years ago, the Telecom operators were providing only basic services such as voice, and some basic messaging. They had little lee-way for innovation other than in the form of Rate Plans (Pricing). There was not much scope for innovation in quality, customer-

service, etc. because quality of voice was treated as a basic commodity. Certainly, differentiation among the operators was difficult. In terms of customer-service also, beyond establishing a basic level of customer support centers, who could handle customer complaints, there was very little that Telecom operators could do in terms of differentiating themselves from their competitors. The only possible innovation was on Pricing Models and price plans. But however much the companies tried to offer different rate plans, the prices were on the decline, and structure was tending towards a flat-fee. Even an internet access from a mobile phone could only reflect as a charge on the customer's bill in terms of data bits transferred. As mentioned earlier in this paper, the operators faced falling Voice Revenues and temporary growth in Data Revenues that could stagnate, Content Revenues, most of whose share went to the Content Providers and not the telecom operators. With the introduction of internet access, then a few more revenue models emerged, surrounding content, such as Ringtones, videogames, music downloads. The real change started happening due to Web 2.0, 3GPP Standardization on the Service Layer APIs, Social Networking and SOA (Service Oriented Architecture). The next wave of innovations will be platform-centric. Telecom Networks hold a lot of potential when combined with Internet Services to unlock the Long Tail of Services (Chris Anderson). In his Master's thesis (Marc Schaer, 2008) attempted to answer the following questions:

- What are the unique capabilities that operators could expose?
- What are possible services that could emerge out of the "long tail"
- What are different innovation sources and how could they be unlocked?
- What are viable business models to capture revenue from this new domain?
- How would a possible technical architecture look like?
- Does this all have an impact on the operator internal organization?
- Could certain parts be shared among non competing operators (services, infrastructure)?

Based on his research, he proposed the following innovation model for small-size Mobile and Full Service Telecom Operators in Western Europe, especially where the markets are saturated. He collected and used data from the Swiss Markets. To unlock the Long Tail of Services (Chris Anderson), Marc proposed using Open Business Models (Chesbrough). He proposed an architectural change to move from the different silos that

Mobile and Landline infrastructure and services that they operated in, to an integrated service stack (horizontal architecture). The same thoughts are widely prevalent in the industry and today every Telco is striving to move in this direction.

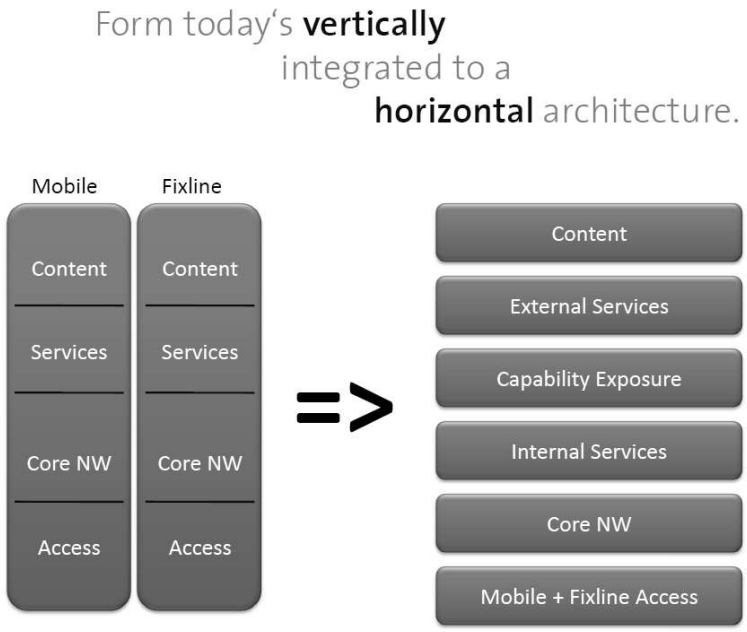

Fig.17 Moving From a Vertically Integrated Archtecture to a Horizontal Architecture, Schaer

For Open Innovation and building partner networks, the sources of Innovative ideas were explored by many companies, such as IBM. The results of the 2006 Report of IBM is given in the figure below.

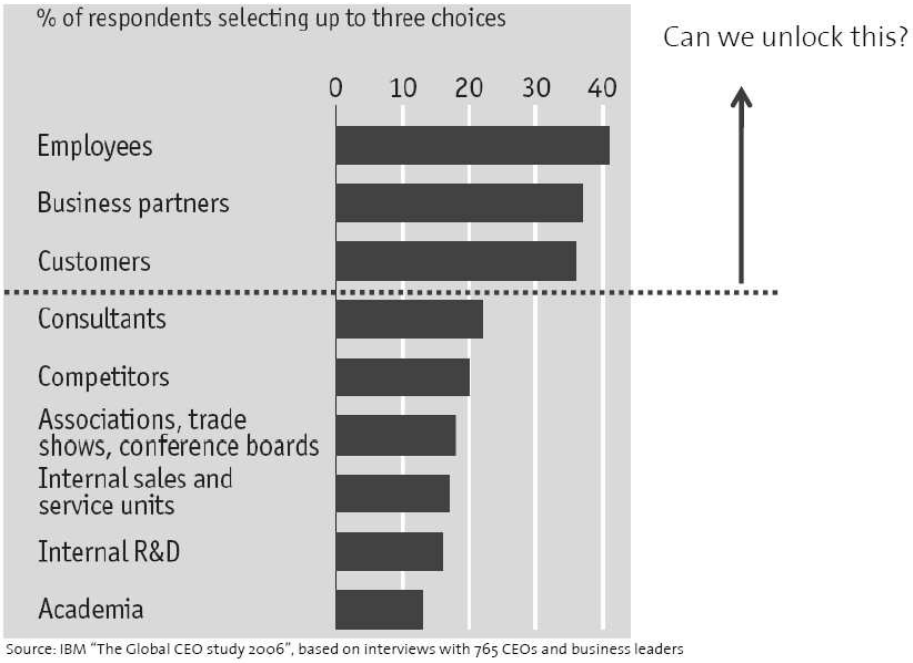

Fig.18 Source IBM – The Global CEO Study 2006, based in interviews with 765 CEOs and Business Leaders

Bringing together the concepts of Web innovations like Mashups, Chris Anderson's Long Tail and Chesbrough's Open Business Models in order to build Telco 2.0, Schaer proposed the following technology innovation model that Telcos could adopt.

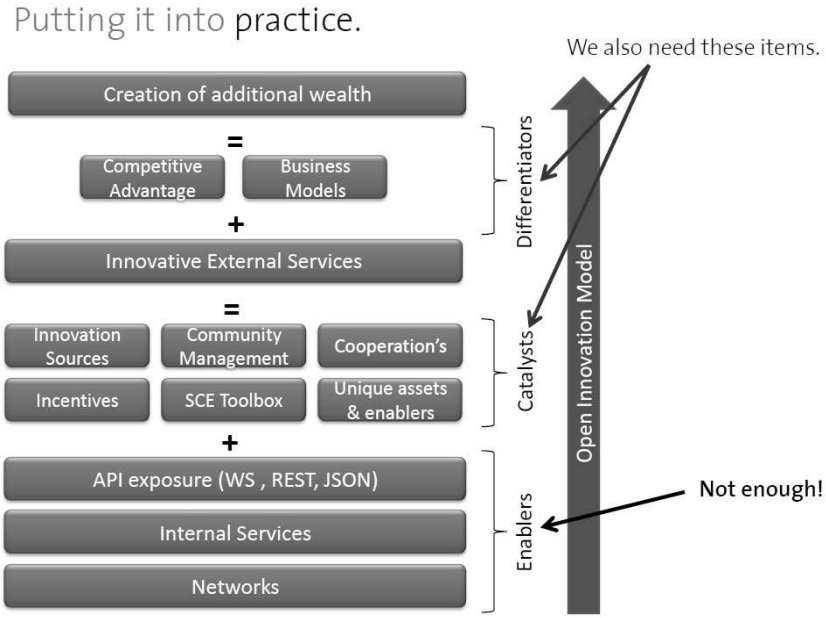

Fig. 19 A Proposed Technology Innovation Model, Schaer

There are not only Technology Enablers like the Network infrastructure, Internal Services and Services exposed through APIs (like Web Services, REST, etc.), but above that there is the next layer comprising of Catalysts – like Community Management, Partnerships, Toolboxes, Labs, etc. which Catalyze the adoption & growth of the services. All this is driven from the top – the layer of Differentiators – the Business Models and Competitive Advantage based on which the entire Service Ecosystem is built. Marc Schaer's work was very limited in scope, owing to its being a Master's thesis, concentrating largely on the technology aspects, and restricted to Switzerland (extendable to Western Europe), and mainly addressing saturated economies, not growth markets like Asian countries.

14. Telecom Forums and Standards

Telecom Forums and Standardization play an important role in driving innovation forward. There are several industry forums and consortiums, but the largest ones that drive the Telecom Industry are:

- ITU-T (International Telecommunications Union – Telecom)
- TMF (Tele Management Forum)
- OMA (Open Mobile Alliance)
- TIA (Telecommunications Industry Association)
- IEEE (The Institute of Electrical & Electronics Association)
- ITS (International Telecommunications Society)
- GSMA OneAPI Initiative in Canada

A few other influential Telecom forums/News/Analyst organizations are:

- Ovum
- Analysys Mason
- MoMo (Mobile Mondays)
- Telecom Asia

A few India specific organizations are:

- COAI (Cellular Operators Association of India)
- ISPAI (Internet Service Providers Association of India)
- ICA (Indian Cellular Association)
- AUSPI (Association of Unified Telecom Service Providers of India)

- IMAI (Internet & Mobile Association of India)
- Centre for Telecom Management Studies

These industry organizations aim to simplify the complexity of running a Telecom business, and serve as unifying force in the industry. They establish themselves in the role of thought leaders and work across countries and continents to critical business issues through access to a wealth of knowledge, intellectual capital and standards. The forums provide a unique, fair and safe environment for the entire value-chain to collaborate on pressing industry issues, helping companies of all sizes gain a competitive edge and the flexibility and speed they need to underpin future growth (TMF). As a good example, TM Forum's Frameworx Architecture provides a mature integrated business architecture that brings together the Service Providers and the Suppliers to enable them to collaborate in providing rich & complex services in a sustainable and scalable manner.

The OMA – Open Mobile Alliance is a Standards body which develops Open Standards for the Mobile Industry. The OMA standardizes applicative protocols, so that OMA specifications are meant to work with any cellular network technologies being used to provide networking and data transport. These networking technology are specified by outside parties. In particular, OMA specifications for a given function are the same with GSM, UMTS or CDMA2000 networks. The advantage in doing this is that the Telcos can roll out services to a much larger subscriber base without worrying about the interoperability caused by technology or networks.

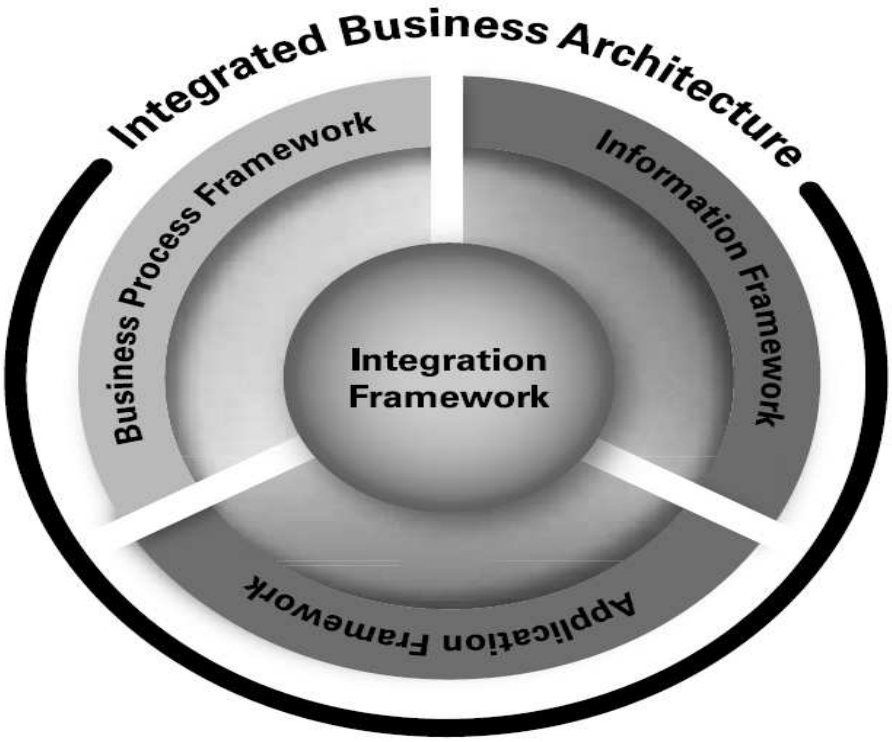

Fig.20 TM Forum's Frameworx Integrated Business Architecture

They may launch platform-based services, for example, that different subscribers (even of another operator) can plug-in and interact seamlessly. Standards are very powerful in driving future innovation, especially Open/Network Centric Innovation Models.

15. Literature Gaps

There is a growing body of literature in Open Innovation and Open Business Models since the past 10 years. Most of the literature has focused on product innovations. Only recently, since the past 3 years, has Services Innovation come into focus. With regard to the Telecom sector, some academic research work has been done in Services innovation pertaining to open platforms for services development and delivery. However there is not much empirical research on how Open Innovation & Open Business Models have actually helped in improving the Telecom Sector.

The existing research literature has gaps in the following areas:

a) The prevalence of Open Innovation & Open Business Models in the Telecom Sector world-wide

b) The specifics of application of the Open /Network Centric Innovation models for the Telecom Sector

c) The effect of implementing the Open/Network Centric Innovation Models , on the Telecom Operators

d) Observations and Recommendations based on empirical findings

In general, an empirical approach to analysis is missing in the existing literature. Furthermore, there is less literature on the Telcos in the growth economies such as the BRIC countries. Analysis both at the firm level and division level are very sketchy. There are an abundant number of articles, white papers and trends by industry analysts and forums outlining the trends and factors in play, but real research papers in ranked journals are very few and dated.

16. Conclusions and Areas for Further Study

From the literature, it is evident that Open Innovation can play a significant role in the transformation and growth of Telcos. Many industry and research forums such as TeleManagement Forum, The Open Group, Open Mobile, etc. have evolved frameworks and platforms to enable successful implementation of Open Innovation based models. For example, the Telco operators need to find innovative ways to monetize mobile traffic. They can do this by unlocking the long tail of services. By working out Open Business Models, they can enter into innovative partnerships with Content Providers or Content Owners, for example. They can also launch platform-based services to enable co-creation with different parties – including end-users, other Telcos, media & content owners, etc. There is an explosive growth in Value Added Services provided by Telcos. The markets, both on consumer side and the enterprise side are responding well. Public Cloud Services, i.e. software that is hosted in back-end servers instead of an end-consumer's computer are expected to grow four times faster than the spending on overall IT Sector in 2011 (Gartner Report 2011). This is a huge opportunity for Telcos, on whose infrastructure these services will need to rely on, to be able to provide remote services. Furthermore, Telcos can target consumers and directly provide high valued content and services to them. This can be done through open collaboration wherein they include end-consumers in the entire value chain right from content creation to marketing. For Location Based Services, for example, the

end-user's preferences and activity & consumption patterns can be analyzed to provide highly relevant content and services. Data & Mobile traffic can be analyzed at different levels in order to target different services and content to subscribers. Deep Packet Inspection – DPI can analyze and determine the kind of traffic in the network, based on which different premium rates can be charged for applications utilizing high bandwidth. Whereas data synthesized from simple usage and configuration such as mobile travel patterns, consumption signatures, etc. can lead to more intelligent targeting of services, with bundled & flexible charging. Network Equipment vendors such as Juniper have also realized the value of these forces and have implemented the enabling features right into the Network Infrastructure (Juniper, 2011). Mobile Money will revolutionize the wealth creation & distribution around the globe. In countries like India, there are more mobile phone subscribers than bank accounts. Most banks will look at the growing mobile channel to increase their network and transaction volume (Pitroda, 2010). Mobile Money could play a big role in expediting the delivery of public services (e-governance) including clean air, water, food, sanitation, transportation, energy, housing, primary healthcare, education, law & order, and justice. Using the 80/20 rule, it can optimize the delivery of the top dozen or so services that have the highest impact on citizens on a daily basis. In all of these, Open Innovation and Open Business Models will be the driving forces, potentially creating employment and entrepreneurship opportunities.

Further study can be done on how Telecom Operators are embracing Open Innovation & Open Business Models - the consequent benefits they're enjoying, and the transformation brought about. The different innovative collaborations being done by the Telcos worldwide can be studied to see whether Open Innovation is leading to improvement in the ROI, growth and profitability of the Telcos. It can also be studied whether Open Innovation is leading to new business models, revenue streams, sustainability and increase in market share in different segments.

REFERENCES

A. Barros and M. Dumas, "The Rise of Web Service Ecosystems", *IEEE IT Professional*, 8(5), 2006, pp. 31-37.

Barney, J. B. ,"Firm Resources and Sustained Competitive Advantage",*Journal of Management*, 1984.

Barry Eichengreen and Poonam Gupta, "The Service Sector as India's Road to Economic Growth?", *Indian Council for Research on International Economic Relations*, April 2010.

Blog for Open Innovation by Researchers from Gothenberg: www.openinnovationgbg.se

Boston Consulting Group, "Measuring Innovation", *BCG Senior Management Survey*, 2006.

Business Models about the web available from: http://digitalenterprise.org/

Carlos Eduardo Yamasaki Sato, "*Organising innovation in services: The case of telecommunications next generation networks (NGN), IEEE, Innovations in NGN: Future Network and Services",* 2008. K-INGN 2008. First ITU-T Kaleidoscope Academic Conference.

Carlos Eduardo Yamasaki Sato, "*Building the Network As a Platform for Integrated Solutions and Service Innovation in the Transition to the Next Generation of Telecommunications: The Case of BT*", PhD Thesis submitted to SPRU (Science and Technology Policy Research), University of Sussex, September 2009.

Chris Anderson, "*The Long Tail*", RH Business Books.

Chris Anderson, "*Free: How today's smartest businesses profit by giving something for nothing*", RH Business Books.

C. K. Prahalad and Venkatram Ramaswamy, "The Co-Creationn Connection", *Strategy and Business Review*, summer 2002.

C. K. Prahalad and Venkatram Ramaswamy, The New Frontier of Experience Innovation", *Sloan Management Review*, summer 2003, winner of MIT PriceWaterhouseCoopers Award for Best Article in 2003 that contributed to the enhancement and advancement of management practice

C. K. Prahalad, "The Future of Competition", *Harvard Business School Press*, 2004.

Clayton Christensen, "The Innovator's Dilemna", *Harvard Business School Press.*

Clayton Christensen, "The Innovator's Solution", *Harvard Business School Press.*

Corina Pascu, "User-led, citizen innovation at the interface of services", VOL. 11 NO. 6 2009, pp. 82-96, Emerald Group Publishing Limited, ISSN 1463-6697, *European Communities*, 2009.

Creative Commons website: www.creativecommons.org

C. Reidl, T. Böhmann, J. M. Leimeister and H. Krcmar, *"A Framework for Analysing Service Ecosystem Capabilities to Innovate*", Proceedings of the 17th European Conference on Information Systems, Verona, Italy, June 8-10, 2009.

Daniel Fasnacht, "Open Innovation in the Financial Services", *Springer*, 2009.

"Designing Virtual Customer Environments for New Product Development: Toward a Theory", *Academy of Mangagement Review*, 2002.

Docherty M., "Primer on Open Innovation: Principles and Practice", PDMA Vision, April 2006.

D.S. Evans and R.Schmalensee, "Markets with Two-Sided Platforms", *Issues in Competition Law and Policy* (ABA Section of Antitrust Law 2008), chapter 28, 2008, pp. 667-693.

Forrester Research, "Service Oriented Architecture", *Forrester Research*, 2007.

For the term Service, we refer to the ISO 9004-2 (1991) Quality Managemnt and Quality Systems Element – part 2: Guidelines for Services (Online). *Internatinal Organization for Standardization*, http://www.iso.org

Frank Pillar's website on Mass Customization, Customer Co-Creation and Open Innovation: http://www.mass-customization.de/

GSMA – One API Standard , Canadian Government Initiative - http://canada.oneapi.gsmworld.com/

H. Bouwman, C. Carlsson, P. Walden and F. J. Molina-Castillo, "Trends in mobile services in Finland 2004-2006: from ringtones to mobile internet", *Info*, vol. 10, no. 2, Emerald Group Publishing Limited, 2008, pp. 75-93.

H. Bouwman, H. De Vos and T. Haaker (eds), Mobile Service Innovation and Business Models, *Springer-Verlag Berlin Heidelberg*, 2008.

Henry Chesbrough, "Open Business Models: How to Thrive In the New Innovation Landscape", *Harvard Business School Press*, 2006.

Henry Chesbrough, "Open Innovation: The New Imperative for Creating & Profiting from Technology", *Harvard Business School Publishing*, 2006.

Henry Chesborough, "Open Innovation", *Harvard Business School Press*, 2006.

Henry Chesbrough, "*Open Services Innovation: Rethinking Your Business to Grow and Compete in a New Era*", Book published by Jossey Bass, January 2011.

IBM Global CEO Study, 2006 – Interviews with 765 CEOs and Business Leaders.

Jeff Howe, "The Rise of Crowdsourcing", *Wired*, June 2006.

Jerome Adda and Marco Ottaviani, London Business School, "The Transition to Digital Television", January 2005, *Economic Policy*, Vol. 20, No. 41 (Jan., 2005), pp. 159+161-209, Centre for Economic Policy Research, Wiley Blackwell.

Juniper Corporation - www.juniper.com – Juniper's MobileNext.

"Kano's methods for understanding customer-defined quality", *Center for Quality Management Journal*, Special Issue, Fall 1993.

Kelen A.,"Telephony in an era of Network Cornucopia – Strategic Considerations on the Declining Value of Proprietary Networks", *Acta Oeconomica*, Vol 55, No. 1 (2005), pp 23-42, Published by Akademiai Kiado.

Kirchbaum Robert, 2005, "Open Innovation in Practice", *Research-Technology Management*, July-August 2005.

Kristina Heinonen, Tore Strandvik and Karl-Jacob Mickelsson, "A customer-dominant logic of service", *Journal of Service Management*, Vol. 21 No. 4, 2010, pp. 531-548

McKinsey, "*How Companies Approach Innovation*", 2007.

McKinsey, "Leadership and Innovation", *McKinsey Quarterly*, 2008.

Michael Sapien, "Telco 2.0 Lessons Learned", *Ovum*, June 2009.

Ministry of Finance, Government of India, "*Economic Survey 2009-10*", http://indiabudget.nic.in/es2009-10/chapt2010/chapter.zip

Morgan Swink, "Building Collaborative Innovation Capability", *Research Technology Management Journal*, March 2006.

Nirmali Sivapragasam, Aileen Agüero and Harsha de Silva , "*The potential of mobile remittances for the bottom of the pyramid: findings from emerging Asia*", LIRNEasia colloquium, 2010, Emerald Group Publishing.

OECD Report on "*Open Innovation in Global Networks*", 2008

Oracle Corporation – www.oracle.com

P. Ballon, "*Control and Value in Mobile Communications: A political economy of the econfiguration of business models in the European mobile industry*", PhD thesis, Vrije Universiteit Brussel, 2009.

Per J. Nesse, *Open service innovation in telecom industry – case study of partnership models enabling 3'rd party development of novel mobile services*, Telenor Research & Innovation, Service Innovation Group, 2009.

Peter Hall, "Cloud Computing Strategies of Global Telcos", *Ovum*, July 2010.

PhD Thesis of Jose Maria Del Álamoramiro, "*Contribution to Operation Support Systems and Service Management Architecture For User-Centric Telecommunications Services over Next Generation Networks*", Madrid Polytecnic University, 2009.

Risto Rajala, Matti Rossi, Virpi Kristiina Tuunainen and Janne Vihinen Technology, "*Revenue Logics of Mobile Entertainment Companies – Observations from Companies Producing Mobile Games*", May 2007.

Sam Pitroda and Mehul Desai, "The March of Mobile Money", *book by Collins Business*, 2010.

Satish Nambisan and Mohanbir Sawhney, "*The Global Brain*", Wharton School Publishing, 2008.

Sawhney, Prandelli and Verona, "The Power of Innomediation", *MIT Sloan Management Review*, 2003.

Senge P., "The Fifth Discipline: The art and practice of a learning organization", *Currency Doubleday*, New York, 1990.

Service Sector in India, Government Website: http://business.gov.in/Industry_services/services_sector.php

"Success Factors in Developing New Business Services", *European Journal of Marketing*, 1993.

Sundbo, J., "Managiement of Innovation in Services", *The Service Industrial Journal*, 1997

TeleManagement Forum, www.tmforum.org

The Open Source Initiative, www.opensource.org

The Open Group - www3.opengroup.org/

The World Economic Forum Annual Meeting, "*The Power of Collaborative Innovation*", January 2008.

TMN Perspectives, "The Innovation Revolution", *TeleManagement Forum*

Venkat Ramaswamy and Francois Gouillart, "The Power of Co-Creation", *book by Free Press*, 2010.

Wernerfeld, B., "A resource-based view of thte firm", *Strategic Managemnet Journal*, 1984.

Y. Raivio, S. Luukkainen and A. Juntunen, "Open Telco: A New Business Potential", Proceedings of the 5th ACM Mobility Conference 2009, ACM, *Nice*, France, September 2-4, 2009.

Yrjo Raivio, Sakari Luukkainen, Saku Seppälä, "*Towards Open Telco – Business Models of API Management Providers*", IEEE Proceedings of the 44th Hawaii International Conference on System Sciences, 2011.

List of working papers of IIFT

Sinha, Deepankar (2010), "Multi-Dimensional Approach to Management of Port Life Cycle: The Case of Major Ports in India" Working Paper No: LD-10-01, Indian Institute of Foreign Trade, New Delhi and Kolkata. This paper can be downloaded from http://cc.iift.ac.in/research/Docs/WP/01.pdf

Raychaudhuri, Bibek and Chakraborty, Debottam (2010), "Export Potential at the State Level: A Case Study of Karnataka", Working Paper No: EC-10-02, Indian Institute of Foreign Trade, New Delhi and Kolkata. This paper can be downloaded from http://cc.iift.ac.in/research/Docs/WP/02.pdf

Nag, Biswajit (2011), "Comprehensive Economic Partnership Agreement Between India and Sri Lanka: Where Does it Lead?", Working Paper No: EC-11-03, Indian Institute of Foreign Trade, New Delhi and Kolkata. This paper can be downloaded from http://cc.iift.ac.in/research/Docs/WP/03.pdf

Sinha, Deepankar (2011), "Container Yard Capacity Planning: A Causal Approach" Working Paper No: LD-11-04, Indian Institute of Foreign Trade, New Delhi and Kolkata. This paper can be downloaded from http://cc.iift.ac.in/research/Docs/WP/04.pdf

Rastogi, K. Siddhartha (2011), "Welfare Assessment of SPS Standards: An Empirical Study of Indo-US Mango Trade Dispute", Working Paper No: EC-11-05, Indian Institute of Foreign Trade, New Delhi and Kolkata. This paper can be downloaded from http://cc.iift.ac.in/research/Docs/WP/05.pdf

Nag, Biswajit and Sikdar, Chandrima (2011), "Welfare Implications of India-ASEAN FTA: An Analysis using GTAP Model", Working Paper No: EC-11-06, Indian Institute of Foreign Trade, New Delhi and Kolkata. This paper can be downloaded from http://cc.iift.ac.in/research/Docs/WP/06.pdf

Datta, R.P. and Saha Sanjib (2011), "An Empirical comparison of rule based classification techniques in medical databases", Working Paper No: IT-11-07, Indian Institute of Foreign Trade, New Delhi and Kolkata. This paper can be downloaded from http://cc.iift.ac.in/research/Docs/WP/07.pdf

Dasgupta, Pinaki (2011), "Implications of Revenue Model for Social Networking Sites and Beyond", Working Paper No: MA-11-08, Indian Institute of Foreign Trade, New Delhi and Kolkata. This paper can be downloaded from http://cc.iift.ac.in/research/Docs/WP/08.pdf