MOBILE PHONES: AN ANTHROPOLOGICAL REVIEW OF ITS EVOLUTIONARY IMPACT

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Abstract

20 century has observed the rapid development of mobile phone technology and increase in the number of users. This rapid development has direct/indirect impact mainly on 3 parameters such as societal, environmental and economical. This paper is an attempt to show an anthropological review of mobile phone and its various evolutionary impacts. This paper limits its discussion on societal impact (in particular) with brief description on environmental and economical. An analysis was carried out by cross-impact analysis using the fifteen identified societal impact variables/indicators. From the analysis it can be said that impact on variable can cause a detrimental changes on one or several variables.

Key Words: mobil phone,

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1. Introduction

The need, necessities and desires of man has lead to the invention of technologies. The various technologies introduced for the communications have made life simple, easy and accessible. Before the electronic communication development, there were various kinds of communications used to communicate over the long distance such as torch relays, voice relays, smoke relays, letters, telegraphy etc which eventually lead to the invention of telephone. 1876 witnessed the landmark invention of 'talking device' by Graham Bell which could transmit a human voice to a listener. However Bells' device had extremely weak flow of signals that made difficulty in hearing. This problem was overcome by introducing carbon transmitter by Thomas Edison in 1878.

By the end of the 19th century electromagnetic waves were used as communication medium. The first systems mobile telephone service used in cars were introduced in the early 1950s. The car telephones were outdated with the introduction of Analog Cellular (First Generation, 1G) during late 1970s and early 1980s, which was smaller, light weight and more sophisticated mobile systems a practical reality for many users. It also showed the increase in annual growth market rates of 30 to 50 percent, rising nearly, 20 million subscribers by 1990s against the less than a million for car telephones (Rice, 2006). Radiolinga in Finland in 1991 launched the first "modern" network technology on digital known as second generation (2G). The development of 2G cellular system was driven by the need to improve transmission quality, system capacity and coverage. With the miniaturization of digital components, mobile phones have become increasingly handy over the years.

1.1. Technology

Technology is a broad concept that deals with a species usage and knowledge of tool and crafts, and how it effects a species ability to control and adapts to its environment (http://www.techmotivator.iitm.ac.in/). The technology consists of two components:

1. Technology should be an entity (physical existence)
2. Technology should embody some knowledge (knowledge content)

Technologies can classify into various categories as shown in the figure 1.

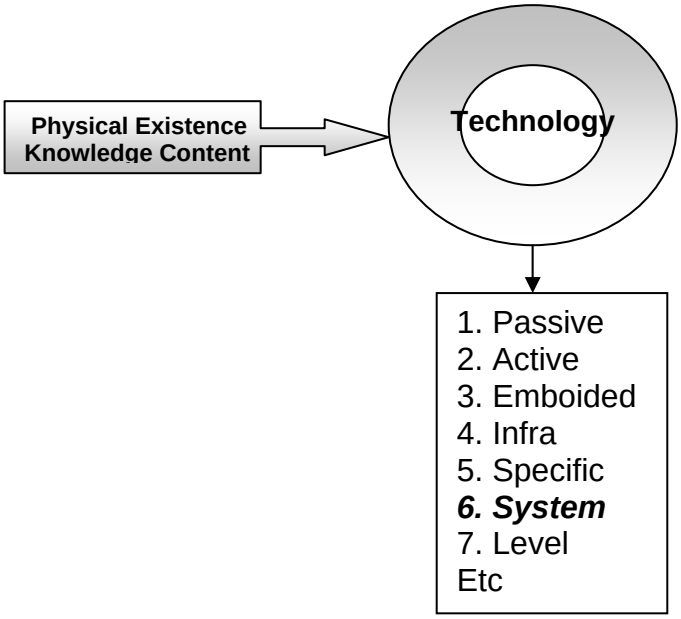

Figure 1. Technology

The mobile technology can be more appropriately classified under ***system*** technology. System technologies is the constituent technologies of a fusion of technologies (system integration), the mobile phone technology is also a fusion of technologies such as transmission networks, software, multi-media, interfaces etc.

In order to understand the technology viz system technology for a mobile phone using figure 2. The *knowledge* content of the technology can be grouped as goals (Social interactions, entertainment, information access etc), attention (full/partial) and tasks (make call, send photos, view videos, find local information etc). The *physical* content of technology can be grouped as carrier (services), connection (speed, reliability) and device (software, hardware, capabilities etc). The knowledge content and physical content need an *interface* such as human beings to use a technology successfully. The mobile phone technology can be used during walking, driving (activity). Any technology is largely bound by Environment and Culture (religion).

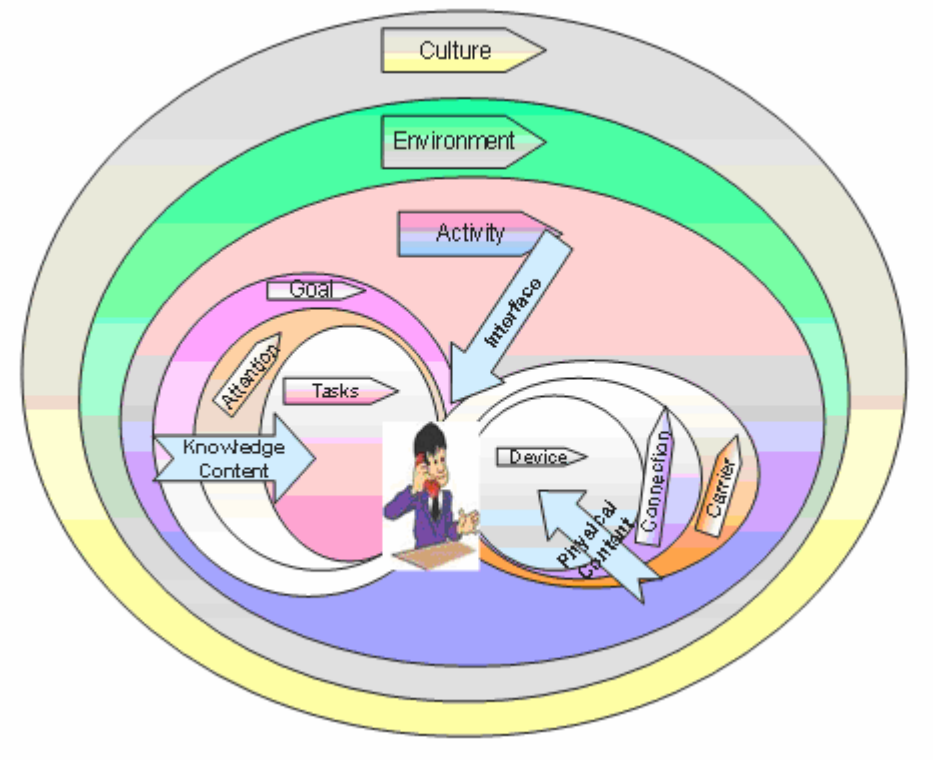

Figure 2. Mobile phone technologies

1.2 How Does A Mobile Telephone Work?

Mobile phones are two ways radios. When a person talk into a mobile phone it picks up the voice of the person and converts the sound to radiofrequency energy. The radiowaves travel through the air until they reach a receiver at a nearby base station. The base station then sends the call through the telephone network until it reaches another person (Fig 3). Base stations are designed for number of different purposes, such as to provide coverage to a wide area or to increase capacity in a heavily congested area.

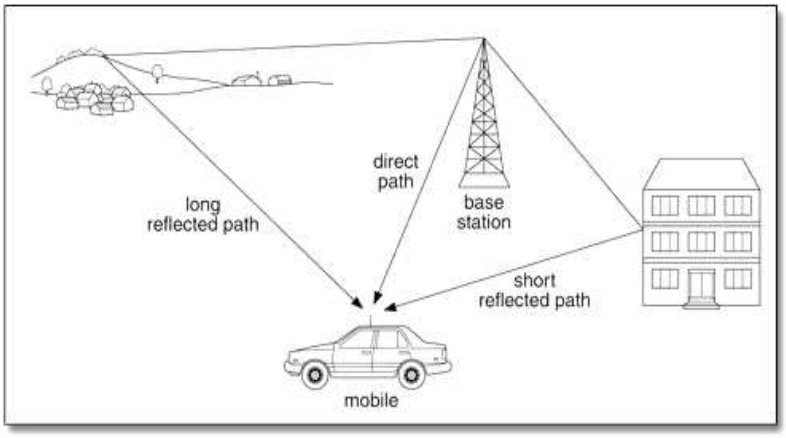

Figure 3. Mobile telephone depicts users and base station.

2. Morphology For Mobile Phone

Advancement in Mobile phone technology has taken place through morphology of the technology. Morphological Analysis represents the study of 'structure' and 'form'. A comprehensive morphological representation of a technology would enable a deeper understanding and also lead to the discovery of newer technological possibility (Figure 4).

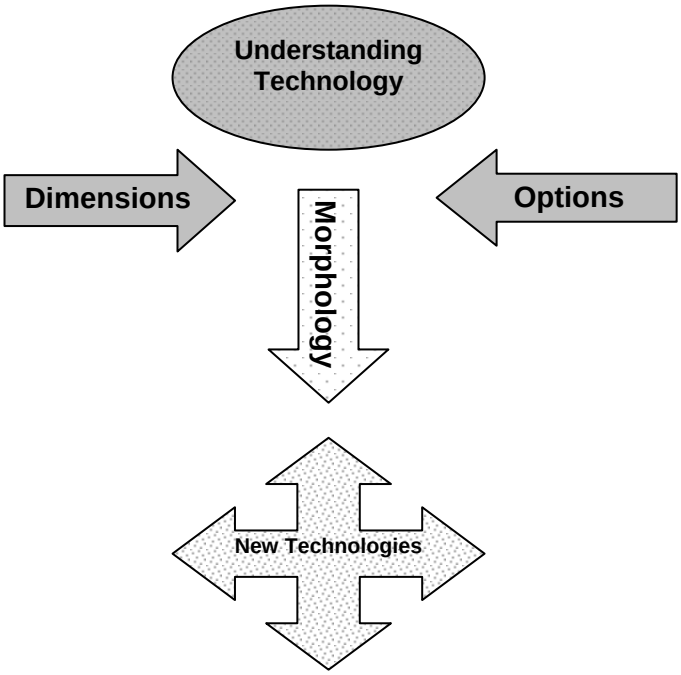

Figure 4. Morphology of technology

Table 1 shows the morphology of the mobile phone. It is interesting to find the various dimensions and options available for the technology. The components (dimensions) of the mobile phone are housing, key pads, display, personal information management etc. for each of these components there are variants. For example, housing of the mobile phone would consist of different geometrical shapes, made of different materials accordingly to the available options. This analysis will help to understand the evolution of the technology and their refinement with the desires/wants of the society. This will eventually lead to the inventions of the new technologies.

Dimensions	Functional characteristics considered under each dimension	Options
Housing	Personality trade	Different varieties
Visual Appeal	Shape	Varying
	Material	Polybag/Blister
	Length, Width, Thickness	Varying
	Water proof resistant	Yes/No
	Scratch Proof	Yes/No
	Is it openable?	Yes/No
	Weight	Light/Heavy
Charger	Shape	Varying
	Whether indicative of battery discharge?	Auto charger/Auto off
	Connectors	Square/Rectangular
	Varieties	Travel/Home/Car/Fancy/
	Weight	Emergency/Solar
	Universal Compactable	Light/Heavy
	Operational Power(volts)	Yes/No
	Connectors (shape)	110, 220
		Square, Circular, Rectangular
Key Pads	Texture	Soft/Medium/Hard

	Shape	Square/Circular
	Size	Varying
	Numbers of Key pad	Yes
	Spacing between pads	Varying
	Number of keys on pad	Qwerty/Alpha numeric
Display	Type	LCD, Plasma
	Shape	Square/Rectangular
	Material	Glass, Low e-plastic, Reflective/Mirror
	Anti-glare	Yes/No
	Connector	Square/ Circular
	Weather resistant	Yes/No
Frequency	GSM	800/1800/1900
	CDMA	Yes/No
Special Features	12/24 hour clock	Seconds/Minute
Time	AM/PM indicator	Yes/No
	Daily alarm	Yes/No
	Memo recordings	Yes/No
	On-off switch	Yes
	Calculator	Yes/No
	Data exchange with computer	Yes/No
	Camera provision (internal)	Yes/No
Personal Information Management	Alarm for appointments, reminders etc	Yes/No
	Storage of Names and Address	Yes/No
	Internet access	
	Memo recording	Yes/No
	Does it show date, place (location)?	Yes/No
		Yes/No

Speaker	Ringtone Clarity	Yes/No Varying (Good/Bad)
Security	Mobile Tracker	Yes/No
Multimedia Audio Video	Speaker phone MP3, AAC, MPEG Resolution Universal Standards Zoom Flash	Mono/Stereo Yes/No 640X480/ 1024X768/ 176X144 MPEG/ 3GP/ MP4 Magnify/Shrink Yes/No
Connectivity	Bluetooth USB cable IR	Yes/No Yes/No Yes/No
Fashion Hand/ Neck strap	Material Colours	Polybag Varying

Table 1. Morphology of mobile phone technology

3. Sustainability

In general sustainability should focuses on the viability and health of natural environment systems to sustain humanity (Mani et al 2005). Any technology (Mobile phone technology in this case) is bound with the following aspects as shown in the figure 5:

The social aspects of sustainable development should try to achieve a fair and just society and provide people with an acceptable quality of life. This can achieve by the availability of mobile telephone to all the sects of the society for education, social interaction, ease to use, cheap, no/less harmful to the health of human etc.

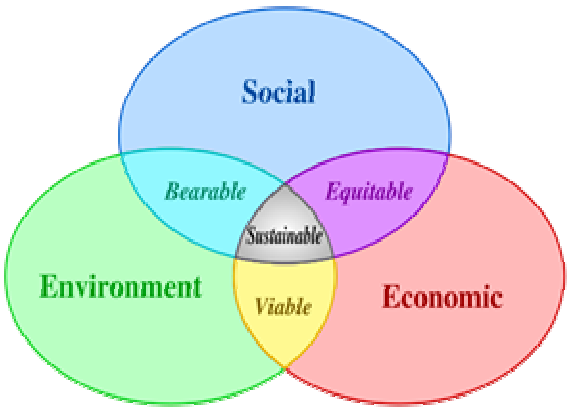

Figure 5. Sustainability of technology

The environmental aspects of sustainable development should try to achieve balance between protecting the physical environment and its resources, and way to use these resources to enable the natural environment to continue supporting the human society. The mobile technology should bring no harm or minimal harm (permissible/desirable level) to the environment, such as dispose of electronic wastes (e-waste) generated by the mobile phones. There should be stringent norms such as 4 R's policy (Reduce, Recycle, Reuse, and Recover) and norms for disposing the e-waste (Avvannavar and Shrihari, 2007).

The economic aspects of sustainable development should aim for an economic system that will facilitate equitable access to all the section of the society such as cheap, services, coverage provided by the leading mobile phone manufacturers. Based on the available resources it should provide opportunities for viable business and industries based on the ethical principles to enable sustainable livelihoods and realization of basic human rights. The focus should be equitable prosperity for all, within the bounds of ecological feasibility.

3.1. Sustainability Levels For Mobile Phone Technology

The sustenance of mobile phone and their activities depend on the availability of and access to resources. While the need for resources is satisfied through exploitation, and sometimes destruction of the natural environment, in context of human societies it is also accompanied with waste generation (e-waste) and its results in environmental pollution (dismantling of e-waste generates plastic (dioxin gas), metal, battery (leaches into soil, groundwater contamination) etc).

The resource exploitation and consequent waste generation and pollution are chiefly responsible for threatening the sustainability of both, present and future generations, by directly affecting their ability to maintain resource availability. Hence, in general, increase resource consumption inherently implies an increasing threat to sustainability (Figure 6).

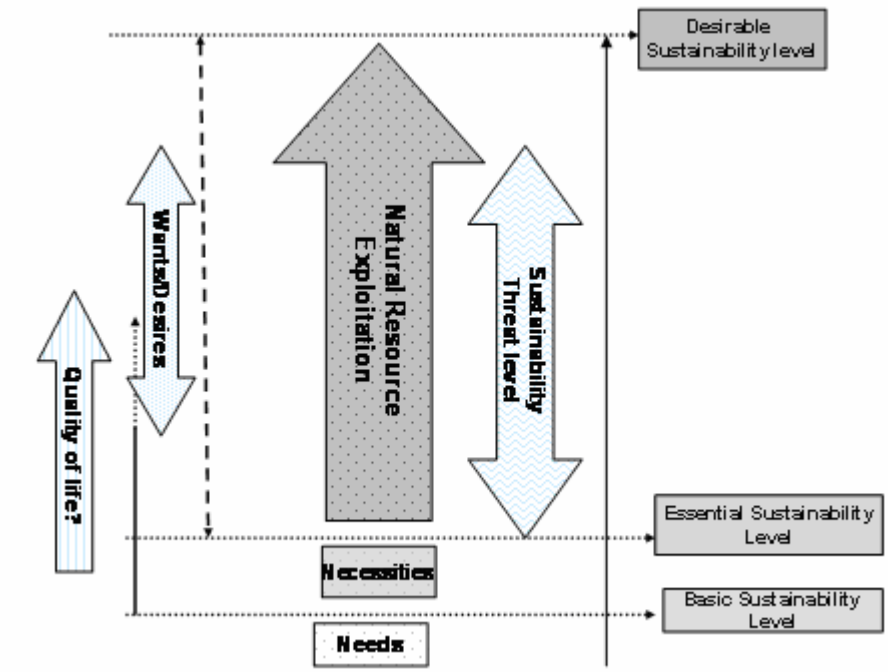

Figure 6. Sustainability levels for Mobile phone technology

Source: Mani et al 2005

This can be justified by the mobile phone penetration rate in various countries. Luxembourg has the highest mobile penetration rate in the world, at 164% in December 2001. In Hong Kong the penetration rate reached 117% of the population in September 2004. The statement can be further strengthened by the following explanation as follows:

At present Africa has the largest growth rate of cellular subscribers in the world, its market is expanding nearly twice as fast as Asian markets (Rice, 2006). Global mobile phone use will top 3.25 billion equivalent to around half the world's population in 2007 as cell phone demand booms in China, India and Africa (Times of India, 29 June 2007). These figures show the weak sustainability approach (in which economy is given high consideration compared to society and environment)

for the mobile phone technology. In order to meet the desires/wants of societies it can be concluded that the natural resource exploitation is at rapid and there will be an alarming threat to the present and future generation. In order to understand the possible impact of mobile phone technology on various parameters such social, economic and environment the following discussion is taken forth.

3.2. Indicators for sustainable development

For a community to progress towards sustainability, it is important to have some means to assess progress and monitor performance. Indicators provide the means to assess progress and monitor progress. For any system under study, indicators aid in understanding the processes involved and enhances researchers understanding of the system.

Sustainability indicators are related to the quality of life of a community. They judge (assess and monitor) whether the economic, social and environmental systems that make up communities living environment provide a healthy, productive and sociable life for all, the present and future generation. This can be achieved by answering questions pertaining to past and desired changes would enable the community to identify aspects of quality of life that are of concern (that is, what has changed? and what should change? respectively) (Table 2).

How has a quality of life changed since the last 20 years?	**What has changed?**
How has it changed economically? How has it changed socially? How has the living environment changed?	Unemployment level Poverty level Level of exports Crime level Community interaction level Homelessness level Pollution level (exceeding acceptable standards)
How should quality of life be in next decade?	**What should change?**

How should it change economically?	Reduce unemployment by 50% Eliminate poverty
How should it change socially?	Reduce crime rate by 75% Reduce homelessness by 50%
How should the living environment change?	Reduce pollution levels to acceptable standards

Table 2. Identifying Indicators for sustainable development

Source: Mani et al 2005

3.3. Identification of indicators

In order to identify the indicators of sustainable development of mobile phone a systems approach is considered. A system approach to sustainability entails considering the various agents or entities interacting in the world as systems. Systems thinking attempts to illustrate that events are separated by distance and time and that small catalytic events can cause large changes in complex systems. For better understanding of the indicators the following explanation is given as follows:

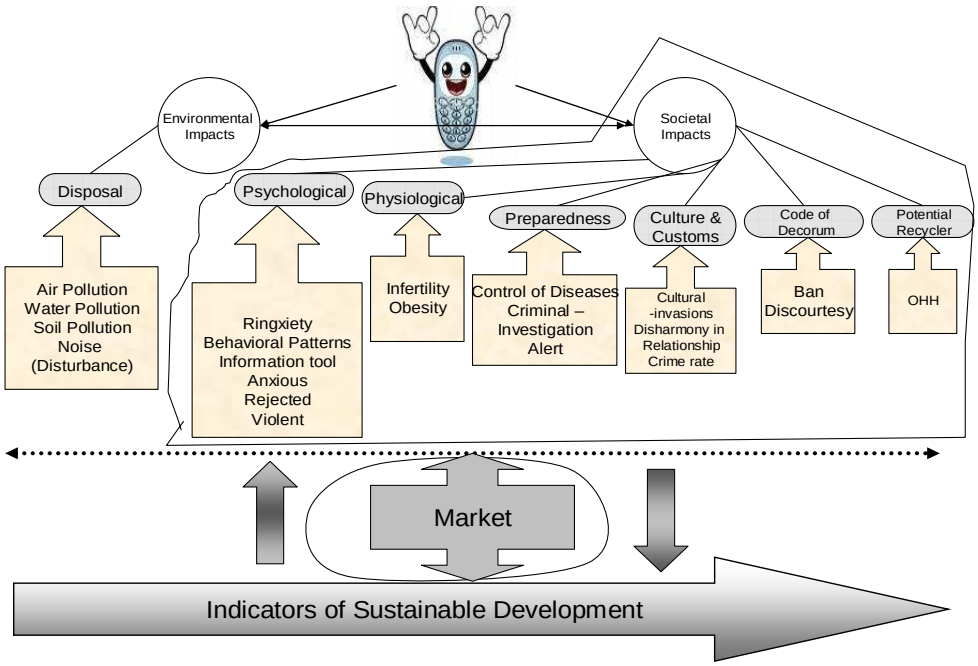

Figure 7. Systems thinking approach- Mobile Phone and its impacts

Mobile phone in present day context it would mean for social networking, to listen music, view videos, surfing, to find local information etc. There are various indicators listed in the figure 7 which indicate whether the technology has an impact on society, environment and economics.

3.4. Integrated Model Concept Development

Modeling of mobile phone and its impact on society, environment and economic is a challenging tasks but very valuable in terms of assessing the development of the sustainable development of the society, environment and economic with the introduction of mobile phone technology. The change in the lifestyle, change in the impulsive behavior, ease accessibility, increase/decrease in crime rate, environmental degradation, inflation in market etc determine the sustainability of the technology. Integrated models can serve as bases for simulation systems that can be used to study and forecast the implications of the mobile phone technology and their impacts on sustainable development. Development of an integrated model concept involves many sub-activities, such as, preliminary study and investigation, detailed study and investigation, and synthesizing the model concept (Mani, M; Ganesh, L.S. and Varghese, K, 2005).

The model is based on the concept that the changes brought in society, environment and economic with the introduction of mobile phone technology. With increase in the desirable sustainability level, the lifestyle of common man has changed to a greater extent. This would includes the changes in the approaches of social interactions, traditions and culture, religion, beliefs, science and technological achievements, politics, industrial practices, law and order, and every other way of life it pursues. The synthesis is done by considering the objective assessing and forecasting impacts of mobile phone technology on society, environment and economic. Sustainability assessment refers for what and how the society uses the mobile phone determines its sustainability. Forecasting involves the variables that describe the changes brought about with the introduction of technology. The integrated model comprising the two action components, sustainability assessment and forecasting impacts brought due to the introduction of technology, as shown in the figure 7. The paper discussion is restricted for the ***societal impacts*** mainly; it does discuss the *environmental and economic impacts* but in brief.

3.5 Societal Impact

It's no doubt that introduction of mobile phone has made life simple, easy to reach and accessible all the time. In less than two decades, the mobile telephone has become cheaper and more easily available. It has also brought out various impacts on the society with the ease availability of resources such as availability, physiological, psychological, tool during preparedness' etc.

3.5.1. Health Risks

Psychological effects: A recent phenomenon has been observed by psychiatrists in India for heavy mobile phone users known as *"Ringxiety"*. This is general observed in heavy mobile users, in which user imagine their phone is ringing or feel it vibrate when it actually doesn't. According to Dr Jitendra Nagpal, senior psychiatrist at VIMHANS, that ringxiety is becoming common in India; he estimated a threefold increase in the number of cases of behavioral changes caused by excessive mobile phone use in the past few years. In a recent study in the US involving participants aged 18-26 years, 66 percent of those surveyed reported suffering from ringxiety. The study, conducted by David Laramie from the California School of Professional Psychology at Alliant International University, Los Angeles, found that 67 percent of the people suffering from this phenomenon has higher monthly charges, used more minutes, sent text messages and showed higher levels of impulsive behavior (Sinha, 2007).

According to Dr Y Machiswala, a senior psychiatrist at Mumbai's Masina Hospital, a unique case was observed from a couple. They called each other at least six times during the day and the SMS count was anywhere from 20-30. So by the time they got back home, they had exhausted all the topics. Their addiction had

gone to such lengths that they would even call each other while both of them were in the same house." Many people preferred and cared for cell phones rather than their life partners. Dr Bharat Shah, a consulting psychiatrist at Leelavati Hospital, Mumbai, says the isolating nature of cellphone dependence is not very different from narcotic addiction. Many patients claim they felt upset, anxious or rejected if they did not receive text messages every five minutes. Teenagers are known to get violent with parents after being denied the cellphone (Kukday, 2007).

Physiological effects: Since the introduction of mobile phones, concerns have been raised about the potential health impacts from regular use (The Australian Newspaper, 29 April, 1997). Concern continues about exposure to radiofrequency (RF) field from sources used for mobile telecommunications. As mobile phone penetrations grew over the fixed landline penetration levels in 1998 in Finland and from 1999 in Sweden, Denmark and Norway. The Scandinavian health authorities have run continuous long term studies of effects of mobile phone radiation effects to humans, and in particular children. Cancer has been suggested as an outcome of exposure to mobile telephones by some scientific reports (Repacholi, 2001). A study conduct by Muscat et al (2000) for patients between the ages of 18 and 80 years from 1994 and early 1998 in New York and concluded that, " use of handheld cellular telephones is not associated with risk of brain cancer, but further studies needed to account for longer induction periods, especially for slow-growing tumors with neuronal features." Similar conclusions were drawn from the studies conducted by Lonn et al. (2005) of a case-control for the approximately 3.7 million people in Sweden. Finnish study found that people who used the phones for more than 10 years were 40% more likely to get a brain tumor on the same side as they held the handset. Equally alarming, blue-chip Swedish research revealed that radiation from mobile phones killed off brain cells, suggesting that today's teenagers could go senile in the prime of their lives.

An Israeli study by exposing human and rat cells to low-level radiation at 875 MHz, a similar frequency to the one used in many mobile phones. Within ten minutes the chemical signals detected were involved in the division of cells (The Times of India,19 Sep, 2007). Studies in India and the US have raised the possibility that men who use mobile phones heavily are likely to reduce sperm count.

According to Professor Lawrie Challis, there isn't any damage to the biological or adverse health effects in the short term by the usage of mobile. But it doesn't rule out the possibility of long-term effects (that is, more than 10 years) (Jha, 2007, Lonn et al 2005).

There have been cases in recent times where rashes are observed near ear, because of the usage of nickel coated mobile phones for 2-3 hours a day. Dr.Abarham stated that, "It's less reflection of the incorrect use of a cell phone and more of today's lifestyle (Singh, 2007).

Health hazards of base station: The effects of population residing near to the base stations (that is, the antennas on the surface which communicate with the phones), which emits radiation continuously and is more powerful. According to Santini et al 2002, a variety of self-reported health effects for people who reported that they were living within 1000 feet or 300 feet from the base station in rural and urban area respectively. Fatigue, headache, sleep disruption and loss of memory were among the effects found.

Potential recyclers: E-waste is the collective name of the discarded electronic devices that the waste stream from various sources. There have been various recommendations and proposal made by European directives 2002 to recycle, recovery and reuse the e-waste to protect the health of the recyclers. Mercury is used in mobile phones and it can cause damage to various organs including brain and kidneys, as well as fetus for the potential recyclers.

3.5.2. Application of mobile during disaster preparedness

Mobile phone technology is being developed to help manage the spread of diseases such as HIV and bird flu (BBC, 18 Oct 2006). The software is designed to allow field workers using handsets to send and receive data on disease outbreaks along with patient and drug information. This means doctor working in the field can send information to a central database about how many people are affected by a disease, patient status, drug inventory levels and guidelines or lab test results. The Finnish government decided in 2005 that the fastest way to warn citizens of disasters was the mobile phone network. In Japan, mobile phone companies provide immediate notification of earthquakes and other natural disasters to their customers free of charge. In event of emergency, disaster response crew can locate trapped or injured people using signals from their mobile phones. Finland rescue services suggest hikers carry mobile phones in case of emergency even when deep in the forests beyond cellular coverage, as the radio signal of a cell phone attempting to connect to a base station can be detected by overflying rescue aircraft with special detection gear. Also, users in the U.S. can sign up through their provider for text message when an *Amber Alert* goes out for a missing person in their area.

Mobile telephone communication evidence has become a tool for criminal investigations (Zeta et al, 2007). The concern over terrorism and terrorist use of technology prompted an inquiry by the British House of commons Home Affairs select committee into the use of evidence from mobile telephone devices, prompting leading mobile telephone forensic specialists to identify forensic techniques available in this area. An example of criminal investigations using mobile phones is the initial location and ultimate identification of the terrorists of the 2004 Madrid train bombings. In the attacks, mobile phones had been used to detonate the bombs. However, one of the bombs failed to detonate, and the SIM

card in the corresponding mobile phone gave the first serious lead about the terrorists to investigators. By tracking the whereabouts of the SIM card and correlating other mobile phones that had been registered in those areas, police were able to locate the terrorists.

3.5.3. Code of Decorum

Mobile telephone use code of decorum is an important matter of social discourtesy, phones ringing during funerals, weddings, in toilets, cinemas and plays. Users often speak loudly (may be due to weak signals), leading to book shops, libraries, bathrooms, cinemas, doctors' offices, and houses of worship prohibiting their uses, and, in some places, the installation of signal-jamming equipment to prevent their use, while is currently practiced in Indian parliament (though in many countries, including U.S., such equipment is currently illegal). Some new buildings, such as auditoriums, have installed wire mesh in the walls (making Faraday cage) which prevents signal penetration that does not violate signal jamming laws. The usage of aircrafts is also banned in aircrafts, as it may interfere with aircraft radio communications and disrupt the ground mobile telephone network during take off and land (Yahoo News, April 13, 2007). In similar veins signs are put up in UK petrol stations and it is enforced to be practiced in countries by prohibiting the use of mobile phones due to possible safety issues. Most of schools in US and recently government of Karnataka, India has decided to ban the use of cell phone for school children till the age of 14. As cell phones have become potential means for cheating via text messaging, and the possibility of photographing someone without consent. In UK, possession of mobile phone in an examination can result in immediate disqualification from the subject or from all their subjects (BCC News, 15 April, 2005).

3.5.4. Mobile Ban Action (MBA)

Mobile-phone use while driving is common but controversial. While few jurisdictions have banned motorists from using mobile phones while driving outright, some have banned or restricted drivers from using hand-held mobile phones while exempting phones operated in a hands-free fashion. Using a hand-held mobile phone while driving is an impediment to vehicle operation that can increase the risk of road traffic accidents. However, some studies have found similarly elevated accidental rates among drivers using hands-free phones, suggesting that the distraction of telephones conversation itself is a significant safety problem. A British study shows talking on a mobile phone while driving is more hazardous than drunken driving. The law enforces hefty fine and given life sentences if the drivers are found using their mobile while driving (The Times of India, 8 Sep 2007).

Use of handheld mobile phones by drivers is illegal in many European countries and a number of Asian and South American countries and Australia. Use of hands-free mobiles is permitted, although the Australian states of New South

Wales and Victoria have banned hands free for learner and first year provisional/probationary licence holders.

However some countries like Japan ban mobile phone use while driving completely. Similar laws exist in six U.S. states with legislation proposed in 40 other states. The

US department of Defense (DoD) has outlawed the use of mobile phones while driving on any DoD installation, unless a hands-free device is used. In Israel, it is common practice to pull over to the side road where possible to answer a mobile phone and which is generally seen in India also. In India, the use of hand held or hands free is completely banned and enforced strictly for motorists since from August 2007 onwards. Since from January 2007 to August 2007, Karnataka (India) traffic police have booked 11,136 motorists for using mobile phones while driving (Amabrish, 2007).

3.6. Environmental impacts

The disposal of electronic waste is termed as e-waste. Mobile phone is one among the e-waste. There are no lucid policy and legislation to control the inflow of these wastes from the overseas. Essentially imports are not controlled, e-waste is imported freely and recycling is done in a hazardous manner. Mostly backyard recycling is done in India. Over 1 million poor people are involved in recycling operations. Inorganic mercury present in mobile when disposed in water gets transformed into methylated mercury in the bottom sediments. It easily accumulates in living organisms and concentrates through the food chain, particularly, via fish.

3.7. Economic impacts

Since the introduction of mobile telephone service in the United States in 1984, the number of subscribers has increased substantially every year. Mobile phone has become one of the key means to communicate with each other. With the introduction of Short Message Service (SMS) in December 1993 (Finland) spawned the “texting” sub-culture. Over 1.8 billion users generated $ 80 million of revenue in 2006 by texting. By the end of 1999, there were more than 86 million mobile telephone users (Muscat, 2000). At present Africa has the largest growth rate of mobile phone subscribers in the world, its marketing is expanding nearly twice as fast as Asian markets. With increase in number of applications and services, the mobile phone is a fashion totem custom-decorated to reflect the owner’s personality. This aspect of the mobile telephony business is, in itself, an industry, for example, ringtone sales exceeded $ 5 billion in 2006. Some people carry many mobile phones with different connections from different service providers to make sure the person is always accessible. This shows the boom in economy of telephony sector.

4. Integrated Model simulation

The simulation system represents the computational component of the sustainability assessment and forecasting model. The integrated model concept is based on the belief that 'everything is connected to everything else'. The assessing and forecasting involves long-range forecasting. Long-range forecasts form the foundation for scenario generation and evaluation studies in sustainability. The proposed model-concept involves some core variables, which by their very nature are subjective. In addition, the model involves some degree of spatial representation and analysis associated with the variables. Thus, a system that simulates interactions between quantitative and qualitative variables, while considering spatial significance, is crucial. Considering the above simulation system requirements, the cross-impact analysis method is used as the simulation system core.

Cross-impact analysis is a well-known future technique adopted for long-range forecasting, scenario generation and evaluation, which makes it very useful for decision support. Kane's simulation (KSIM) technique is adopted for projecting transformed values of model variables. It is based on cross-matrix approach. This method uses suitably scaled time series variables and variable values. The simulation is based on the expected nature of interactions between the variables. The key feature of this approach is that it allows one to work with data at any level, from subjective estimate to highly precise physical measurements (Mani et al 2005; Kane, 2002).

5. Discussion and Conclusion

The interaction of15 chosen variables was found out from the matrix as shown in the Table (3). The table is just an indicative but not exhaustive set of the variables. The impact on row variable by the column variable was found by assuming appropriate value and the trend was obtained for 25 years from now as shown in the figure (8). It is assumed that the present conditions would remain same for the next 25 years. The fig (8) shows the trend of 15 chosen variables.

	V-1	V-2	V-3	V-4	V-5	V-6	V-7	V-8	V-9	V-10	V-11	V-12	V-13	V-14	V-15
Var-1	0.2	0	0	0	0	0	0.1	0.1	0.1	0	-0.1	0	0	0.1	0
Var-2	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0
Var-3	0	0	0	-0.1	0	0	-0.1	0.1	0	0	-0.1	0	0	0	0
Var-4	0	0	0		0	0	0	0	0	0	0	0	0.1	0.1	0
Var-5	0	0	0	0	0	0.1	0	0	0	0	-0.2	0	0.2	0.1	0

Var-6	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.2**	**0.1**	**0**
Var-7	**0**	**0**	**0.1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**-0.2**	**0**	**0**	**0.1**	**0**
Var-8	**0.1**	**0**	**0.1**	**0.1**	**0**	**0**	**-0.1**	**0.1**	**0**	**0**	**-0.1**	**0.1**	**0.2**	**0**	**0**
Var-9	**0.1**	**0**	**0.1**	**0.1**	**0**	**0**	**-0.1**	**0.1**	**0**	**0**	**-0.2**	**0.2**	**0.1**	**0**	**0**
Var-10	**0**	**0**	**0**	**0.1**	**0**	**0**	**0**	**0**	**0**	**0.1**	**0**	**0**	**0**	**0.1**	**0**
Var-11	**0**	**0**	**0**	**0**	**0**	**0.1**	**0.1**	**0**	**0.1**	**0**	**0**	**0**	**0**	**0**	**0**
Var-12	**0**	**-0.1**	**0**	**0.1**	**-0.1**	**-0.1**	**-0.2**	**-0.1**	**-0.1**	**0.2**	**-0.5**	**0.2**	**0**	**0.1**	**0**
Var-13	**0**	**0**	**0**	**0**	**0**	**0**	**-0.1**	**-0.1**	**-0.1**	**0**	**-0.1**	**0**	**0**	**0**	**0**
Var-14	**0**	**0**	**0**	**0**	**0**	**-0.1**	**-0.15**	**-0.15**	**0**	**0.1**	**-0.1**	**0.1**	**0**	**0**	**0**
Var-15	**0**	**0**	**0**	**0**	**0**	**0.1**	**0**	**0**	**0**	**0**	**-0.1**	**0**	**0.2**	**0.1**	**0**

Table 3. Interactions of various variables (Indicators) [1]

[1] Var 1 (Distrubance), Var 2 (Ringexity) and so on Var 15 (Brain cell damage).

Note: [1] Var 1 (Distrubance), Var 2 (Ringexity) and so on Var 15 (Brain cell damage).

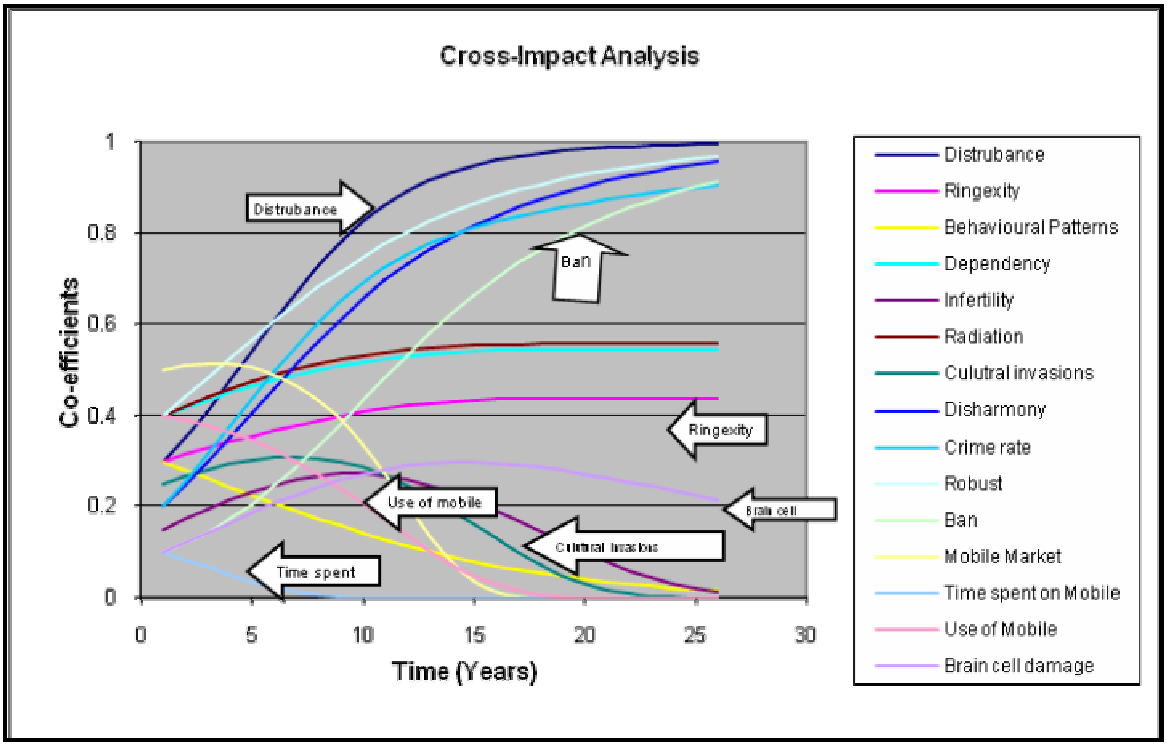

Figure 8. Cross-impact analysis trend for fifteen variables/ indicators

From the fig (8) it can be interpreted that, with the ban of the mobile phones at various places will bring down the use of mobile for longer durations, reduces cultural invasions, ringexity phenomena will be decrease among regular users, time spent on mobile phone will also reduces. This can be further extrapolated to other indicators to understand the impact on one variable on the other variable. There is need of refinement of the variables and the value assigned to it. Often we see not a variable but rather changes in a variable. Our response to environment has much this character. These subjective conclusions can be made precise through the associated people, and such derivative interaction is very important and is the subject of other papers.

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