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Journal of Communication System and Technologies

Aims and Scope

Journal of Communications System and Technology is open to researchers from all types of institutions and organisations worldwide, aimed at the increasingly important area of communication technology. The Journal's emphasis is particularly on the issues impacting behaviour at the system, service and management levels. It provides coverage of advances that have a significant potential to impact the immense technical and commercial opportunities in the communications sector.

Areas of Research:

- Transmission/Switching/Distribution technologies (ATM, SDH, TCP/IP, routers, DSL, cable modems, VoD, VoIP, WDM, etc.)
- System control, network/service management
- Network and Internet protocols and standards
- Client-server, distributed and Web-based communication systems
- Broadband and multimedia systems and applications, with a focus on increased service variety and interactivity
- Trials of advanced systems and services; their implementation and evaluation
- Novel concepts and improvements in technique; their theoretical basis and performance analysis using measurement/testing, modelling and simulation
- Performance evaluation issues and methods.

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Role of ICT in U-Commerce and Examine the Field of Wireless Communication

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A B S T R A C T

Information and Communication Technology role in the field of wireless communication is vital as the technology shifts from conventional to electronic; electronic based to mobile way of commerce is also changed. But apart from all of these technologies and development. We updated with another version field of wireless communication during this research, called U-Commerce. The vision of ubiquitous commerce (ucommerce) is realized through the convergence of electronic, mobile, television, audio and silent commerce application. The ubiquity, universality, uniqueness and unison of u-commerce will provide two principal benefits for single users and businesses: increased convenience as well as more personalized and modified services. However, ubiquity will also bring emerging issues such as a greater degree of privacy concerns that will impact individual users, companies and society at large. Also perform a detailed analysis of the research questions and identify the major factors on working by several stakeholders while adopting this newly invented technology within its business.
Keywords - ICT, Wireless communication, ubiquitous, convergence, ubiquity

INTRODUCTION

Information and communication technology have immense impact on association, specifically on organizations, businesses and buyers. Many stakeholders are taking more innovative ways to maximize the use of ICT and grab the advantages of Web information for their business activities. The rapid use of ICT is boosting U-Commerce.

Commercial activities on the internet are drastically increasing all over the world. U-Commerce becomes an effective and flexible way of quick business. For organizations in particular, the modern Economy brings infinite and extremely demanding competition and more opportunities on a universal scale. E-Commerce is unquestionably a corporate weapon, if it has been well utilized than it will lead to unstoppable success in terms of business profitability and competitive advantage in the marketplace.

Ubiquitous commerce, otherwise known as u-commerce, ultimate commerce and uber-commerce, extends traditional commerce to a world of u networks and universal devices (Junglas and Watson 2003[1]). As an extension of e-commerce and m-commerce, Watson introduced the concept of ubiquitous commerce (u-commerce) in 2000. As the next generation business model, it got the business people attention. U-commerce emerges as a continuous, seamless stream of communication, ideas and services exchanged among businesses, suppliers, employees, customers, and products. It helps to interact and transact from any location and at any moment without being forced to stay connected through power and telephone connection. U-commerce described as: "The use of u-commerce networks to support customized and uninterrupted communications and transactions between a business and its different stakeholders to offer a level of value, above and beyond traditional commerce[2]"

Conventional Marketing ⟶ E-Commerce ⟶ M-Commerce ⟶ U-Commerce

U-commerce can be considered as a necessary extension of E-commerce and M-commerce. It express the next stage of commerce, starts from E-commerce updated to M-commerce; U-commerce is will be the next wave in commerce – i.e., after E- Commerce and M-commerce Watson, (2000). Ubiquitous commerce or U-commerce is the combination of E-commerce and wireless, audio and silent commerce. It is not a substitute for other types of commerce, but an updated version of them.

Ubiquity - Reach ability + Accessibility + Portability
Universality - Mobile networks + Mobile devices
Uniqueness - Localization + Identification + Portability
Unison - Mobile application + Data synchronization

U-Commerce explains the generic term for all-inclusive business transactions through or by means of Information and Communications Technology. U Commerce is a product and service offered by Touch Net Information Systems, Inc. and it is registered under U.S. trademark (Reg. 4,069,063). The Influence and development of Ubiquitous Commerce is based on different information and communication technology. These technology developments were driving forces for the growth to business transactions at anytime and in anyplace.

U-Commerce computing is viewed less as a different area of technology, but rather as a developed application of information and communications technology that is combined into the everyday life more than before. The target is to meet the object of "anything, anytime, anywhere" for data processing and communication through the ubiquity of ICT systems[3]. Ubiquitous computation is a complementary model to virtual reality, rather than recreate and simulate the world with a computer, ubiquitous

computation turns all objects in the actual world into part of an information and communications technology system. U-commerce computation is certainly changing the ways in which we use computers. In ubiquitous, a variety of process runs automatically (programmed) and interacts behalf of the user. The user does not have to provide instructions or make decisions. Ubiquitous involves smart environments that are predictable as an individual's cooperative companion. On the other hand, the clearly disappearance of the computer together with the delegation of complicated processes or tasks to a ubiquitous ICT infrastructure builds serious questions[3]. The anytime/ any place principle of ubiquitous computation development as the result of research and technological advance in wireless and sensor networks, embedded systems, mobile computation, distributed computation, agent technologies, autonomic computation and communication. Ubiquitous computation paradigm integrates computation into the environment[4].

FEATURES OF UBIQUITOUS COMPUTATION:

Embeddedness: Small capable devices are installed in the physical world and connected to the wireless network.

Mobility: User devices must be operated under the mobile and flexible network infrastructure.

Nomad city: Provides a rich set of computation and communication capabilities and services to nomads as they move from place to place in a way that is transparent, integrated, convenient, and adaptively.

Pro activeness: The system needs to be self-active to capture what its users want to increase the service quality.

Invisibility: To be as modest as possible, enable the user to put as little data as possible.

Portability: Provides services with hands-free or at least single-handed light devices[5].

Considering the adaptive capability of these process, the ubiquitous concept can be introduced in several areas such as learning, cultural heritage and tourism, becoming a new tool for promotion, retailing, by predicting the u-commerce as an innovation able to make traditional e-commerce obsolete and to force business people to develop new capabilities for fast responding to the market trend [6]. In the U-commerce environment, figure out devices can be embedded in ordinary objects to make them

intelligent and interactive. Ubiquitous is based on the four U's – ubiquity, uniqueness, universality, and unison – U-commerce described as a new measure environment (also known as ubiquitous computing environment) ubiquitous computing environment, applications will become independent of the ssential network, data, or the device used[7].

OBJECTIVE OF THE STUDY:

1. To Examine and evaluate the individuals and stakeholders favorof adopting the new technology

2. To Observe and analyze the factors identified by stakeholders to better understand the value of U- commerce in the near future

3. To find the important factors that increase the customer satisfaction, security, trusted transaction and to develop the company loyalty

4. Role of Information and Communication Technology in U-Commerce

RESEARCH METHODOLOGY:

The research work is empirical in nature. A survey questionnaire designed and distributed under Random sampling method. 50 valid samples are considered for the study. Books and websites constitute the secondary data.

REVIEW OF LITERATURE:

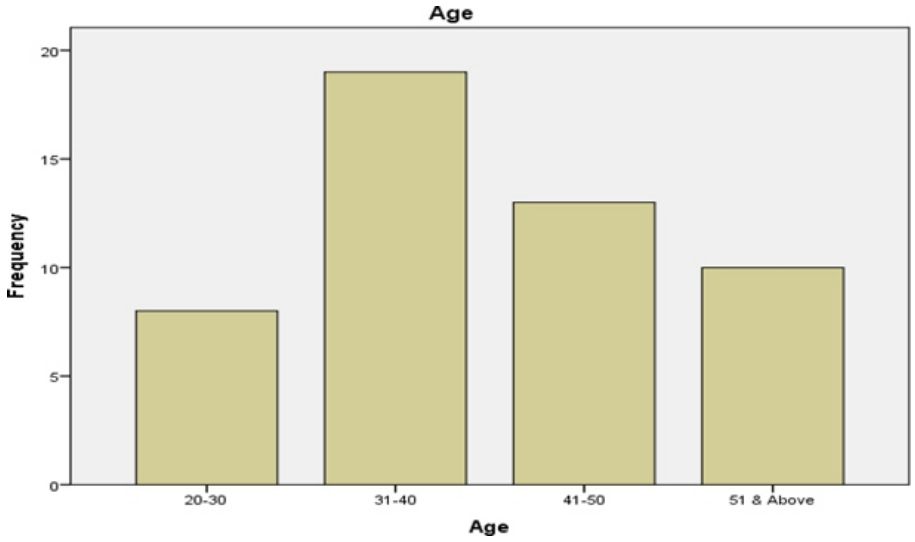
Holtjona Galanxhi-Janaqi, Fiona Fui-Hoon Nah, (2004)[8] reveled Ubiquitous commerce or U-commerce is the mixture of recognized e-commerce and wireless, television, audio and silent commerce. U- commerce includes ubiquity, universality, uniqueness and unison. It is not a substitute for other types of commerce, but an updated version of them. While bringing many benefits, there are issues and obstacles to overcome. Research is needed to assess the value of u-commerce and to address its related issues and challenges. Questions which are need to be answered are: the value of u-commerce, the ways to maximize the advantages and value of u-commerce, it is the right technology and which directions need to be considered, the privacy issues and risks involved in it, about trust and security, the strategies for businesses in utilizing and implementing u-commerce.

Analysis and Interpretation:

Classification of Respondent's on the basis of Age

Age	Frequency	Percent
20-30	8	16
31-40	19	38
41-50	13	26
51 & Above	10	20
Total	50	100

Bar Chart on the Basis of Respondent's Age



Interpretation:

The frequency table shows 38% of Respondents are in 31-40 age group and 16% of Respondents are below 20-30 age group.

Table showing Chi square between groups based on Age and Level of agreement on New Technology U-Commerce requirement

Age * Level of agreement on New Technology U-Commerce requirement Cross tabulation							
		Level of agreement on New Technology U-Commerce requirement					Total
		Strongly Agree	Agree	Neutral	Dis agree	Strongly disagree	
	20-30	0	0	2	5	1	8

Age	31-40	2	4	10	3	0	19
	41-50	0	4	0	4	5	13
	51 & Above	2	4	0	4	0	10
Total		4	12	12	16	6	50

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	34.108[a]	12	0.001
Likelihood Ratio	41.314	12	0
Linear-by-Linear Association	1.227	1	0.268
N of Valid Cases	50		
a. 19 cells (95.0%) have expected count less than 5. The minimum expected count is .64.			

Interpretation:

H0- There is no association between groups based on Age and Level of agreement on New Technology U-Commerce requirement

H1- There is association between groups based on Age and Level of agreement on new Technology U- Commerce requirement

The Chi Square table value shows p value as 0.001 which is less than 0.05. Hence, Null hypothesis is rejected. There is an association between groups based on Age and Level of agreement on new Technology U-Commerce requirement. Respondents of Age group are dependent towards Level of agreement on new Technology U-Commerce requirement.

Table indicating important factors influencing stakeholders towards U-Commerce

Communalities		
Factors influencing stakeholders	**Initial**	**Extraction**
Ease Availability	1	0.773
Convenience	1	0.577
Reliability	1	0.618
IT and data security	1	0.721
Increase in Efficiency	1	0.836
Make the work more interesting	1	0.695
Increase the quality of project	1	0.741
Infrastructural Readiness	1	0.692
Increase in Productivity	1	0.674

Project presentation	1	0.85
Financial Readiness	1	0.795
Ease learning Technology	1	0.574
Updated to Current Technology	1	0.826
Supportive Software	1	0.707
Extraction Method: Principal Component Analysis.		

Interpretation:

From table it is foundthat the 14 variables exhibit the variance limitation from 0.574 to 0.850 which is 57% to 85%. Thus these variables can be reduced to predominant factors.

Indicating Mean and Standard deviation for factors that increase the Stake holders' satisfaction, security, trusted transaction and to develop the company loyalty

Factors Influencing	Mean	N	Std. Deviation
Improving communication between consumer	2.52	50	1.199
Remove Security Concern	3.48	50	1.249
Trusted Transaction	2.92	50	1.158
Build Company Loyalty	2.66	50	1.319

Interpretation:

Above table shows there is a difference in level of agreement among respondents hence using the rate scale (1) Strongly Agree (2), Agree (3), Neutral, (4) Disagree, (5) Strongly disagree.
Below 1 to less than
1.5 considered to be - Strongly agree, more than 1.5 to less than 2.5 - agree, more than 2.5 to less than - Neural, more than 3.5 to less than 4.5 - Disagree, more than 4.5 – Highly Disagree.
Improving communication between consumer (2.52), Build Company Loyalty (2.66), Trusted Transaction (2.92) and Remove Security Concern (3.48) therefore all the factors are dominate on Neutral. Hence it's dominantly proved factors that increase the Stake holders' satisfaction, security, trusted transaction and to develop the company loyalty are Neutral.

Suggestion and Conclusion:

This research paper reveals that U-Commerce is a continuously emerging field of wireless communication in the present scenario and one of the non-negligible technologies in the market

place. We have been seen in the whole research, U-Commerce enable users to connect the whole world anytime and from any moment. There has been mix opinion of stakeholders about this technology but most of them are in favor of it. The major findings are:

- 16 Stakeholders said technology updating is required, 12 of them are Neutral and 22 of the reveals E-Commerce and M-Commerce is enough to meet the business challenges.
- Respondents of Age group are dependent towards Level of agreement on new Technology U-Commerce requirement.
- 14 variables exhibit the variance limitation from 0.574 to 0.850 which is 57% to 85%. Thus these variables can be reduced to predominant factors. None of the factors are dominant on influencing Stakeholders towards U-Commerce.
- Factors that increase the Stake holders' satisfaction, security, trusted transaction and to develop the company loyalty are neutral.

U-Commerce is the updated tool of technology for a marketplace and a landmark of wireless technology, which reaches individuals where they are at using the devices that they want to use, with the networks doing the work, Factors Influencing U-Commerce is not been a Inspiring measures, stakeholder's feels E- Commerce and M-Commerce are well known technologies. U-Commerce was not been a well known technology in India. U-Commerce should seek much more supportive factor from ICT to be an updated version of Technology.

REFERENCE:

1. Junglas, I. A. and Watson, R. T. (2003) 'U-commerce: An Experimental Investigation of Ubiquity and Uniqueness', Proceedings of the International Conference on Information Systems, Seattle, WA: 414–26.

2. Zhang, L., Liu, Q., & Li, X. (2009). Ubiquitous commerce: theories, technologies, and applications. Journal of Networks, 4(4), 271-278.

3. Sen, J. (2012). Ubiquitous Computing: Applications, Challenges and Future Trends. Embedded Systems and Wireless Technology: Theory and Practical Application, Aquino Santos, R. Et al.(eds.), 1-40.

4. Sánchez-Pi, N., & Molina, J. M. (2009, June). A multi-agent platform for the provisioning of u-commerce services. In Fuzzy Information Processing Society, 2009. NAFIPS 2009. Annual Meeting of the North American (pp. 1-6). IEEE

5. Kim, S., Suh, E., & Yoo, K. (2004). Ubiquitous Computing Based Mobile Commerce: Toward the Ubiquitous Commerce. In ICEB (pp. 847-852).

6. Pantano, E. (2013). Ubiquitous Retailing Innovative Scenario: From the Fixed Point of Sale to the Flexible Ubiquitous Store. Journal of technology management & innovation, 8(2), 84-92.

7. Sheng, H., Nah, F. F. H., & Siau, K. (2008). An experimental study on ubiquitous commerce adoption: Impact of personalization and privacy concerns. Journal of the Association for Information Systems, 9(6), 15.

Holtjona Galanxhi-Janaqi,

8. Fiona Fui-Hoon Nah, (2004) "U-commerce: emerging trends and research issues", Industrial Management & Data Systems, Vol. 104 Iss: 9, pp.744 – 755

Smartphone Usage: Assistance or Interference to Work and its Impact on Job Performance

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A B S T R A C T

Smart Phone Usage is a relatively new and wildly popular form of technology. With deep mobile penetration, the use of mobile technology has become very popular in the last few years in India. There is considerable debate among academics and business practitioners on the value of the use of smart phones by employees. In recent years, the way knowledge is shared has changed significantly. Many new technologies that allow easy access have emerged. Some claim that the use of smart phones by organizational members is a waste of time, while others believe it leads to improvements in job performance, partly due to employees' successful efforts to balance work-life realms. However, the negativity that surround smart phone Usage at workplace overshadows the opportunities it provides the organisations. Hence this study is on whether Smartphone usage is of assistance or interference to work and in turn if it impacts the job performance of the employee.

Keywords - Smartphone, Job Performance, Technology, Assistance to Work, Interference to Work

SIGNIFICANCE OF THE STUDY

Studying the effect of Smartphone Usage in the workplace gives us an understanding on whether it assists in creating a good communication, relationship, knowledge sharing and flexible work environment among the employees or whether it is a cause of interference due to the job stress, non-work purposes, addiction and work overload that is caused due to Smartphone usage. It can help reveal the organizations to either allow or disallow the use of Smartphone in the workplace.

Research Problem

With the increased usage of Smart Phones at Workplace, is it of assistance or interference to work.

Objective

- To examine the interference caused in workplace due to the usage of Smart Phones
- To study the assistance in workplace after the use of Smart Phones
- To find if the usage of Smart Phones at workplace results in better Job Performance

LITERATURE REVIEW

A Smartphone can be defined as "a device that combines a cell phone with a hand held computer, typically offering internet access, data storage, e-mail capability, etc". These typically are touch screen and can include: iPhone, Android, Windows, or Blackberry (Tricia, 2014). Work-life balance can be defined as "the extent to which an individual is equally engaged in and equally satisfied with his or her work role and family role" (Greenhause, et al, 2003). The opposite of this is work-life conflict, which is when the areas of work and life are incompatible, and doing something for work interferes with family life, and vice versa. (Harris et al, 2011).

The use of technology at work becomes more and more popular everyday "In fact, some mobile phone users consider their handsets as extensions of their physical selves" (Campbell & Russo, 2003). A reason for this is that workers often embrace technology because it gives them the flexibility to work from home if they choose. Technology is often used in organizations in order to help employees solve problems and have easier access to information. It has also been shown to help the performance of employees because they can easily communicate with co-workers from anywhere (Day et al, 2012). Use of job-provided or personally owned Smartphone at work and at home, has created a "new open door policy," portending many changes for employees and organizations Haejung Yun et al, 2012. However, some researchers (Nancy A. Cheever et al , 2014; Chesley, 2005; Haejung Yun et al,2012; Chesley & Johnson, 2010; Currie & Eveline, 2011) have examined whether this technology is actually having a negative impact on employees' ability to balance work and life.

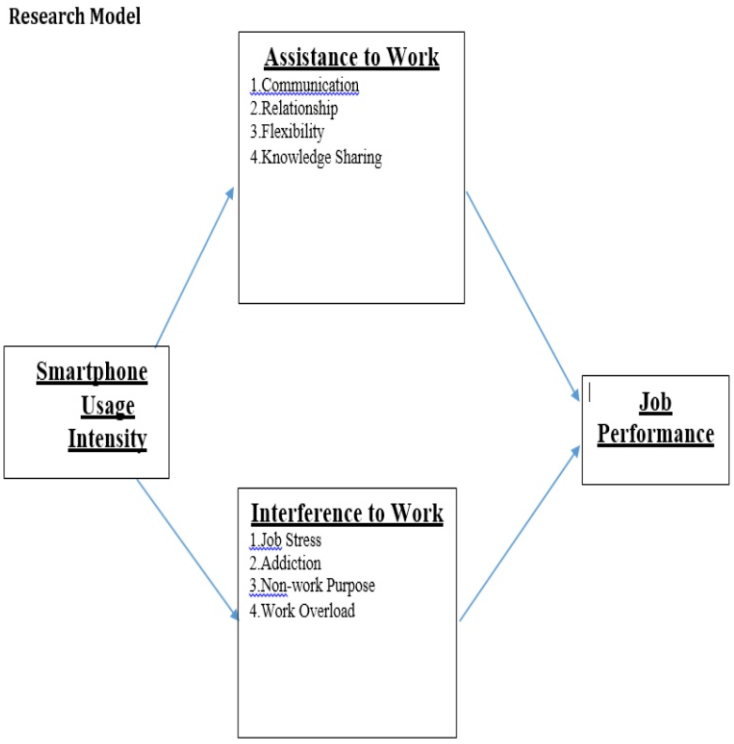
Hypotheses 1: Smartphone Usage Intensity is positively associated with effective communication process

Hypotheses 2: Smartphone Usage Intensity is positively associated with a better relationship among the employees

Hypotheses 3: Smartphone Usage Intensity is positively associated with flexibility in work

Hypotheses 4: Smartphone Usage Intensity is positively associated with effective Knowledge sharing

Hypotheses 5: Smartphone Usage Intensity is positively associated with job performance



Hypotheses 6: Smartphone Usage Intensity is negatively associated with job stress
Hypotheses 7: Smartphone Usage Intensity is negatively associated with addiction towards smartphones Hypotheses 8: Smartphone Usage Intensity is negatively associated with non-work purposes Hypotheses 9: Smartphone Usage Intensity is negatively associated with work overload

RESEARCH METHODOLOGY

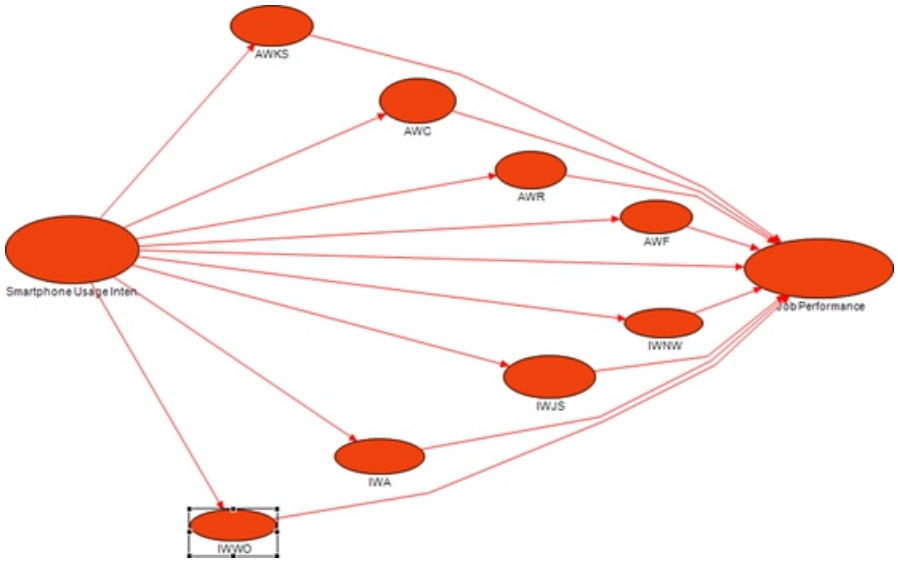
Survey methodology was used and a random sample of 95 employees who were IT professionals based in Chennai responded. This is an exploratory research hence Partial Least Squares-Structural Equation Modeling Analyses has been done through Smart PLS Software.

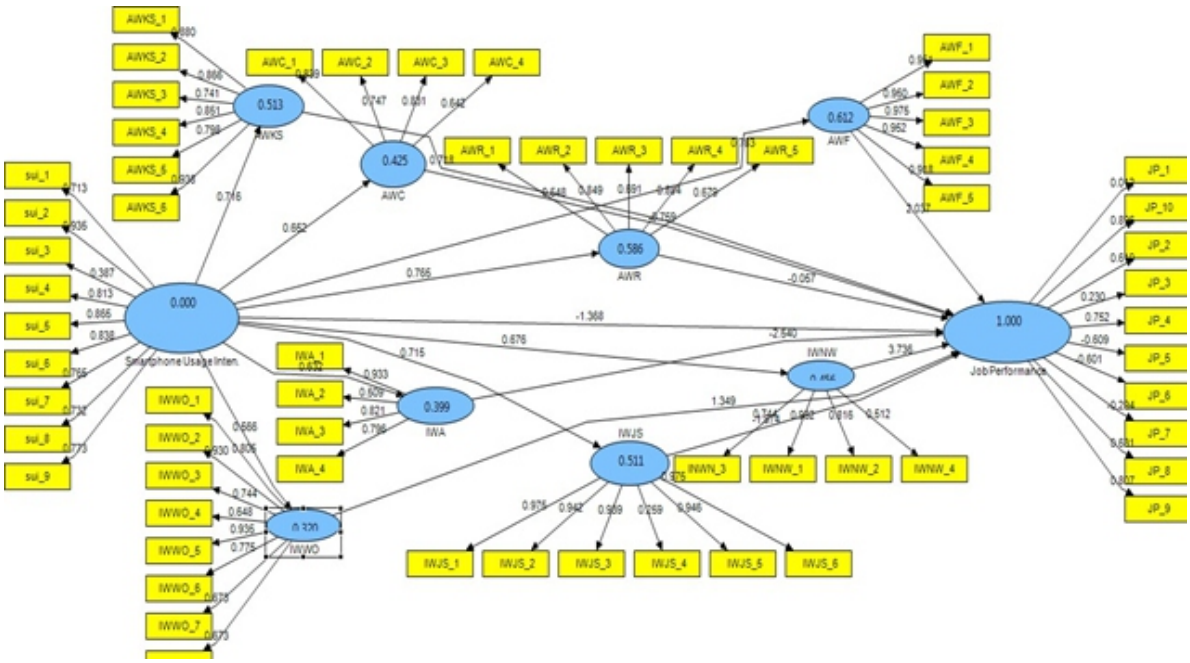
DATAANALYSIS

The competencies of PLS-SEM are such that it is able to handle small sample sizes, no assumptions of the particular scale and as well as the normality of the data distribution ,(Fornell, (1982), Hair et al, (2012), Wold,(1985)).and also it well known that PLS can handle all data types and scales such as interval, nominal, ordinal and ratio(Fornell, 1985, Garson,2012, Latan & Ghozali, 2013) .

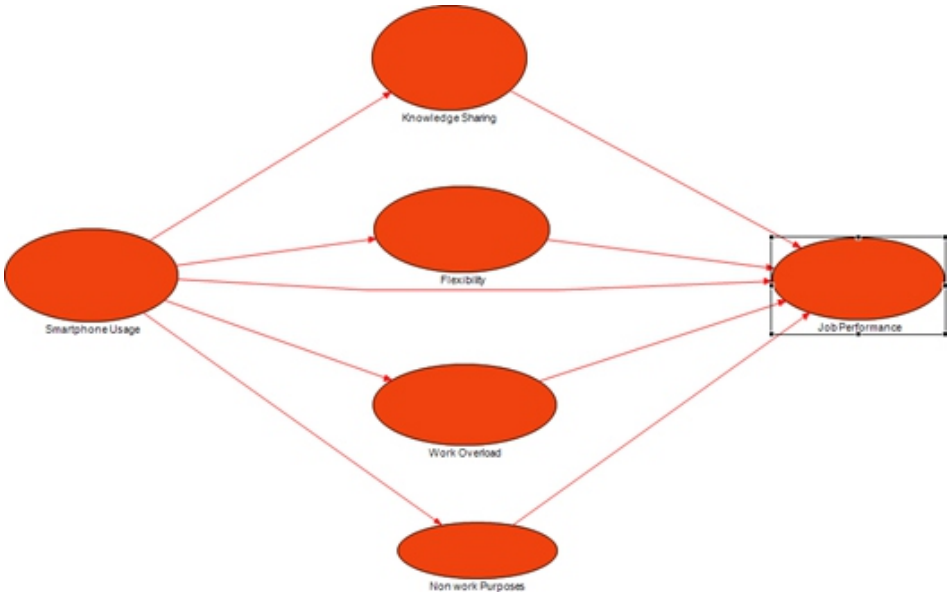
Measurement Instrument

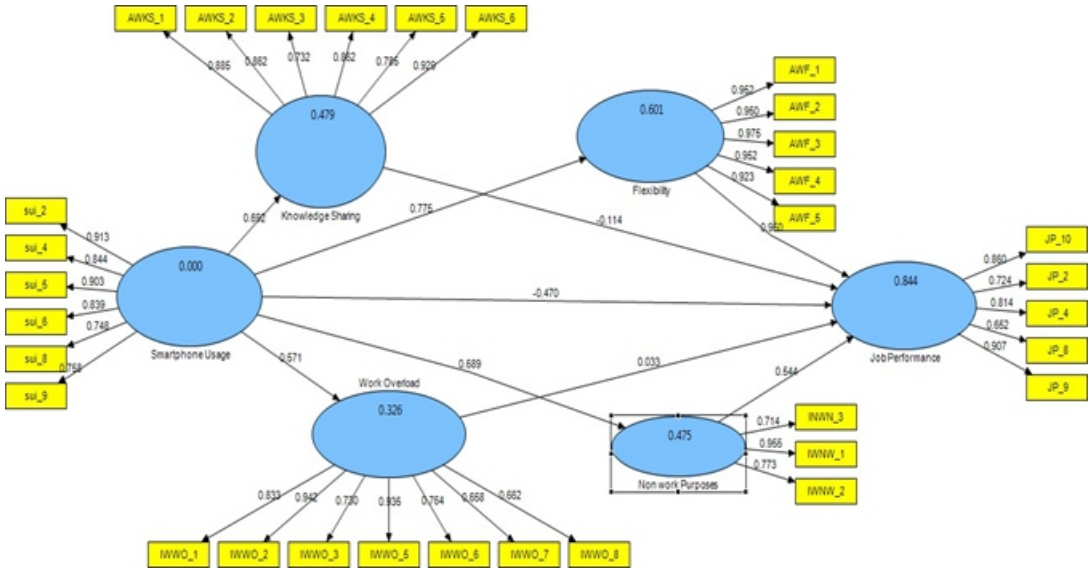
Constructs	Lit Review
Smartphone Usage Intensity	Murad Moqbel, (2012), Jacob Grauers(2012)
Assistance to work	
Knowledge Sharing	Vathsala Wickramasinghe and M.S.M.Nisaf(2013)
Communication process	Rabia Sarwar. Abdul Ghafoor ,(2014)
	Carol Xiaojuan Ou Choon Ling Sia Chun Kit Hui, (2013)
Relationship Network	Carol Xiaojuan Ou Choon Ling Sia Chun Kit Hui, (2013)
Flexibility	Vathsala Wickramasinghe and M.S.M.Nisaf(2013)
	Haejung Yun, William J. Kettinger, and Choong C. Lee,(2012)
Interference to work	
Work Overload	Vathsala Wickramasinghe and M.S.M.Nisaf(2013)
	Haejung Yun, William J. Kettinger, and Choong C. Lee,(2012)
Non-work purposes	Vathsala Wickramasinghe and M.S.M.Nisaf(2013)
Job stress	Haejung Yun, William J. Kettinger, and Choong C. Lee,(2012)
Addiction	James.A.Roberts et al,(2014)
Job Performance	Vathsala Wickramasinghe and M.S.M.Nisaf(2013)
	Murad Moqbel, (2012)





In order to obtain a model fit , a few items were dropped. It has been suggested that the cut-off for the outer loading be >=0.6 for research data that are exploratory (Chin,1998Hair et al,2011, Latan & Ghozali,2013),





	sui_2	sui_4	sui_5	sui_6	sui_8	sui_9
Iteration 1	0.1917	0.177	0.1639	0.2722	0.2049	0.1925
Iteration 2	0.1963	0.1778	0.1719	0.2752	0.1941	0.1839
Iteration 3	0.1963	0.1779	0.1722	0.2755	0.1937	0.1834
Iteration 4	0.1964	0.178	0.1723	0.2755	0.1936	0.1831
Iteration 5	0.1964	0.178	0.1723	0.2756	0.1936	0.1831
Iteration 6	0.1964	0.178	0.1723	0.2756	0.1936	0.1831
Iteration 7	0.1964	0.178	0.1723	0.2756	0.1936	0.1831

	AWF_1	AWF_2	AWF_3	AWF_4	AWF_5
Iteration 1	0.2367	0.2106	0.2171	0.1919	0.1952
Iteration 2	0.2351	0.2109	0.2162	0.1921	0.1973
Iteration 3	0.2353	0.2104	0.216	0.1924	0.1975
Iteration 4	0.2353	0.2104	0.216	0.1925	0.1975
Iteration 5	0.2353	0.2103	0.216	0.1925	0.1976
Iteration 6	0.2353	0.2103	0.216	0.1925	0.1976
Iteration 7	0.2353	0.2103	0.216	0.1925	0.1976

	AWKS_1	AWKS_2	AWKS_3	AWKS_4	AWKS_5	AWKS_6
Iteration 1	0.3141	0.2431	0.0655	0.2431	0.1116	0.1793
Iteration 2	0.3361	0.2476	0.047	0.2553	0.0971	0.1704
Iteration 3	0.3401	0.2474	0.0432	0.2591	0.0942	0.1687
Iteration 4	0.3406	0.2474	0.0427	0.2595	0.0939	0.1685
Iteration 5	0.3407	0.2474	0.0427	0.2596	0.0938	0.1684
Iteration 6	0.3407	0.2474	0.0427	0.2596	0.0938	0.1684
Iteration 7	0.3407	0.2474	0.0427	0.2596	0.0938	0.1684

	INWN_3	IWNW_1	IWNW_2
Iteration 1	0.1589	0.7226	0.2539
Iteration 2	0.1534	0.7256	0.2552
Iteration 3	0.1502	0.7298	0.253
Iteration 4	0.15	0.7301	0.2529
Iteration 5	0.1499	0.7302	0.2528
Iteration 6	0.1499	0.7302	0.2528
Iteration 7	0.1499	0.7302	0.2528

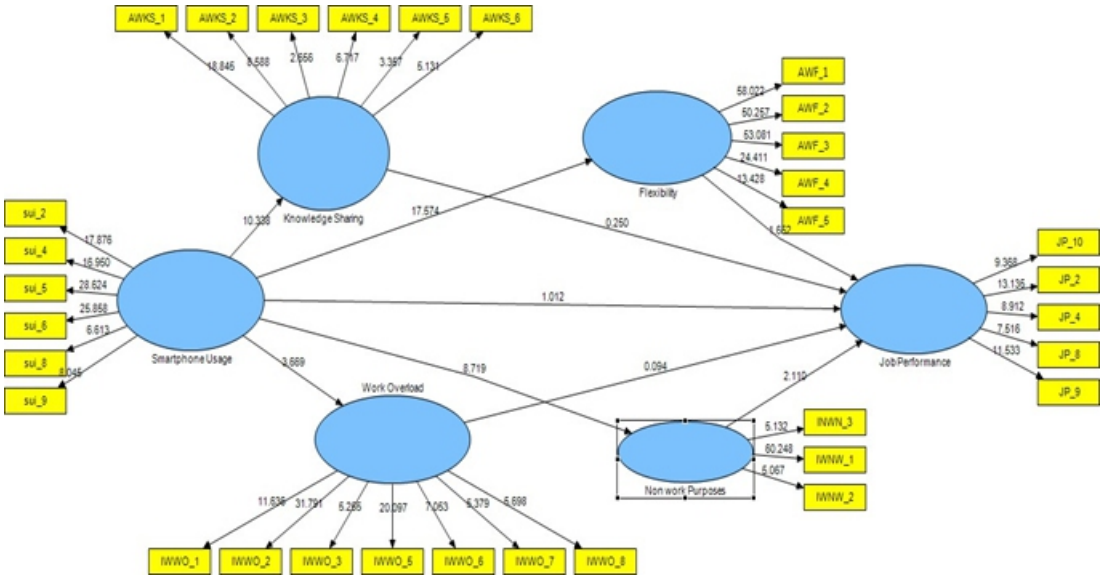
	IWWO_1	IWWO_2	IWWO_3	IWWO_5	IWWO_6	IWWO_7	IWWO_8
Iteration 1	0.2648	0.2471	0.1355	0.2267	0.1962	0.077	0.053
Iteration 2	0.262	0.2457	0.1346	0.2281	0.1975	0.0775	0.0554
Iteration 3	0.2635	0.2465	0.1338	0.2285	0.1986	0.0755	0.0537
Iteration 4	0.2635	0.2466	0.1337	0.2285	0.1986	0.0754	0.0536
Iteration 5	0.2636	0.2466	0.1337	0.2285	0.1986	0.0754	0.0536
Iteration 6	0.2636	0.2466	0.1337	0.2285	0.1986	0.0754	0.0536
Iteration 7	0.2636	0.2466	0.1337	0.2285	0.1986	0.0754	0.0536

	JP_10	JP_2	JP_4	JP_8	JP_9
Iteration 1	0.3086	0.2506	0.2178	0.2145	0.2603
Iteration 2	0.3026	0.2479	0.2253	0.2053	0.268
Iteration 3	0.3028	0.248	0.2253	0.2046	0.2683
Iteration 4	0.3027	0.248	0.2255	0.2043	0.2685
Iteration 5	0.3027	0.248	0.2255	0.2043	0.2685
Iteration 6	0.3027	0.248	0.2255	0.2043	0.2685
Iteration 7	0.3027	0.248	0.2255	0.2043	0.2685

The t statistics in the table above indicate that all structural path coefficients are statistically significant(>0.05) (Chin,1998, 2010, Henseler et al.,2009, Latan & Ghozali,2013)

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Standard Error (STERR)	T Statistics (|O/STERR|)
Flexibility -> Job Performance	0.95	0.9821	0.5749	0.5749	1.6524
Knowledge Sharing -> Job Performance	-0.1142	-0.0366	0.4562	0.4562	0.2502

Non work Purposes -> Job Performance	0.5445	0.5823	0.2581	0.2581	2.1098
Smartphone Usage -> Flexibility	0.7755	0.7823	0.0441	0.0441	17.5744
Smartphone Usage -> Job Performance	-0.47	-0.5398	0.4647	0.4647	1.0116
Smartphone Usage -> Knowledge Sharing	0.6918	0.7307	0.0669	0.0669	10.338
Smartphone Usage -> Non work Purposes	0.6893	0.7128	0.0791	0.0791	8.7188
Smartphone Usage -> Work Overload	0.5706	0.5796	0.1555	0.1555	3.6694
Work Overload -> Job Performance	0.0335	-0.0105	0.3553	0.3553	0.0942



FINDINGS

The findings of the study have both theoretical and practical implications. With regard to theoretical implications, first, both academics and practitioners need valid information to understand the influence of Smartphones on productivity. This becomes important because the popularity of Smartphones is relatively new, and employees engaging in Smartphones during office work hours are growing while scholarly research in this area is presently lacking.

The findings suggest that Smartphones Usage does not directly influence the Job Performance of an employee but influences Knowledge Sharing and Flexibility in work which in turn affects the Job Performance. It was found that employees using Smartphone at work enjoy several benefits such as solving work-related problems collaboratively and gaining knowledge through its usage. The

Flexibility in the job created due its usage enables employees to work from home as well as plan their work schedule in a more effective manner. Therefore, it is beneficial for firms with a long term-view to pay more attention to evolving Smartphone usage.

However, employees also suffer from certain interference due the work overload created due to Smartphone Usage and also due to Non-Work purposes involved at workplace due to its usage. The findings of this study also show that an increased work overload due to Smartphone use results in greater work to-life conflict. Employees feel they get loaded with too much of information which they are not able to handle and feel pressurised. Several non-work purposes like social media are interference at workplace. These findings imply the difficulties organisations face in balancing both effects of Smartphone usage, assistance as well as the interference caused at the workplace due to its usage at work.

LIMITATIONS AND FUTURE RESEARCH

The data were collected from IT professionals based in Chennai. The study relied on self reported Smartphone usage and Job performance. Future studies can be based on employees from various professions and also from different cities in India as well as abroad. More constructs based on work-life balance can be included in the study on Smartphone Usage.

REFERENCES

1. *Alexandre Rodrigues,(2011),The perceived impacts of smartphone use on the performance of senior managers in South African firms", Thesis-MBA, The Graduate School of Business University of Cape Town.*
2. *Andrea Ferreira,(2008),"The effect of online social networking on employee productivity within a tertiary education institution",Thesis submitted to The University of Johannesburg.*
3. *Boshoff, M. and du Plessis, T. (2008), "Preferred communication methods and technologies for organisational knowledge sharing and decision making", South African Journal of Information Management.*
4. *Carol Xiaojuan Ou Choon Ling Sia Chun Kit Hui, (2013),"Computer-mediated communication and socialnetworking tools at work", Information Technology & People,*
5. *Davenport, E. (2001), "Knowledge management issues for online organisations: 'Communities of Practise' as an exploratory framework", Journal of Documentation*
6. *Ferreira, A. and du Plessis, T. (2009), "Effect of online social networking on employee productivity", South African Journal of Information Management*
7. *Fornell, C., & Larcker, D. F. (1981). Structural equation models with unobservable variables and measurement error: Algebra and statistics. Journal of Marketing Research,*
8. *Gokul Chittaranjan Jan Blom Daniel Gatica-Perez, (2013),"Mining large-scale smartphone data for personality studies", Journal Personal and Ubiquitous Computing.*
9. *Harri Jalonen,(2014),"Social Media And Emotions In Organisational Knowledge Creation",Proceedings of the 2014 Federated Conference on Computer Science and Information Systems.*

10. *Hair, J.F., Hult, G.T.M., Ringle, C.M., Sarstedt, M., 2013. A Primer on Partial Least Squares Structural Equation Modeling. Sage, Thousand Oaks,.*
11. *Hair, J.F., Ringle, C.M., Sarstedt, M., 2011. PLS-SEM: indeed a silver bullet. Journal of Marketing Theory and Practice*
12. *Hair, J.F., Sarstedt, M., Ringle, C.M., Mena, J.A., 2012. An assessment of the use of partial least squares structural equation modeling in marketing research. Journal of the Academy of Marketing Science*
13. *Henseler, J., 2010. On the convergence of the partial least squares path modeling algorithm. Computational Statistics.*
14. *Henseler, J., 2012. Why generalized structured component analysis is not universally preferable to structural equation modeling. Journal of the Academy of Marketing Science.*
15. *Henseler, J., Chin, W.W., 2010. A comparison of approaches for the analysis of interaction effects between latent variables using partial least squares path modeling. Structural Equation Modeling Advertising. Edward Elgar Publishing, Cheltenham,*
16. *Henseler, J., Ringle, C.M., Sinkovics, R.R., 2009. The use of partial least squares path modeling in international marketing. Advances in International Marketing.*
17. *Kaisa Henttonen Minna Janhonen Jan-Erik Johanson, (2013),"Internal social networks in work teams: structure, knowledge sharing and performance", International Journal of Manpower.*
18. *Murad Moqbel, (2012), "The Effect Of The Use Of Social Networking Sites In The Workplace On Job Performance", Thesis-Doctor Of Philosophy In International Business Administration, Texas A&M International University.*
19. *Paul Burton,Yu "Andy" Wu and Victor R. Prybutok(2010),"Social Network Position and Its Relationship to Performance of IT Professionals",the International Journal of an Emerging Transdiscipline*
20. *Rabia Sarwar. Abdul Ghafoor ,(2014),"Mobile Phones Usage and Employees' Performance: A Perspective from Pakistan",International Journal of Academic Research in Accounting, Finance and Management Sciences.*
21. *Rémy Magnier-Watanabe Michiko Yoshida Tomoaki Watanabe, (2010),"Social network productivity in the use of SNS", Journal of Knowledge Management,*
22. *Rosalie G.B.M.,Lidewey E.C,Kees (2011), "Social Networks:Effects On Identification,Performance And Satisfaction",Nyenrode Research Paper*
23. *Thiraput Pitichat,(2013),"Smartphones in the workplace: Changingorganizatio nal behavior, transforming the future",A Journal of Transdisciplinary Writing and Research from Claremont Graduate University.*
24. *Vathsala Wickramasinghe and M.S.M.Nisaf(2013),"Organizational policy as a moderator between online social networking and job performance", VINE,The journal of information and knowledge management systems*
25. *Wong(2008), "Task knowledge overlap and knowledge variety: the role of advice network structures and impact on group effectiveness", Journal of Organisational behavior..*
26. *Xi Zhang, Yang Gao, Hui Chen, Yongqiang Sun, Patricia Ordenaz de Pablos, (2015), Enhancing Creativity Or Wasting Time?: The Mediating Role Of Adaptability On Social Media - Job Performance Relationship, Pacis 2015_Proceedings*

Utilisation Of Information And Communication Technologies In The Health Sector: A Case Of Public Hospitals In The Midlands Region, Zimbabwe.

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ABSTRACT

Information and communication technologies (ICTs) are becoming a part of every aspect of life and all industries including the health sector are embracing ICTs in order to improve efficiency and productivity in their day to day operations. The use of ICTs in the health sector has been seen to improve healthcare delivery. The purpose of this study is to investigate the extent of ICT utilisation in the health sector in Zimbabwe. The study further examines the benefits of using ICTs and the challenges faced in the usage of ICTs in the sector. The study followed an exploratory research design where a structured questionnaire was used as the main tool for collecting data. The questionnaire was administered to 80 healthcare professionals and the data that was collected was analysed in order to determine the extent of ICT usage. The study revealed that although there was some reasonable use of the available ICT technologies, the ICTs were used insufficiently to manage patients. The perceived benefits of using ICTs that were identified included improving patient management, enabling collaboration among health professionals, improving availability of clinicians during emergencies and improving efficiency and productivity. The strongest ICT usage barriers found were high cost of ICT facilities, lack of adequate ICT facilities, poor connectivity and inadequate access to ICT facilities.

Keywords - Information and communication technologies, Healthcare professionals, Healthcare sector, ICT utilisation, Zimbabwe

INTRODUCTION

Paul (2003) defines Information and Communication Technologies (ICTs) as a variety of technologies that allow users to get, produce and share ideas and resources. The technologies consist of computing technology which enables users to transmit, store, access and manipulate information, (Adeleke et al., 2015). The technologies make possible the managing of information and facilitate different forms of communication. ICTs allow people who are in different parts of the world to communicate

instantaneously and people are able to gather and access information resources from databases anywhere in the world. ICTs encompass the wide range of technologies from radio, film, television, press, telephone, theatre and video, to electronic systems such as e-mail, e-commerce and the internet.

Information and communication technologies are becoming an important aspect of life. There is widespread use of ICTs in people's daily activities such as buying goods, services and even when socialising. These technologies are also being widely used in organisations and they have affected the way business is carried out and how different entities compete (Barnes and Hinton, 2007). Organisations that have embraced ICTs are moving away from the conventional manual ways of doing business and ICTs have enabled the efficient running of almost all industries in any economy of any country.

The health care delivery sector is one sector that has also been affected by the use of ICTs. The development, growth and use of ICT products has transformed the current healthcare systems in areas such as patient management, communication with colleagues and end users, training of healthcare providers and storage and retrieval of up-to-date health information (Bello et al., 2004). Gates (1999) indicated that American doctors were now able to collaborate with other doctors all over the world as often and as quickly as they wanted through the use of ICTs. Healthcare professionals can now get

feedback on areas of interest from experts who are in remote locations within a few minutes. The availability of ICT has made possible the immediate and unprecedented access to the most recent and reliable results of clinical research and good healthcare information in everyday medical practice, (Adeleke et al., 2015).

The provision of quality health-care delivery in a country is guided by the level of the ICT infrastructure possessed and used by that country. A good ICT infrastructure, therefore, is a prerequisite for enhancing the well-being of a country (Hassan, Siyanbola & Oyebisi, 2011)). To ensure growth in the ICT sector, the Government of Zimbabwe and the private sector have made relevant investments. These include new fibre optic links being deployed to improve international connectivity via neighbouring countries with access to international submarine fibre optic cables (Kelly & Cook, 2011). The private sector has carried out similar projects where they linked major cities using optic fibre. These projects have facilitated reliable, high-speed, affordable networks, (Tsokota and Solms, 2013).

Despite the investments made to improve the ICT sector, the Government of Zimbabwe has not fully embraced ICTs in most of its operations since most processes are still being done manually. This shows that there is still a low uptake of ICTs by most government departments, (Tsokota and Solms, 2013). The

government should adopt and use ICTs in its operations in order to encourage adoption by the domestic market. In other industries or sectors the usage levels are still very low and ICTs are currently being used for basic functions. Zanamwe et al. (2012) revealed low usage levels in the pharmaceutical sector and there are also low usage levels in agribusiness, (Mupemhi, Mupemhi, & Duve, 2011). The adoption and usage levels in Small and Medium-sized Enterprises (SMEs) is also still very low and the majority of SMEs are yet to adopt the technology (Mashanda, Cloete & Tanner, 2012). While most banks in Zimbabwe have adopted ICTs, usage levels have remained relatively low, (Dube, Chitura & Runyowa, 2009). Research has shown that regardless of the rapid increase in ICT investment and the benefits associated with adopting ICTs, uptake and acceptance has been slow. It is against this background that this study attempts to firstly determine the extent of ICT utilisation in public hospitals in Zimbabwe, determine the benefits of using ICTs and the barriers of using ICTs in the health sector. While similar researches have been carried out in both developing and developed countries, a study in the Zimbabwean context is imperative. Zimbabwe has got a unique environment as compared to other countries due to its unique economic and political background. Research results from other countries cannot therefore be directly transferrable to Zimbabwe.

LITERATURE REVIEW

ICTs in the health sector

Healthcare experts and healthcare consumers believe that ICTs play an important role in transforming healthcare services (Chaudhry et al., 2006). ICTs are making it possible for the health care sector to move away from the traditional, manual way of delivering health care. The technologies are now facilitating a variety of tasks which include researching, collecting information from patients, and cross-checking patients' histories. Health professionals are kept updated on knowledge concerning diseases, drugs and

new research findings. Basically the ICTs support information processing, record keeping, decision making and enables interactivity between or among users of the technology.

ICTs have not only proved successful in supporting health care processes but they have managed to make these processes easier and faster in spite of distance, location or time. Odousoro (2014) specified that ICTs enable simultaneous distribution, processing, retrieval and reception of information worldwide. ICTs enable Health care professionals to have access to up-to-date information from online databases and other health care experts. Doctors are able to collaborate with other doctors in other parts of the world and are able to share experiences with colleagues, (Gates, 1999). The doctors are able to

make real-time decisions about life threatening cases because of the easy and fast access of relevant information.

Benefits of ICTs in the Healthcare sector

Various benefits of using ICTs in the healthcare sector have been cited by various researchers. Odousoro (2014) revealed that healthcare professionals are able to better diagnose diseases, and are able to use clinical decision support systems to make better decisions. He further indicated that ICTs have made available medical tools such as electronic health records and diagnostic tools that improve the management of patients and their records. Patients with chronic diseases like diabetes can be monitored and managed effectively through ICT based technologies. The ICTs will be used to monitor the trend in the clinical parameters and to quickly detect any deviations.

Health care providers that have adopted ICT technologies have disclosed that ICTs can improve the quality of service and efficiency in health care (Shekelle & Glodzweig, 2009). The researchers further revealed that quality of service is enhanced through improving the safety of patients by eliminating errors like inattentiveness, lack of knowledge and poor judgement. Health care professionals are able to execute their functions faster, therefore attending to a larger number of patients and initiating treatment without delay, (Chaudhry et al., 2006). The adoption of ICT technologies also enables the reduction of operating costs of clinical services through the efficient processing of data and documents.

In addition, medical practitioners have to carry out researches on the epidemiology of different diseases, disease detection and which treatment modalities have the best outcomes. These researches are carried out because medical knowledge evolves with time. Therefore, medical practitioners need to have access to a wide range of information in order to carry out the researches. These researches are made possible through access to ICT technologies like the Internet, (Odousoro, 2014). The Internet enables the health workers to have access to any information of interest relating to health care and they are able to identify current research issues, review previous researches, access clinical trials, drug databases, clinical decision support tools and published research findings. Godlee et al (2004) concluded that health professionals should have access to universal health care information so that they acquire up-to-date information which is essential to improve patient care.

The adoption of ICTs in the health sector enables interaction between patients and practitioners and interaction among practitioners. This could be through platforms like video conferencing, chats and many other ICT based platforms. The introduction of ICTs has encouraged the development of professional networks and on-line communities. Health workers are taking advantage of these networks

to share information and to develop effective professional relationships. If there is a key public health concern, medical professionals use ICTs to discuss and exchange ideas on the issue thereby reinforcing new learning. Furthermore, healthcare professionals can also deliver health information and offer web-based therapies to patients and the public through the use of ICT technologies. Wantland (2004) revealed that there was evidence of improved knowledge and behaviour from the patients/public using web-based interventions. The health information delivered through websites includes raising awareness on pertinent health issues, encouraging good health-seeking behaviour in the community, and reminding patients of scheduled appointments.

Telemedicine is a technology that has been used to improve health care delivery in remote areas. (Bashshur, 2009) have shown that telemedicine is useful in addressing shortages of manpower as well as unequal distribution of clinicians, in particular specialists, between urban and rural health settings. Indeveloping countries, most people are based in rural areas and telemedicine has made it possible for this population to be diagnosed and treated closer to where they live in an effective manner and also to improve maternal health, (Martinez, 2005).

With ICTs, patients have the capacity to self-monitor the progression of their conditions, for example, a hypertensive patient can use an electronic blood pressure machine to monitor his/her blood pressure levels at home. Patients can also have access to medical databases, medical expert systems, clinical guidelines and medical personnel using the Internet and other communication media. The web-based services facilitate self-care practices like self-diagnosis and self-monitoring. They can also provide tutorials by experienced clinicians.

Health care facilities that have implemented ICTs are now using information systems which enable automated data collection, processing and analysis of patient information over a period of time. The analysed data provides information on how the health system is performing and decisions can then be made on areas which need improvement, professionals needing training in specified areas and how best resources can be allocated in order to achieve set objectives. Comparisons with other well-performing systems can then be made and organisations will be able to detect quality improvement opportunities, (Kukafka et al., 2007).

Barriers of ICT usage in the health sector

Regardless of the potential benefits associated with the implementation of ICTs by health facilities, some barriers exist that prevent their widespread utilization. Some of the barriers include limited access to ICTs, the high cost of providing access to ICTs, and inadequate ICT infrastructure. Jensen (2001)

identified the cost of internet services, computer hardware and the lack of organisational structures to support ICTs as some of the major barriers to ICT adoption in developing countries. The researcher further cited lack of capital to acquire facilities as another factor that hinders the successful implementation of ICTs.

Olatokun & Adeboyejo (2009) identified erratic power supply as a major challenge that prevented the full utilisation of ICTs in the health sector in Nigeria. They also identified other challenges that included lack of ICT facilities, inadequate knowledge on use of ICTs, insufficient access to ICT facilities, high cost of ICT facilities & services, and constant breakdown of equipment. Smith et al. (2007) also noted that health professionals, especially those working at primary and district levels had insufficient knowledge on how to use electronic devices, including computers, due to lack of exposure. High telecommunications tariffs and inappropriate or weak policies were also identified as major barriers to using ICTs in health facilities. Asemahagn (2015) also identified several challenges which included poor infrastructure, management problems, educational status, computer illiteracy, and resource shortage.

Usage level of ICTs in the health sector

Taylor and Lee (2005) conducted a study on the use of ICTs by occupational therapists in Western Australia. Their study revealed that the most commonly used ICT based services were personal computers, the Internet and e-mailing. The competency of the therapists in the use of ICTs was checked and it was noted that most of the therapists rated their competency level as good or better, although competence was rated lower for Web searching. The therapists that were based in the rural areas had less access to computers in their work places as compared to their counterparts in cities. However, they used videoconferencing, e-mailing and teleconferencing more frequently than their counterparts in cities. The study further noted that around one third of respondents were disappointed with the level of technical support offered to them, and only a third had participated in basic computer training provided by the company.

In a research done by Idowu, Ogunbodede & Idewo (2003), their findings revealed that personal computers and mobile phones were available and used in Nigerian teaching hospitals. However, internet services were not available in the hospitals. Health workers who needed internet connectivity would use external internet cafés. They further indicated that only 21.4% of the medical staff did not use the Internet in any way, while the majority of 70.7% who used the Internet, used it for e-mails. On the contrary, Olatokun & Adeboyejo (2009) revealed that reproductive health workers in Nigeria used ICTs in their day to day operations.

Satellife (2005) determined the extent of use of HealthNet by health workers. The study revealed that HealthNet was used by 1,950 health-care workers in more than 150 countries worldwide and that it has made major contributions in Africa towards enabling connectivity between rural and urban societies. The study revealed that health workers in Zambia who used to travel long distances each week to collect data for clinical trials now used HealthNet to send the information. Surgeons from Mozambique, Tanzania, and Uganda used HealthNet to learn new reconstructive surgery techniques while physicians in Ethiopia used HealthNet to schedule consultations. In the Democratic Republic of Congo it was used to report progress on treating trypanosomiasis to public health organizations in the north of the country while, in Gambia, malaria researchers used HealthNet to submit data to European medical schools for clinical trials. The study further indicated that many physicians in developing countries used HealthNet as a source of information on important drugs, public health promotion and the management of AIDS and tropical diseases.

A review of literature shows that ICT related technologies are yet to be fully utilised in health care facilities in developing countries. Medical doctors in these countries were found to use ICTs mainly for research and the use in medical diagnosis, communication, collaboration, doctors' training and patient management was low, (Shittu, Ajayi and Garba, 2008; Olatokun and Adeboyejo, 2011). It is against this background that the researchers would want to find out the usage levels of ICTs in public hospitals in Zimbabwe.

RESEARCH METHODOLOGY

The study was carried out at three public hospitals in the Midlands region to determine the usage levels of ICTs. An exploratory research design was used and it was considered the most suitable approach in this study. This research design was adopted given the nature of the problem to be explored in this study. A questionnaire was used as the main instrument of collecting data to make an assessment on the usage of ICTs in health care facilities. It included both structured and semi-structured questions. The questionnaire was validated by pre-testing it with a sample of six respondents and was then modified in order to improve its clarity.

The questionnaire was divided into four sections. The first section determined the basic demographic information of the respondents. The second part of the questionnaire sought to determine the level of ICT usage in public hospitals. The third section dealt with the nature of the challenges faced by healthcare professionals in the implementation of ICTs in healthcare facilities and the fourth section sought to determine the benefits associated with using ICTs in the health sector. The questionnaire was

developed by referring to different related studies, (Asemahagn MA., 2015; Olatokun WM, Adeboyejo OC., 2009).

The questionnaires were distributed to nurses, doctors, medical laboratory scientists, pharmacists and the administrative staff. The respondents were randomly selected from the hospitals and their responses were used to assess the usage of ICTs in healthcare facilities. The sample size for each hospital was determined proportionally based on the total number of health professionals in each hospital. A sample of the study of 90 respondents was drawn from health professionals as follows: - 22% was from the administrative staff, 8% medical laboratory scientists, 6% pharmacists, 14% doctors and 50% nurses. From the 90 questionnaires that were distributed to the selected respondents, a total of 80 were returned giving a response rate of 88.9%.

Presentation and discussion of results

Socio-demographic characteristics of study participants

Table 1 below, shows the profile of the respondents in terms of those characteristics that impact on the usage of ICTs in health facilities. Two-thirds of health professionals were female and 70.1% had ages ranging from 26years to 35years. Of the 80 respondents, more than half (51.3%) were nurses, a fifth (20%) were administrative staff, 15% were doctors, 7.5% were medical laboratory scientists and 6.2% were pharmacists. Majority (57.5%) of health professionals had greater than 5years of work experience and more than three-quarters (83.8%) had ICT awareness.

Table 1: Profile of respondents

Survey Question	Response category	Frequency (N)	Percentage (%)	Cumulative frequency (%)
Age	20 – 25	13	16.3	16.3
	26 – 30	31	38.8	55.1
	31 -35	25	31.3	86.4
	>35	11	13.6	100
Gender	Male Female	27	33.8	33.8
		53	66.2	100
Professional category	Administrative staff Medical lab. Scientist Pharmacist	16	20	20
	Doctor Nurse			
		6	7.5	27.5
		5	6.2	33.7
		12	15	48.7
		41	51.3	100

Working experience	≤5 years	34	42.5	42.5
	6-10 years	28	35	77.5
	11-15 years	11	13.8	91.3
	≥16 years	7	8.7	100
ICT	Yes No	67	83.8	83.8
awareness		13	16.2	100

ICT access and utilization among the healthcare professionals

Table 2 below illustrates how ICTs are utilised among the various professional participants.

Table 2: ICT access and utilization among health professionals

ICT variable	Response	Frequency(N)	Percentage(%)
Computer access	Yes No	33	41.3
		47	58.7
Purpose of computer access	Storage Report writing	23	69.7
	Internet access	29	87.9
		20	60.6
Access to mobile devices	Yes No	80	100
		0	0
Purpose of mobile device access	Communication Internet access	80	100
	Drug database Chats	67	83.8
		17	21.3
		80	100
Internet access at work	Yes	34	42.5
	No	46	57.5
Medical diagnosis	Yes No	50	62.5
		30	37.5
Diagnostic technologies accessed	x-ray imaging ultrasonography	12	15
		12	15
Research and publication	Yes No	15	18.8
		65	81.2
Use of fax services	Yes No	25	31.3
		55	68.7
Use of printer/photocopy services	Yes	39	48.8
	No	41	51.2

All study participants had access to a mobile device but more than half (58.7%) did not have access to computers at the workplace. Of those that had computer access, 87.9% used them for report writing, whilst 69.7% used them for storage and only 60.6% had internet access. This tallied with Asemahagn (2015), whose study also showed that the majority of healthcare professionals did not have computer access and those that did mainly used them for writing reports, storing documents and access to the internet. Our study also showed that, workplace telephones were universally used for communication

purposes. Mobile internet access (83.8%), use of drug databases (21.3%) and chats (100%) were only done through personal mobile devices. 62.5% of health professionals used ICTs for medical diagnosis but only 15% had access to X-ray imaging and ultrasonography mainly because only doctors and clinical officers could order these investigations.

Out of all the study participants, only 31.3% and 48.8% of professionals had access to fax and printer/photocopy services respectively and the majority of professionals (57.5%) had no access to the internet at work. These results are in contrast to Asemahagn (2015) where the majority of participants had access to fax, photocopying and printing services. This was attributed to the fact that, in the health facilities where our study was carried out, clinicians had access to diagnostic and therapeutic technologies whilst the administrative staff had greater access to information technologies and the internet. Patient data collected by clinicians was recorded manually and would only be uploaded onto computers by the administrative staff for scheduled reports or when clinicians were no longer using it.

ICT usage barriers

To determine ICT usage barriers, respondents were asked to rate the barriers on a five point Likert scale ranging from 1 (not important) to 5 (very important). In order to establish the rank order for ICT usage barriers, the mean rating of each statement was calculated. A barrier with a mean score larger than three was considered as important. The results are summarised in table 3 below.

Table 3: Rank order of ICT usage barriers

Rank	ICT usage challenge		Freq(N)	Mean	Std. Deviation	Variance
1	Erratic power supply		80	2.4	0.927	1.026
2	Inadequate access to ICT facilities		80	3.55	1.376	1.528
3	High cost of ICT facilities		80	3.72	1.181	1.277
4	Constant breakdown of equipment		80	2.24	1.146	1.318
5	Poor connectivity		80	3.1	1.212	1.016
6	Computer illiteracy		80	2.47	1.497	1.651
7	Security and privacy issues		80	2.09	1.021	1.249
8	Lack of adequate ICT facilities		80	3.21	1.279	1.307

The results show that high costs of ICT facilities, inadequate access to ICT facilities, lack of adequate ICT facilities and poor connectivity had means that were greater than three, hence these barriers were considered strong inhibiting factors to ICT usage (see table 3 above). Olatokun W.M. and Adeboyejo O.C., (2009) and Asemahagn MA., (2015) also identified inadequate ICT facilities as a major barrier. Most respondents did not have access to computers in these studies. However, Olatokun W.M. and

Adeboyejo O.C., (2009) also found erratic power supply as a major barrier. This is contrary to our findings which made this factor a weak inhibitor as the health facilities had standby generators in case of power failures. Security and privacy issues and constant breakdown of equipment were the least perceived barriers in this study.

The current study revealed high cost of ICT facilities as a major barrier. This corresponds to the findings by Zanamwe et al. (2012) who found cost as a significant barrier to adoption of ICTs in the pharmaceutical sector but in their study complexity of technology and privacy related issues were also among significant barriers, which was not the case in this study. In the current study we found computer illiteracy as a weak barrier to ICT usage. This is not in line with the widely held view that computer literacy is a backbone for ICT utilisation. However, Asemahagn MA., (2015) found computer illiteracy of health professionals to be 55% and identified this factor as one of the factors that affected ICT usage in Ethiopian hospitals.

Benefits of using ICTs in healthcare facilities

In an attempt to establish whether the health professionals were aware of the benefits of using ICTs in the health sector, respondents were asked to rate the importance of perceived benefits in influencing their decision to use ICT-based technologies on a five point Likert scale ranging from 1 (not important) to 5 (very important). To establish the rank order for perceived benefits of using ICTs, the mean rating of each statement was calculated. A benefit with a mean score larger than three was considered as important. The results are summarized in table 4 below.

Table 4: Rank order of perceived benefits of using ICTs in healthcare facilities

Rank	ICT benefit	Freq(N)	Mean	Std. Deviation	Variance
1	Improves patient management	80	3.96	1.091	1.547
2	Access to up-to-date information	80	2.11	1.264	1.298
3	Aids in research and publication	80	2.01	1.193	1.497
4	Improves efficiency and productivity	80	3.12	1.072	1.352
5	Enables collaboration among health care professionals	80	3.08	0.981	0.937
6	Improves availability of clinicians during emergencies	80	3.2	0.804	0.972

The factors that were considered as the most important benefits included improved patient management, enabling collaboration among health professionals, availability of clinicians during emergencies and improved efficiency and productivity which had means greater than three. Results also indicated that access to up-to-date information was regarded as a weak benefit. Assistance in research and publication

was seen as the least beneficial and this could have been due to the fact that medical research was mostly done by health professionals who are affiliated with teaching hospitals and teaching hospitals were not part of the study in this case.

The research finding regarding improving efficiency and productivity was also regarded as a significant benefit to ICT usage by Shekelle & Glodzweig (2009) and Chaudhry et al. (2006). The researchers revealed that health professionals were able to perform their duties faster, see more patients and make diagnoses more quickly. Improved availability of clinicians during emergencies and improved patient management were also considered as important benefits of ICTs by health professionals. This correlates with Udousoro (2014) who found the most important perceived benefits to be quick assembly of health professionals in emergencies, access to updated information and improved patient management.

In our study, we also rated collaboration among health workers as an important benefit of using ICTs in the health sector. Similar studies by Simon et al. (2004) and Gates (1999) found collaboration among health workers as a major benefit since ICTs enabled the development of professional networks which could be used for sharing information on areas of interest. The networks enable health professionals to get information from counterparts.

CONCLUSION

The study sought a) to explore the extent of ICT utilisation and b) to investigate the benefits and barriers of ICT usage in the health sector in Zimbabwe. Research findings suggested that there was some reasonable use of the available ICT technologies although the degree of access varied with the different professions. Health professionals, however, used ICTs insufficiently to manage their patients. The perceived benefits of using ICTs were improving patient management, enabling collaboration among health professionals, improving availability of clinicians during emergencies and improving efficiency and productivity. The Zimbabwean health sector is still behind in the management of hospital systems using ICTs because of challenges such as high cost of ICT facilities, lack of adequate ICT facilities, poor connectivity and inadequate access to ICT facilities.

RECOMMENDATIONS

In order for the health sector to ensure better utilization of ICTs and enjoy the innumerable benefits offered by ICTs, the following recommendations were made:-

- The government must foster an environment which facilitates development, distribution and use of ICTs in the daily activities of health professionals.
- The government must invest in acquiring and upgrading the ICT infrastructure and provision of ICT services which are applicable to the health sector. It must acquire ICTs in sufficient numbers in order to improve ICTs utilisation among the health professionals.
- Health care professionals must be educated on potential benefits of ICTs so they can embrace them and improve workplace efficiency.

REFERENCES

1. *Adeleke I.T., Salami A.A., Achinbee M., Anamah T.C., Zakari I.B., Wasagi M.H., (2015) ICT knowledge, Utilization and Perception among Healthcare Providers at National Hospitals Abuja, Nigeria. American Journal of Health Research. Vol. 3(1) pp. 47-53.*
2. *Asemahagn M. A., (2015) Challenges of ICTs Utilization among Health Professionals: The Case of Public Hospitals in Addis Ababa, Ethiopia. SMJ Public Health Epidemiol. 1(3):1012.*
3. *Barnes D. and Hinton M., (2007), Searching for e-business performance measurement system, The Electronic Journal of Information System, 10(1), pp134-142.*
4. *Bashshur, R.L., (2009), "National Telemedicine Initiatives: Essential to Healthcare Reform", Telemedicine and e-Health, Vol. 15, pp. 1-11.*
5. *Bello I.S., Arogundade F.A., Sanusi A.A., Ezeoma I.T., Abioye- Kuteyi E.A., Akinsola A. (2004). Knowledge and utilization of information technology among healthcare professionals and students in Ile-Ife, Nigeria: A case study of a University teaching hospital. J Med Internet Res. 2004; 6(4): e45.*
6. *Chaudhry B., Wang J., Wu S., et al. (2006). Systematic review: impact of health information technology on quality, efficiency and costs of medical care. Annals Internal Medicine. 144:742-752.*
7. *Dube, T., Chitura, T., & Runyowa, L. (2009) Adoption and Use of Internet Banking in Zimbabwe: An Exploratory Study. Journal of Internet Banking and Commerce 14(1), pp1-13.*
8. *Gates, W. H. (1999). Business at the speed of thought. New York: Warner Books.*
9. *Godlee F., Pakenham-Walsh N., Ncayiyana D., Cohen B., Packer A. (2004) Can we achieve health information for all by 2015? Lancet.2004; 364: 295-300.*
10. *Idowu, B., Ogunbodede, E., & Idewo, B. (2003). Information and Communication technology in Nigeria: The health sector experience. Journal of information Technology 3 (2), 69-76*
11. *Jensen, M. (2001). Policies and strategies for accelerating Africa's information infrastructure development. In G. Nulens, N. Hafkin, L. V. Audenhove, & B. Cammaerts (Eds.), The digital divide in developing countries: Towards an information society in Africa (pp. 77–112). Brussels, Belgium: VUB University Press.*
12. *Kelly, S., & Cook, S. (2011). Freedom on the net 2011: A global assessment of Internet and digital media. April 18, 2011. Retrieved, January 25, 2017, from http://pdf.usaid.gov/pdf_docs/PNADU846.pdf.*
13. *Kukafka, R. et al. (2007), "Redesigning Electronic Health Record Systems to Support Public Health", Journal of Biomedical Informatics, Vol. 40, pp. 398-409.*
14. *Martinez, A., Villarroel, V., Seoane, J., & Pozo, F. D. (2005). Analysis of information and communication needs in rural primary health care in developing countries. IEEE Transactions on Information Technology in Biomedicine, 9, 66–72.*
15. *Mashanda, P., Cloete, E. & Tanner, M. (2012). Proceedings of the 14th Annual Conference on World Wide Web Applications Durban, 7-9 November 2012 (http://www.zaw3.co.za) Accessed on 12 February 2017*
16. *Mupemhi, S., Mupemhi, R. & Duve, R. (2011). E-Commerce in Agro-food Industry in Zimbabwe: Myth or Reality? International Journal of Management & Business Studies , 1(4), pp83-86.*
17. *Olatokun WM, Adeboyejo OC. (2009). Information and Communication Technology use by reproductive health workers in Nigeria: State of the art, issues and challenges. An Interdisciplinary Journal on Humans in ICT Environments. 2009: 5; 181–207.*

18. *Paul.D. (2003). Information communication technology (ICT): integrating digital tools into your project. Information collection and Exchange Publication, 2003, pp 1-85.*
19. *Satellife (2005). Handhelds for health: Satellife's experiences in Africa and Asia. Watertown, MA: Satellife*
20. *Shekelle, P. and C.L. Goldzweig (2009), "Costs and Benefits of Health Information Technology: An Updated Systematic Review", The Health Foundation, London.*
21. *Shittu, A., Ajayi, A., and Garba, S. (2008). Information and Communication Technologies (ICT) Knowledge and Utilisation for Healthcare Delivery among Zaria Medical Doctors. The Nigerian Journal of Communication, 6(1&2), 28-43.*
22. *Simon, E. E. (2004) Telephone psychotherapy and telephone care management for primary care patients starting antidepressant treatment. JAMA , 2004, pp. 935-942.*
23. *Smith, H., Bukirwa, H., Mukasa, O., Snell, P., Adeh-Nsoh, S., Mbuyita, S., Honorati, M., Orji, B., & Garner,*
P. (2007). Access to electronic health knowledge in five countries in Africa: A descriptive study. BMC Health Services Research, 7, 1–7. Retrieved January 4 , 2017, from http://www.biomedcentral.com/content/pdf/1472-6963-7-72.pdf
24. *Taylor, R., & Lee, H. C. (2005). Occupational therapists' perception of usage of information and communication technology in western Australia and the association of availability of ICT on recruitment and retention of therapists working in rural areas. Australian Occupational Therapy Journal, 52, 51–56.*
25. *Tsokota T. and Solms R. (2013) ICT and the turning-around of the Zimbabwean Economy "International Conference on ICT for Africa 2013, February 20 -23, Harare, Zimbabwe"*
26. *Udousoro N.W. (2014) Use and Gratification of ICTs by Health Care Personnel in Nigerian South- South Tertiary Hospitals Asian Journal of Social Sciences & Humanities Vol. 3(4)*
27. *Wantland, D., (2004). The effectiveness of web-based vs non-web-based interventions: a meta- analysis of behavioural change outcomes. J. Internet Medical Research Vol 6 No 4*
28. *Zanamwe, N., Bere, M., Zungura, C., Nyamakura, S. A. & Muchangani, B. (2012) E-commerce Usage in the Pharmaceutical Sector in Zimbabwe, Journal of Internet Banking and Commerce ,17(1), pp1-15.*

Application of Lean Principles along with Internet of Things (IoT) to Improve Supply Chain Efficiencies

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ABSTRACT

Today's markets are becoming more and more competitive and volatile where the demand of products are varying at a highly unpredictable manner and companies are finding it difficult to cater to the exact market demand on time thus reducing the efficiencies of the value chain. The global operations of companies today are highly complex where the products are manufactured elsewhere and sold in various countries across the globe. It has become very tough for managers to integrate the flow of information, products and funds across the value chain efficiently as the levels of value chain increases. Few very successful Fortune 500 companies had been highly profitable because of implementing the lean principles like JIT, close co-operation with suppliers, zero defect, 5s, kaizen, etc thus helping the company to maintain low inventories, high productivity and thereby producing high quality products at the right cost. IoT had been a buzzword in today's digital world and the World Economic Forum in 2015 described IoT as one of the enablers in the 4th Industrial revolution that has taken off this decade which is about to transform the business models of many industries. This paper aims to integrate lean principles with the emerging technology enablers of the present decade and implement it by carrying out value stream mapping of the supply chain in an OEM company to arrive at a conclusion that lean operations with IoT technology innovations will lead to higher supply chain efficiencies.

Keywords - Supply chain,Lean, Transport and Logistics, Value Stream Mapping, IoT.

INTRODUCTION

Supply chains come in all sizes and shapes. It is 'as simple as going to a farmer to buy apples or as complex as involving thousands of suppliers, manufacturers, shippers and retailers'. Simple or complex, if one of the steps fails, the entire chain fails as a result. Therefore, efficient Supply Chain Management is vital for optimum performance, cost minimization and customer satisfaction. The concept of lean by means of elimination of waste can make a supply chain even more efficient and competitive. So, along with lean principles, technologies like IoT can add a lot of value to the entire value chain. The profitability that can be harnessed is enormous. Today companies are looking out to reduce costs by

investing less and thus increase the throughput of their supply chain. Cost innovation strategies are being considered as top operations priorities of most companies. Countries like India and China have already proven their skill sets in cost innovation in various fields. Now, it's time for corporations to look into their supply chain, take the leadership and innovate to make it the most efficient ones. Supply chain efficiency is being looked upon as one of the most important parameter to remain competitive and increase the overall profitability of companies.

According to a Bain & Company (www.bain.com) survey and report, "Why Companies Flunk Supply Chain 101," more than 85 percent of senior executives say improving their supply chain performance is one of their top priorities, but fewer than 10 percent are adequately tracking that performance. Only 15 percent of the companies surveyed said they had full information on sup-ply chain performance at their own companies, and only 7 percent go outside their four walls to track performance of supply chain activities at their vendors, logistics providers, distributors and customers. Another Bain & Company survey of 300 global companies states that "68 percent of managers think they have failed to optimize their supply chain savings– [1]

Lean SCM

The opportunities to remove waste from a supply chain are based on the elimination of excess inventory, time and cost. Flexible network design, along with basics such as postponement, direct shipping and VMI programs, are examples of how lean principles can be applied supply-chain-wide. In the current economic environment, organizations are starving to be more and leanerto add value to the final customer. In reality, a large number of businesses have already introduced such principles but have yet to apply this concept to their suppliers. This should convince them to do so. Every crisis presents an opportunity to introduce new concepts and paradigms; in Japanese, the word 'crisis' also means 'opportunity' or 'chance.' The so called lean principles, the effects and combination of which are essential for success, were developed by Taichi Ohno, an employee of Toyota Motors. Lean production is based on the Just In Time (JIT) philosophy and the Toyota Production System (TPS) and focuses on the elimination of waste and the minimization of stock. The customer is only willing to pay for products and activities that benefit them by adding value; activities that do not achieve this will not be tolerated and must be rapidly erased.

As part of the JIT approach which emphasizes the zero defect mentality — the correct quality part must arrive in the right place at the right time. There are5 lean principles — flow, pull, define value, value stream mapping and zero defect must be implemented into the supply chain to achieve an optimized global supply chain.

There has been a rising pressure from the financial markets which makes it very important to improve the operating margins of a company. Now, this will require an efficient production/service process. Increasing number of companies are relying on LEAN SCM - a planning concept for harmonized production and replenishment planning across the entire supply chain with close linkages to organizational processes and IT infrastructure. LEAN SCM is designed to enable production and replenishment planning across the entire supply chain in a synchronized way. LEAN SCM is influenced by two main developments: first, traditional supply chain planning and, second, the rise of lean operations. On the one hand, LEAN SCM aims to overcome the well-known drawbacks of (traditional) ERP, MRP, or APS - dependency on forecasts and their inherent complexity. On the other hand, it also aims to translate lean manufacturing principles such as production leveling, takts, and pull production into supply chain planning in order to allow for more simplified and consumption-driven processes-[3] If we consider the logistics part of the supply chain, modern logistics contains all links in supply chain. Today, logistics just does not mean transportation and storage. Modern logistics had integrated purchasing, storage, transportation, manufacturing, wholesale, retail and after service. Hence, logistics provides integrated service for supply chain. IoT makes the service provided by logistics more intelligent, fast and convenient, visualize and flexible, thus achieving "large logistics". Applying IoT integrates the material flow, fund flow and information flow between customers and LSSC and makes profit for enterprises participated – [2]

The Internet of Things in supply chain

The Internet of Things(IoT) is often considered to be part of the Internet of the future, consisting of billions of intelligent communicating "things" or internet connected objects(ICO). The use of sensor data in the supply chain is not new. Many organizations such as Unilever, United biscuits, Motorolaand Ford, to name a few, already use auto id data (such as RFID)within supply chains(Angeles, 2005). – [6]

Soon, the visibility of inbound and outbound supply chains will be put to the test. Factories will need higher levels of visibility for inbound raw materials and parts to protect against materials shortages. Outbound order tracking will become more important as production schedules are further refined to align the assembly process, manage multiple production and distribution locations, meet customer deadlines and just-in-time delivery, and minimize overproduction. Wholesalers, retailers, and consumers also will be impacted by these technological advancements. Data currently available through smart labels, for example, will continue to be captured and tracked. Their role will become increasingly important at every phase of the manufacturing and distribution process.– [5]

Connecting vehicles and devices within vehicles using a Cloud-based vehicle network will change the landscape of what's possible from a logistics perspective. All the connected vehicles will be able to distribute data in a very easy, generic way. That will allow for faster innovation cycles, providing more value and increased interoperability. Trucks or container vehicles won't remain as normal vehicles anymore but they are becoming beacons of data. Research firm Gartner estimates the IoT — excluding desktop and laptop computers and smartphones — will include 26 billion discrete pieces of technology by 2020 — up from about 6.4 billion in 2016. Some of those 26 billion units will be sensors on trucks, containers and even pallets. Harnessing the power of the Internet of Things in supply chain involves the identification of the hottest potential markets and getting the right products to production in a timely manneras well as laying thegroundwork for better connectivity in manufacturing environments. – [4]

IOT Architecture

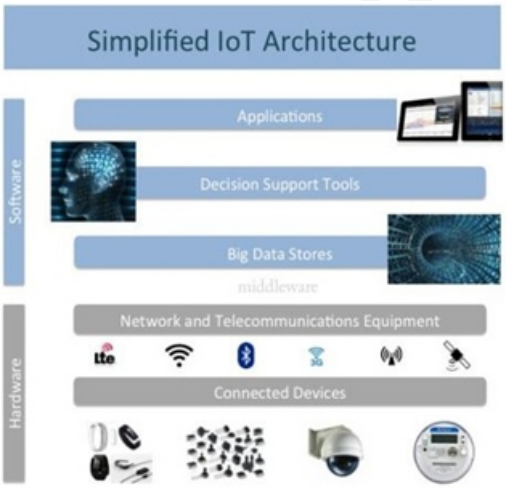


Figure 1 - Simplified IOT architecture – [7]

The above diagram sheds light on the architecture on which IOT platforms are built.

The foundation layer to IoT is the Connected Devices. These devices contain processors, memory and sensors that enable to discover details about the device, its history, its current operating state or about the environment it is located. Sensors include such things gyro / fingerprint reader, /barometer / RG B ambient light / gesture / heart rate /accelerometer / proximity / compass / GPS / temperature sensors, etc. These sensors when coupled together, enables them to become smart not just on sensing data but also to accept remote commands and take an action.

The next layer has the network and communication devices loaded with the sensors. Sensors are connected to common cloud networks. Networks such as Wi-Fi, Bluetooth, 4G, GPS, etc have the power to provide necessary bandwidth to interconnect these devices.

The Big Data Stores are the next important layer of the architecture. The data collected and stored in cloud cannot be useful unless it is processed into valuable information for business intelligence. This intelligent data is then fed to decision support systems for the top management to take decisions based in it. It's here that business Analytics comes into picture.

Decision Support Systems - Without automation, the sheer quantity of data becomes unmanageable and largely unstable.
The filtering, post processing of the data is the first step. The second step is toprovide business rules to that data which is generally known as Event Processing. These processes create the triggers that advice the applications to act to make important decisions and take actions based on the current state of the data being received.

The Application layer is where the business functionality lives. It involves complex piece of scheduling software that has multiple data points from sensors to launch an action like automatic procurement of a material when the inventory is about to attain the re-ordering level. This can be utilized as e-Kanban systems. – [7]

Currently, the majority applications of the IoT are based on the EPC network of RFID. RFID is a non-contact automatic identification technology. It uses the radiofrequency electromagnetic waves through space coupling (alternating magnetic field or electromagnetic fields) to achieve noncontact transmission of information between the reader and the classified tractable moving objects (objects with RFID tags attached).

The **Raspberry Pi** is a series of credit card –sized single-board computers/micro controllers developed in the United Kingdom by the **Raspberry Pi** Foundation. Many projects are being developed on this platform using Java Microedition (ME) with pre-configured I/O libraries. The sensors mounted on the goods as well as the trucks like GPS, temperature and pressure sensors communicate to the servers to which the Raspberry micro controllers are connected to. This enables real time data collection and monitoring for further analysis and decision making.Then there is the logistics management system where the transport vehicle location is monitored in real-time. Once the vehicle fails to move along the scheduled routes or leave the route to pull private goods, etc., a warning will be given immediately. The logistics management system in major includes user management, vehicle management, site management, order management, and distribution management modules.

Application of IoT in Transport and Logistics (T & L)

Intelligent logistics is based on a wide use of the internet of things. It makes use of the advanced information collection, information processing, information flow and information management technologies, and completes a number of basic activities through the whole moving process including the transportation, warehousing, distribution, packaging, loading and unloading. It can help to maximize profits for the supply and provide the best service for the demand while consuming the least natural and social resources and maximizing the protection of the whole intelligence community logistics management system in the ecological environment. - [10]

Transport and logistics (T & L) are fundamentally about moving things from one place to another. Therefore, the main service components of T&L can be categorized into the things that move and the things that do the moving—**the "demand"** and "**supply**" sides of logistics. The supply side includes warehouses, where goods are stored and forwarded; a transport network (roads/tunnels/sea/air); and the vehicles/vessels/crafts that are used to move goods from suppliers to warehouses and, ultimately, the customer. The capacity, efficiency, manageability, reliability, and, of course, cost efficiency which T&L companies can provide are the key drivers of value on the supply side. Naturally, the common supply-side IoT applications currently focus on improving these drivers and reducing cost (table 1).

Table 1. Common applications of IoT for logistics supply (warehouses, trucks, planes, etc.)

Capacity sensing	Planning & reporting	Route optimization	Energy management	Fault detection & resolution
Systems that can detect and communicate open spaces in a warehouse, port, or parking lot	Systems that can detect and analyze events such as traffic accidents within a delivery network, allowing for more accurate delivery dates	Tools that can map the shortest or most fuel-efficient route for delivery vehicles, for example	Tools that monitor and enable decision making about the use of fuel, lighting, and heating/ cooling within vehicle fleets and facilities	Systems that can monitor fleets of vehicles, aircraft, or ships for faults and maintenance needs, improving uptime for the fleet

The demand side, on the other hand, includes goods to be transported and the customers expecting the goods. The value to customers is determined by the time, security, traceability, and condition of their cargo. Similarly, current IoT use cases focus on improving those factors and include environment monitoring, threat detection and prevention, and real-time traceability down to unit level (table 2).

Table 2. Common applications of IoT for logistics demand (customers, packages, containers, etc.)

Environment monitoring & management	Threat detection & prevention	Real-time traceability
Systems that can monitor and adjust the temperature at which a package is maintained	Tools that can help detect unauthorized openings of shipping containers, helping to prevent and reduce theft	Systems that can track and track not just vehicles or shipments but individual items

Thus far, T&L companies have implemented IoT technologies mostly as track-and-trace applications, intending to decrease network complexity. For example, GPS asset tagging can be used to optimize

routes by plotting the real-time locations of trucks and deliveries and using analytics to draw the shortest or most fuel-efficient route between them. Adaptation on the supply side requires a wider scope, integrating multiple external suppliers and distributors throughout the supply chain. In order to avoid such kinds of issues, all participants in the value chain should be connected to a single data system. This helps in reducing the idle time across the supply chain by integrating not only logistics firms and suppliers and distributors in their supply chains but also customers and possible business partners. –[10]

Tools such as a supply-chain risk-monitoring tool offered to customers can take advantage of current knowledge of postal strikes, road closures, natural disasters, and other events that a worldwide fleet gathers, and allows customers to see their supply chain's impact in real time. They can even use the tool to adjust the timing or mode of shipments to minimize the disruption from world events.–[7]

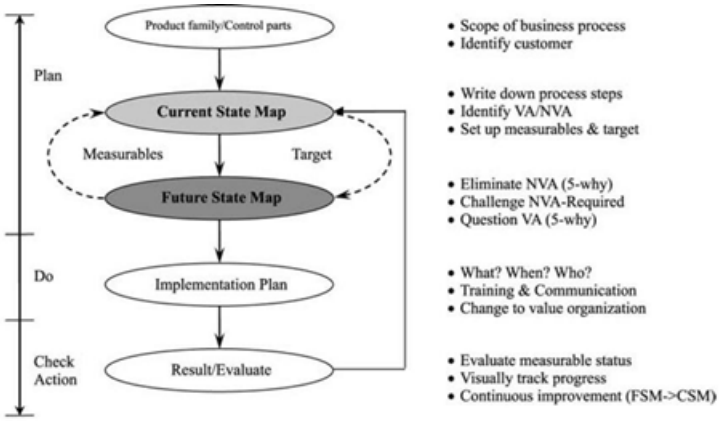
Value Stream Mapping (VSM)

This Value Added and Non Value Added concept were derived mainly from Toyota production System (TPS). "Waste" is defined as anything that interferes with the smooth flow of production (Macduffie and Helper, 1997). The eight wastes highlighted in TPS are overproduction, waiting, conveyance, overprocessing, excessinventory, movement, defects and unused employee creativity, out of which the biggest one being overproduction (Monden, 1998; Liker, 2004). The VSM is a lean supply chain tool used by TPS to identify between wasteful and necessary value-adding activities. VSM begins by listing all operations, and classifies them into VA and NVA (includingwaste). The VA activities are those that customers are willing to pay money for tangible goods or intangible functions. The NVA work includes the eight wastes of TPS. The application of VSM in the TPS not only identifies VA/NVA activities for waste elimination, but also the status of their lead time in the supply chain from incoming parts to finished good delivery. – [8]

A value stream is nothing but the diagrammatic representation of activities required to transform a customer request into a good or service. Creating a VSM is essentially one of the prominent steps of a lean process because VSM involves looking into the current state, identifying the value added and non-value added activities from the customer point of view and them eliminating the waste which can be complimented with the use of technology.

TheVSM of the Indian subsidiary of a Japanese company namely, XYZ India Limited who manufacture automation equipment for process industries was studied and the process starting from the moment a purchase order is placed by a customer to the moment the product is delivered to customer had been analyzed with respect to lean principles. The company manufactures various types of products. For

easiness of plotting the VSM, only one product class called Differential Pressure (DP)transmitters had been considered to draw the VSM as the lead time for different products are different.Currently the whole process from the moment a P.O is placed by a customer till the time product delivery happens at customer location takes 6 (+/-) 1 week on average. The main aim of applying lean principles supported by IoTin the supply chain of XYZ India Limited is to reduce the process lead time which can deliver more competitiveness for the company as few potential large size orders were being lost to its competitors due to more lead time in comparison to the company's competitors. The product is highly recognized by all process industries globally as a highly reliable product with high quality standards. A reduction in process lead times can help XYZ India Limited to win more number of orders and improve overall customer satisfaction levels.



Source: Summarized from Shook, Learning To See (1999)

Figure 2 – VSM Improvement cycle – [8]

Current State VSM

The current state VSM consists of the value stream map has captured the “as-is condition” of the process and used as a baseline to analyze the different kinds of waste which can be eliminated using lean tools and technology. – [11]

The current value stream map had been obtained after studying the entire processes involved from order processing to getting the material ready for dispatch to customer location. Inputs from various departments like Sales, OPD, manufacturing, centralized material handling and Logistics were obtained after discussion with corresponding officials. In the present VSM, the main time consuming processes had been studied which are contributing to major delays and lean principles along with IoT and digitalization had been applied for streamlining the value chain. The current VSM has a lead time of 54 days (8weeks approximately).

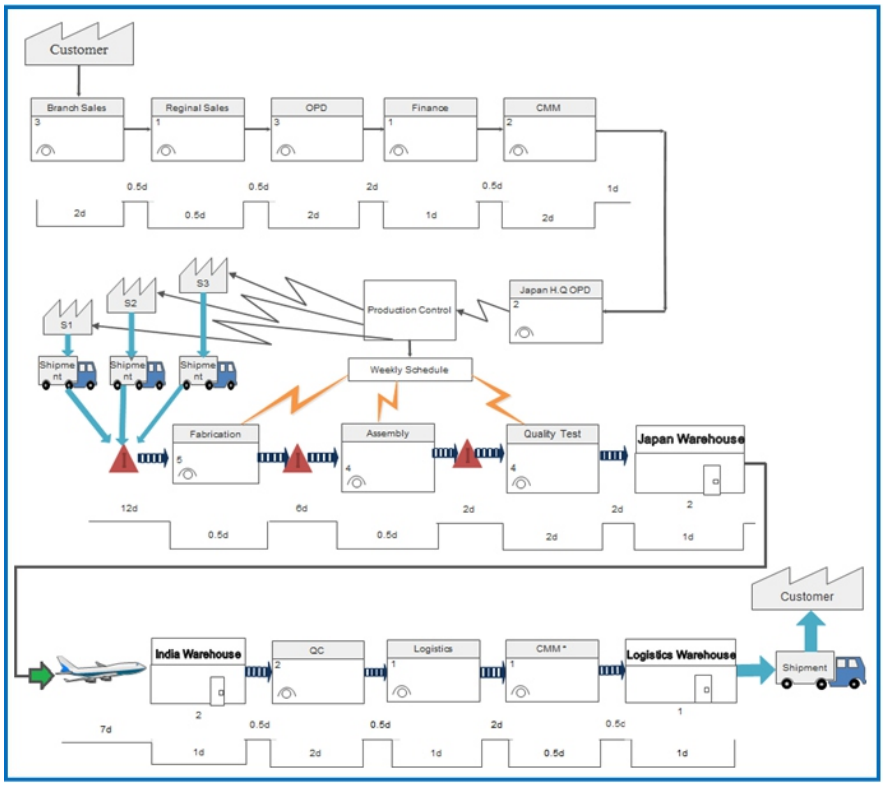


Figure 3 – Current state VSM

Future State VSM

After analysis of the current state VSM, if the order processing process is taken into consideration, few non-value added activities like redundant or excessive paper work can be done in parallel using IoT cloud computing which enables real time monitoring and exchange of data within several departments. This allows few processes not to wait for its predecessor process to complete in order to start processing a purchase order, thus reducing the number of inter-dependencies

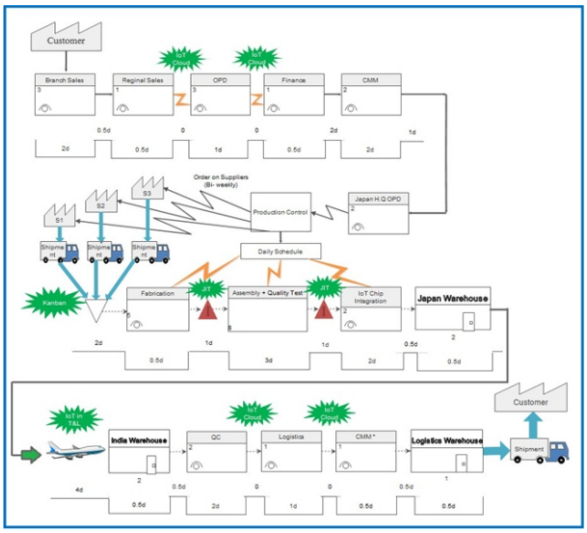


Figure 4 – Future state VSM

Within the manufacturing process in Japan, the production schedule which used to be circulated on weekly basis to the suppliers is to be made bi-weekly. AKanban system should be put in place before the fabrication process. 'Kanban' refers to 'visual cards' and this enables a successful pull/JIT system ultimately resulting in the production being enabled by customer demand. Hence, automatic re-ordering of raw materials from suppliers shall benefit the entire value chain. The Kanban has been designed as e-Kanban using IoT where sensors detect the replenishment quality which is already programmed in the sensors of each raw material store package. When an order is placed in India and once the Finance team clears it, even before the issue of source document by CMM (Centralized Material Management) team, the order details can be fed into the IoT cloud database of the Japan manufacturing facility which helps the Japan OPD (Order Processing Department) to initiate the procurement process with the suppliers. Since the parts are standardized, suppliers are already grouped into Tier 1, 2 and 3 and thus time would not be wasted in deciding the suppliers for each order. Thus, the real time demand is established. This IoT cloud database is shared with the Indian team, Japanese team and even the Tier 1 suppliers in Japan. Hence, real time order processing takes place together at 3 locations.The idle time between fabrication, assembling and quality testing had been greatly reduced due to Just-In-Time (JIT) inventory management. The assembly and quality testing departments had been proposed to be grouped together. Earlier, the quality testing department used to wait for the completion of each lot of material from the Assembly process line. But now that both departments are grouped together, the idle time between each has been eliminated since each transmitter assembled can be directed towards quality checking. An extra process has been added after fabrication which deals with the IoT chip programming and stamping on each box of finished product. Pre manufactured IoT smart chips would already be available in inventory. This enables the real time tracking and easy material identification within the Japanese and Indian warehouses. Along with that, IoT stamping on each box helps faster air delivery from Japan to India and the promised date of material delivery to customer is shared with the 3rd party logistics provider so that each pallet is exported to India at the right time. Earlier, the materials used to be transported to a hub (for example Indonesia) and the material used to wait there in a intermediary distribution center (D.C) until the next connecting flight to India is scheduled. But with IoT in place, since the logistics provider is aware of the end customer delivery date, he doesn't transport the material to hub before the departure time of the aircraft. Now, the transpiration is completely synchronized to avoid delays from airport to airport transfer. Thus, sufficient lead time is saved in this process. Once the material reaches Bangalore airport and after customs clearance is completed, the material reaches the Indian Operations warehouse. Even at this stage, the documentation part of logistics and CMM team can be done in parallel using IoT cloud sharing once Q.C team completes the final testing. The proposed

future state VSM has achieved 64.86 % reduction of Non-value added activities thus delivering the product within 1 month of P.O receipt from customer.

Comparison of current state and future state VSM

Variable	Before	After	Improvement
Total Lead Time (days)	**54**	**29.5**	**45.38%**
C/T Non-Value added (days)	**37**	**13**	**64.86%**

CONCLUSION

As observed from the future state VSM, the lead time had been reduced to 29.5 days (4.2 weeks) which is approximately 1 month, using the principles of Pull, thereby saving 24.5 days in total. This lead time reduction will result in abundant value addition to customers as well as the organization by gaining back the confidence of customers hence enabling XYZ Pvt. Ltd to boost its overall sales revenue. As per Lean principles, this 45% improvement in process speed and capability will result in higher process efficiency and customer satisfaction. The reduced lead time can become a USP for its products as XYZ Pvt. Ltd is now able to deliver the material faster than its competitors with superior product quality. The reduction in total lead time will also result in higher bottom line profits contributing to the better operations profitability.

Further research is recommended in the area of advanced IoT applications which could streamline various complex industry processes. As per World Economic Forum (WEF), Industry 4.0 had already set new standards thus revolutionizing the way business is done in various industries. The realization of a connected and secure world will lead to the emergence of new business opportunities and millions of dollars in profits earned. Hence, the companies who succeed in improving their supply chain efficiencies will have a upper edge over its competitors, thus helping them survive any upcoming industry bursts and strive to survive as world's leading corporations.

REFERENCES

1. *Lean Supply Chain & Logistics Management by Paul Myerson: McGraw-Hill, 2012*
2. *Study on IOT based architecture of logistics based service supply chain – Wei Liu and ZijunGao*
3. *Lean SCM: A paradigm shift in supply chain management- Joseph Packowski and David Francas*
4. *The IoT and the Supply Chain. Electronic Design. Oct2015, Vol. 63 Issue10, p43•44.*
5. *'Smart factories needs smarter supply chains By Charlie Chung, UPS' -www.plantengineering.com PLANT ENGINEERING June 2015 edition.*
6. *Contextual variety, Internet-of Things and the choice of tailoring over platform: Mass customization strategy in supply chain management – Irene Ng, Kimberley Scharfb, GannaPogrebnaa, Roger Maull pg.4*
7. *https://www.iotcodotorg.files.wordpress.com*

8. Lean supply chain and its effect on product cost and quality: a case study on Ford Motor Company; H. M. Wee, Chung-Li, Taiwan, and Simon Wu, Chung Yuan Christian University and Ford Production System Manufacturing Division, Ford Lio Ho Motor Company, Chung-Li, Taiwan, pg 335-341

9. Shipping Master: IoT opportunities in transport and logistics – by Matthew Lacey, Helena Lisachuk, and Andreas Giannopoulos: Deloitte University Press

10. Research and Design of Logistics Management System Based on Internet of Things – by Changhui Yu Faculty of Computer Engineering Huaiyin Institute of Technology Huaian, China.

11. Lean Manufacturing: principles to Practice by Akhilesh N. singh, Publication: L. B. Associates

Information Communication Technology and Libraries

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ABSTRACT

During the last fifty years, the world has witnessed important changes; in particular, information and communication technology (ICT) has brought a revolution in every sphere of life. Information communication technologies facilitate the process of identification, collection, storing, processing, disseminating of the information. With the invention of Information and Communication Technology, libraries now use various types of technologies to aid the services they render. Everyday new technological advances affect the way information is handled in libraries and information centers. Using ICT, libraries have not only observed remarkable changes in their daily operations and services, but also identified a new and active role for librarians. In this paper we describe the usefulness of ICT resources in libraries, the efficiency and effectiveness of ICT in library. This study attempt to explore the gradual advancement of modern technologies in libraries distinguishing old and new technologies. With the development and application of ICT, the libraries have shifted from the traditional to hybrid library, then automated library, digital archives stages, library 2.0 and mobile phone services. With the effect of these changes, the structure of libraries has also changed in a dynamic way, as in a continuous process. By the help of this paper I have drawn attention towards the innovation & development of ICT and its implications in library services, it creates many changes in entire library management system.

Keywords - : Information, Communication, Technology, Libraries. ICT

INTRODUCTION

The 21st century is the age of electronic communication; knowledge and technology have become borderless and have become the basis of all appropriate decisions in relation to the socioeconomic development of the people. Effectiveness of a library services is now largely based upon information and communication technology. The impacts of new technologies are felt by libraries in every aspect. Computing technology, communication technology and mass storage technology are some of the areas of continuous development that reshape the way that libraries access, retrieve, store, manipulate and

disseminate information to users. The introduction of various information technology (ICT) trends has led to reorganization, change in work patterns, and demand for new skills, job retraining and reclassification positions. Technological advancement of the past twenty five years, such as the electronic database, online services, CD-ROMs and introduction of internet has radically transformed access to information. Information and Communication Technology (ICT) has brought unprecedented changes and transformation to academic library and information services, conventional LIS such as OPAC, users services, reference services, bibliographic services, current awareness services, Document delivery, interlibrary loan, Audio visual services and customer relations can be provided more efficiently and effectively using ICT, as they offer convenient time, place, cost effectiveness, faster and most-up-to-date dissemination and end users involvement in the library and information services process. The impact of ICT characterized on information services by changes in format, contents and method of production and delivery of information products. Emergence of internet as the largest repository of information and knowledge, changed role of library and information science professionals from intermediary to facilitator, new tools for dissemination of information and shift from physical to virtual services environment and extinction of some conventional information services and emergence of new and innovation web based.

In the era of information explosion, the tremendous amount of information is being generated and transmitted from every corner of the world in the form of print materials, research articles, lectures, presentations, video conferencing, technical reports, standards and patents etc. In the early stages of 20th century, libraries were facing the problems, of how to cater and fulfill the users' demand in minimum span of time. The solution was to adopt the ICT based products & services. To deal with new challenges and increasing demand of users, libraries are reconsolidating; reshaping, redesigning and repackaging their services and information products by incorporating ICT based products & services The computers and telecommunications led to prevalence of IT. Digital technologies, audio video are providing us multimedia which leaded totally a new dimension in international trade. In this changing environment modern libraries are no longer mere depositories of conventional knowledge but these are becoming increasingly information oriented. Information and Communication Technology has revolutionized the concept of libraries. Each and every library is slowly getting digitized. A 'digital library' comprises digital collections, services and infrastructure to support lifelong learning, research, scholarly communication as well as preservation and conservation of our recorded knowledge. It is also a process of democratization of information. We are in the age of a networked society where information technology in addition to its use in all spheres of human activity has been used extensively to record, store, and disseminate the information in the digital form. Information technology has almost converted the world into a global village. Libraries are also changing to meet the demand put on them. The new

generation whose demand for information is never met is always demanding that traditional libraries should be developed as a well-equipped and interconnected as digital libraries. Dr. S.R. Ranganathan, the father of library and information science, formulated the five famous laws of library and information science. The fifth law-"Library is a growing organism" is now being challenged by the tremendous progress of ICT and its speedy application in all fields, especially in the field of library and information science. Information and Communications Technology (ICT) is an umbrella term that includes all technologies for the manipulation and communication of information.

Information: Harrods Librarian's Glossary and Reference Book, 7th ed., 1990. "An assemblage of data in a comprehensible form capable of communication"
Oxford English Dictionary – "Information is knowledge communicated concerning some particular fact, subject or event". S.C.Blumenthal in 'Management Information Systems', 1969 "Information is data recorded, organized, related
or interpreted within context to convey meaning"

Communication: The word 'Communication' originated from Latin word 'Communis' meaning 'Common'. Oxford English Dictionary. "Communication is imparting, conveying or exchanging of ideas and knowledge whether by speech, writing or signs" Columbia Encyclopedia of Communication "Communication is the transfer of thoughts and message as contrasted with transportation of goods and persons".

Information Technology: The two revolutions - in computers and communications transformed the computers synonymous to Information Technology. The rapid developments in Information Technology brought revolutionary changes in information processing, storage, dissemination and distribution and became a key ingredient in bringing-up great changes in over all aspects of society. Further the advent of low cost computers and easy-to-use word processing software, computer based image processing techniques paved way for 'digitized information' comprising textual to multimedia – data consisting of text, images along with digitized voice and video. Thus the information stored in libraries has taken a major shift from volume-limiting paper to limitless multimedia digital form. The emergence of IT is wonderful gift of modern science and technologies which has brought tremendous change in library and information science. Application of Information Technology to library and information science work has revolutionized the traditional concept of electronic library.

Information Communication Technology: The term 'Information and Communication Technology' (ICT) first appeared in the mid-1980s. The word ICT is a combination of two words information,

communication & technology. Information means knowledge and technology means use of computer & communication. The term ICT can be defined as "the integration of computing, networking and information processing technologies and their applications" (Riyasat &Fatima, 2008). The ease of communication along with the Internet has brought a paradigm shift in information usage from the need to know basis – information available when and where you need it. Digital publishing technologies and global networking have given rise to the development of a wide variety of digital libraries. ICT incorporates a range of technologies used to support communication and information. ICT includes both network and applications. Networks include fixed, wireless and satellite wireless telecommunications broad casting network. Information and communication technologies is a diverse set of technological tools and resource used to communicate and to create, disseminate, store, manage information.

So we can define Information Communication Technology as the "use and application of computer, telecommunication, microelectronic in the acquisition, storage, retrieval, transfer and disseminate of information. Development in ICT have brought about the merger of the computing information, communication, entertainment, mass media industries thereby providing a means of exchanging information in digital format used by computers. This technological convergence has brought about an enormous impact on the way we live, work, think and play. These changes are quite prevalent in our everyday lives such as the use of e-mail and cellular phones at home and in the workplace and also linked to all facets of society: business, education, military, recreation, transportation, communication, scientific exploration, knowledge management, etc…

Benefits of use of ICT: In services can be broadly explained in terms of 4 Es, namely

- ™ Economy
- ™ Ease,
- ™ Extension (or expansion)
- ™ Efficiency

ICT enabled Library and information Science can be grouped into two categories, ICT enabled conventional LIS, and new services. Conventional LIS such as OPAC, User Services, Reference Service, Bibliographic Service, Current Awareness Service, Document Delivery, Inter-library loan, Audio-Visual Services and Customer Relations can be provided more efficiently and effectively by using ICT, as they offer convenience of time and place, cost effectiveness, faster and most up to date dissemination and end user's involvement in the LIS processes. OPAC and Web OPAC use power of computers to find the library material and also provide many additional benefits such as online reservation of books, remote access, requesting books for loan, loan renewals, books suggestions etc.

Impact of ICT on information services is characterized by changes in format, contents and methods of production & delivery of information products, emergence of Internet as largest repository of information and knowledge, changed role of LIS professional from intermediary to facilitator, new tools for dissemination of information, shift from physical to virtual service environment, and extinction of some conventional information services and emergence of new and innovative web based LIS. Changing traditional library to digital library by building of digital collection which is leading to transformation in the society, academic environment particular.thus, we should facilitate to provide an encouraging environment in libraries to have collaboration among all the stakeholders to satisfy their requirements.Web enabled services are provided through library web page. New services include access to internet and internet based tools and services, access to electronic information sources and digital library of local and institutional documents. Journals, books, dissertation & theses, course material and patents are some of important sources of information that are now available in electronic form. Electronic resources provide 24 hours anywhere flexibility and convenience of use by multiple users and full text searches and faster delivery. Subject gateways are one of the useful tools to provide web access to internet resources. Digital libraries provide local contents in the electronic form through internet to global clients.

At the heart of technology lie two main or branches of technology: computing and telecommunication. The technologies covered are the computer system, Internet/electronic mail (e-mail), mobile phone, and fax machine. In short we can say that the main benefits and functions of ICT in Library system are:

Acquisition and budget
Cataloguing and short loans
Circulation
Serial Control
Provision of access to online catalogue

ICT Based User- Services: Some library user are adopting electronic habit, making increasing use of new ICT including computers, internet, web, intranet, extranet and other technologies. As a result library users are placing new demands on their libraries. They require access to the latest information, updated information resources and access to the ICT facilities that they could use in their work. Use of ICT in libraries enhances user satisfaction. It provides numerous benefits to the library users. Some benefits are:

™ Provide speedy and easy access to the information.

™ Provide remote access to the user.

™ Provide the round clock access to the user.

™ Provide access to the unlimited information from different sources.

™ Provide information flexibility to be used by individual according to his/her requirement

™ Provide increase flexibility.

™ Facilitates the reformatting and combining of data from different sources.

Libraries are also providing various ICT based services to their users, including the following:

™ Provision of web access to OPACs.

™ Electronic document delivery.

™ Networked information resources.

™ Delivery of Information to user desktop.

™ Online instructions.

™ Online reader advisory services.

ICT in Libraries: Various Challenges The use of ICT in libraries has a raised a number of challenges. These include:

™ Changing roles of libraries and librarian.

™ Funding for libraries.

™ Copyright management.

™ Information access.

™ Preservation of digital information resources.

Changing Role of libraries and librarian: More and more library users are using digital technologies and have access to global information resources via. the web. Unfortunately, the huge amount of information are available on the web is

generally overwhelming information user. Further alarge numbers of web user are still not able to use web efficiently. There is a major challenge among librarian for satisfaction of users. Funding for libraries: Due to the severe budget cuts and high piece of books and journal are subscription libraries are faced with no options but reduce expenditure on books and journal subscriptions. Introduction and use of ICT in libraries has not made the situation any better. Money is required to maintain and upgrade the equipment and software, pay software licenses fee, pay for access to electronic journal and online database, pay for internet connection etc. Copyright Management: Digitization and provision of access to digital collections accessed via electronic network especially the internet, is presenting the bigger

challenges to librarians. Unlike print based documents, digital based information resources can be accessed from anywhere any time. Easy at which digital information can be copied and manipulated may result in government under pressure from information procedure to put in place rigid copyright law in which right holder are increased at the expenses of the user and this may affect the provision of access to digital information sources in libraries. Information access: Whereas libraries generally provide and access to selected information resources this is not the case with information accessed on the web. Distribution of pornographic materials and information produced for deliberate disinformation is very easy to do on the web and this presents problems to many librarians on how to exclude access to such type of information, especially on internet workstation located in libraries. Preservation of digital resources: Print based library and archives environment accessed to the digital information environment, has evolved over centuries. Preservation methods and formats for print based document have also been developed and tested. There are print based document that are over 2000 year old in world today and can still be read. The digital information era is in its infancy and already some of the information is store in formats and media that cannot be accessed or read.

Impact of ICT on the library and other information centers

- ™ ICT made information creation in digital format possible.
- ™ ICT made online access and file transfer possible
- ™ ICT made networking and sharing of information resources possible.
- ™ Digital information can be sent in multiple copies simultaneously over information networks in fractions of a minute or even of a second. There is no need for users with PCs attached to the network to physically go to the library. They can access information via their PCs.
- ™ Digital information can be cut/copied and pasted from one document into another
- ™ Digital information may be free or cheaper than print equivalents
- ™ Digital information often modifies librarians' roles in various ways

The shift from print to digital information has a high impact on libraries, information centers and other institutions directly involved in processing information. This shift is generally attributed to the merging of computing, telecommunications technologies and other industries. Computers have permeated society because of their ability to perform high volume error-free repetitive tasks at speeds much faster than human beings, while recent and emerging developments in the area of computing; telecommunications, networking and resource sharing made access to information anytime, anywhere possible.

Roles of librarians in an information society

- ™ Creators: developers and producers of information products and services
- ™ Collectors: librarians, archivists and records managers
- ™ Communicators: information workers, extension workers, subject specialists
- ™ Consolidators: reference librarians, information brokers, analysts

The roles of librarians in an information- based society have changed from relatively passive "gatekeeper" to proactive facilitator of knowledge and information. The profession is continuously evolving into something that is not only concerned with the traditional practices of processing information but also actively involved in the application of ICT in libraries and the development of new services using recent and emerging technologies.

Challenges to libraries

- ™ Collection development
- ™ Resource sharing through networking
- ™ Faster direct communication among scientists and researchers
- ™ Virtual vs. onsite reference service: push and pull technologies
- ™ Better document delivery systems
- ™ Better abstracting and indexing systems
- ™ Availability of full-text materials on the Internet
- ™ Information management vs. collection management

CONCLUSION

Technology alone is not the solution to efficient and effective information delivery, although it is the major contributor to the development of multimedia information and networks. The basic library education acquired in school is more important than the tools but the tools will make information creation, acquisition, consolidation and communication more efficient. ICT are powerful tools that can only be used effectively if the users - administrator librarians, and patrons in this case - have acquired adequate knowledge and skills and a certain level of competency according to their needs. New ICTs can offer real opportunities to improve the quality of community life. It is also important to deepen our level of reflection on community dynamics and on the constraints encountered when introducing and using ICTs for development. ICT are hardware and software that enable society to create, collect, consolidate communicate information in multimedia format and for various purposes. A healthy information society is concerned with getting reliable and timely information to its members. Making

people aware of the benefits derivable from the use of ICTs will help to make the society a healthy one. The current scenario of world's libraries are changing very fast by ICT based products& services. The change enforced by ICT, to adoption of products and services of Information and Communication Technology in libraries are robust indicator of this response. It provides a means for overcoming historically intractable problems of isolation and lack of access to information and knowledge, crucial impediments to libraries development. The ICT products and services have reshaped the educational landscape by transforming the content and modes of release of information. Apart from facilitating the global networked ICT, also enhances knowledge creation and innovation It may be concluded that the provision of hardware, standardized library software, adequate financial resources, and proper training facilities for librarians will help to strengthen ICT application in libraries.

REFERENCE

Parvez, Ahmed (2011). Development in Library Services with the advent of ICT based product services: A continuos process. International Journal of Digital Library and Services, 2 (2).

Islam, Md Shariful (2006). Information and communication technology in libraries: A new dimension in librarianship. Asian journal of information technology. Medwell online.

Akintunde, Stephen A. (2004). Libraries as tools for ICT development: 42nd National Conference/Annual General Meeting of the Nigerian Library Association (NLA)

Chauhan, Buddhi Prakash. (2004). ICT enabled library and information services: Winter School on ICT Enabled Library & Information services, Patiala: TIET

Oqbomo, Monday Obaidjevwe. (2008).Importance's of Information and Communication Technology (ICTs) in making a healthy information society: a case study. Library Philosophy and Practice.

Riyasat, Azmi and Fatima, Nishat (2008). Impact of Information and Communication Technology LIS: Major shifts and practices: 6th International CALIBER University of Allahabad, Allahabad.

Rehman, Anisur (2004). Information and communication Technologies, Libraries and the role of library professionals st in 21st century: With special reference to Bangladesh. ICADL (pp 608-617). LNCS 3334.

Large, John Andrew. ICT for Library and Information Professionals, Canada: Macgraw hill University

Pre seminar volume of the national seminar on Ranganathan's vision on future libraries (NSRV-2012). JBS Publisher and distributor Faridabad. Edited by Prof. K.L Mahawar

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