



4-1-136

## INNOVATION ACTIVITIES IN THE MALAYSIAN PUBLIC SECTOR: FACTORS PROMOTING THE BYPRODUCT OF ICT USAGE

Md. Nor Hayati Tahir<sup>1</sup> & Mohd. Fazli Mohd Sam<sup>2</sup>

<sup>1,2</sup>Faculty of Technology Management and Technopreneurship  
Universiti Teknikal Malaysia Melaka, Malaysia

### Abstract

This paper is based on a questionnaire survey that was conducted among public servants in Malaysia who have used information and communication technology (ICT) in the workplace and have been involved in innovation activity. The objective of this research is to identify the knowledge captured from the use of ICT in the workplace. The findings show that the public servant captures knowledge as the result of using ICT applications at work place and uses that knowledge for innovation activity. It is found that the frequency of ICT usage in the workplace contributes to the innovation activities at work place. The knowledge captured that contributes to the increase of innovation capabilities is positively related to the length of experience of using ICT in the workplace.

Keyword: *Innovation Activities, Byproduct of ICT Usage, Malaysian Public Sector, Public Servant.*

### 1. INTRODUCTION

Malaysia is one of the 'second-tier' of New Industrial Country (NIC) together with Thailand, Indonesia and Philippines, has a dream to be a fully industrialized country by the year 2020. For a take-off, Malaysia needs an active and innovative actors, mainly consist of the government, the business player and the industrialist. These 3 actors have their own role in materializing the dream.

Issue of technology development is the turning point to be fully industrialized country where innovation and R&D act as the trajectory factors. The concern about technology development in Malaysia is that it characterized by robust in high technology production but slow in local innovation activity. The problem arises triggered by the issues of lacking of knowledge shared, networking and failure to internalize the spillover effect of knowledge and skill creation (Jomo and Gred, 1999).

To stimulate the positive effect of those characteristics, ICT was introduced drastically in 1996 when the Multimedia Development Corporation was established to promote Multimedia Super Corridor, the hub of ICT. To complete the circle of ICT environment in Malaysia, the public sector was involved in various applications to serve the public supported by ICT.

This study is an attempt to find out the presence of knowledge captured by the public servant in Malaysia through ICT usage at their workplace and the variables which affect the accumulation of knowledge. Descriptive study was done on 3 major components namely ICT application, knowledge and innovation. By identifying the variables, relationship between the knowledge captured and the innovation created internally by the public servant in the public sector through ICT usage at workplace can be established by using Two Ordered Multiple Regression Method.

### 2. LITERATURE REVIEW

Well-developed and mature technological base are characteristics of fully industrialized nation (Narayanan and Wah, 2000). This well matured technological base should be propelled by self-sustaining innovation and research and development (R&D). In Malaysia, the influx of technology from foreign investors and manufacturers is the major contributing factor to the increase of technology production represent by 60% of export product. As a fast growing country with the best export performance of electronic and electrical product show the potential of achieving a developed nation. The environment is further support by the policy whereby the facilities, infrastructure and incentives. In contrast, the presence of high technology is surrounded by the slow innovative activity by the local player that ranked 49<sup>th</sup> in the world in 2001. These scenarios demand a long sustainability and need for technological maturity within local player. Hence, to optimize return of the afford

that Malaysian had put to the influx of technology, high concern must be toward the innovation and R&D activities.

The issues of innovation and R&D should be supported by the ICT application by the industries and other actor such as the public sector. On top of the usage of the ICT, the knowledge which had been captured from using the ICT plays an important role by the actors. Knowledge is so important because the conversion of an idea to an innovative products or services and to marketplace is base on the knowledge captured by the user. Obtaining and using information through information exchange about technology innovation through ICT usage is crucial component affecting innovation.

Through knowledge, the phenomenon of technology development for the economic growth will be manifested by the existence of technological spillover and externalities which possibly overcoming the threat of diminishing return (Griliches, 1998).

ICT is to support knowledge capturing, growth exponentially in the productivity of knowledge. Wealth creation at the end of 20<sup>th</sup> century had change from financial capital replaced by information and knowledge as the working tools (Daum, 2003). In each of the ICT spending, it drives a hidden collateral investment in infrastructure, people and efficiency of that organization. Investment in information and knowledge represent investment in the capability to create intangible assets, the innovative creation which will assure the competitiveness of the organization. Knowledge creations, the intangible assets, are the basis of an organization's innovation power.

Innovation as defined as any changes affecting one or more terms of one or more vectors of characteristics (technical, service or competence) which brought about by a range of basic mechanism: evolution or variation, disappearance, appearance, association, dissociation or formatting. They may be programmed that is intentional, the product of R&D, design and innovation activity or emergent, that is the fruit of natural learning mechanisms (Gallouj, 2002). The capabilities of capturing the knowledge, which result from the natural learning processes, depend on the environment which influences the production of innovation. Four factors within environment capital that influence the capturing of knowledge are human capital, structural capital, customer capital and partner capital (Daum, 2003). Interaction between these factors during the process of innovation will synergize and exchange of ideas happen while provoking one to each others. Stickiness of knowledge, which results from interaction with customer, will affect the locus and pattern of innovation and related downstream activities which mean that problem-solving will tend to locate at the sites of sticky information (Stoneman, 1995).

Learning process at work can accumulates knowledge of the extent resources and problems of different domains in ways that enable it to become the raw materials that can be transform to innovation. It reflects the interdependence of processes of organization learning, organization innovation and creativity. In turning innovative ideas into finish products or processes, individuals gain an intimate working knowledge of the capabilities and hence, knowledge increase and not diminishing return (Hargadon, 2002). Organization that are at the leading-edge characterized by their abilities upon interaction with wide range of knowledge generating institutions, providing skills and information to enhance and guide internal innovation activities (Stoneman, 1995).

One of the innovation systems that have been supported by the government is the creation of the technological human capital. This is applicable in public sector that may result in more rapid systems and technology development. Internal innovation is to enhance the absorptive capacity of public servant by using the ICT and later can be use to interpret and response to the change of environment and market demand. Not all innovation comes from R&D, instead, from practices and seeks new solution to their needs or problems. It diffused when an innovation was communicated through certain channels over time among the members of a social system, special type of communication and messages concerned with the new ideas (Rogers, 1995).

Hence, to look at the capability of the public servant for the capability of knowledge capturing from using ICT and capability to transfer the knowledge to produce innovation is crucial because skill and knowledge are 2 factors of knowledge-based economy. These 2 factors that involve element of human and technology are to be blended together for development. Spillover is the result of incremental utility of the knowledge gain from the usage of ICT in practice. The knowledge captured by the private sector and public servant must be collate, store, disseminate, generate and utilize. Knowledge must be developed, and transparency within the public sector must be encouraged. Applying those processes, the profitable innovation is not provided by upstream like R&D but downstream (applied) discoveries (NITC, 2004). By these activities, the knowledge-based value added can be promoted.

4-1-1-3d

### 3. STUDY METHODOLOGY

#### 3.1 Scenario In Malaysia

In the case of Malaysia, active internal innovative activities have to be encouraged to fill the gap between the rapid influx of technology and the capabilities of slow response by the local player. The public sector as an important actor to promote this activity whereby the government of Malaysia, through its agencies, had introduced many activities related to innovation. Introduction of ICT application at work place is an important tool for sharing of information because information is crucial to create the new idea. Government of Malaysia had promoted innovation at work place as one of the criteria to be the best organization in the country where Malaysian Administrative and Modernization and Management Planning Unit (MAMPU) as the governing body. Prime Minister's Award and Malaysian Innovation Award are example of appreciation for the best organization and individual in public and private sector for innovation project.

Strategically, well blend ICT application with innovation and creativity will promote the development of economic without the intensification of the labor and capital. At the tip of this strategy and activity, the involvement of the public sector is crucial. As an initiator for the development, the involvement in ICT application and innovation should be cultured in public service at work place. From those scenarios, a problem statement is whether the public servant can capture knowledge from using of ICT at work place that later transform to innovative product must be identified.

The issues of slow technology development that cause by lacking of knowledge shared, networking and failure to internalize the spillover effect of knowledge and skill creation can be study by looking at the variable of ICT usage at work place, the innovation created and the knowledge captured from the ICT usage. The relationship between the creations of innovation promoted by the present of knowledge that had been captured from usage of ICT at work place by public servant can be explore by using the Two Ordered Multiple Regression Model as shown in Figure 1.

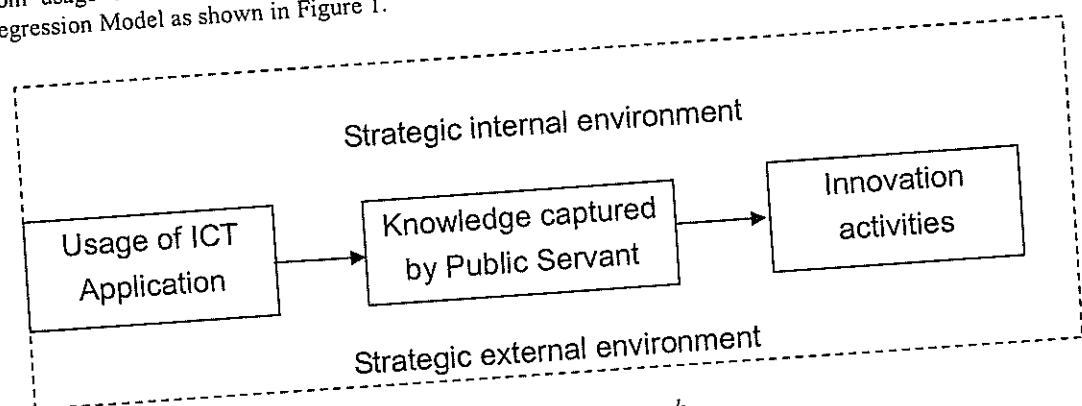


Figure 1: Framework

Figure 1 shows that by using ICT application at work place, innovation activities will be created with certain amount of knowledge captured by the public servant as the mediator. On the other hand, the capability of the public servant to capture the knowledge from ICT usage depends strongly on the strategic internal and external environment of the organization, namely the human capital, decision-making and customer capital.

To study the relationship, usage and involvement of the public servant and the ICT application at work place must be explored. Frequency of using ICT application, level of ICT application's literacy and how significant ICT application improved their productivity are few indicators to look at the involvement of public servant.

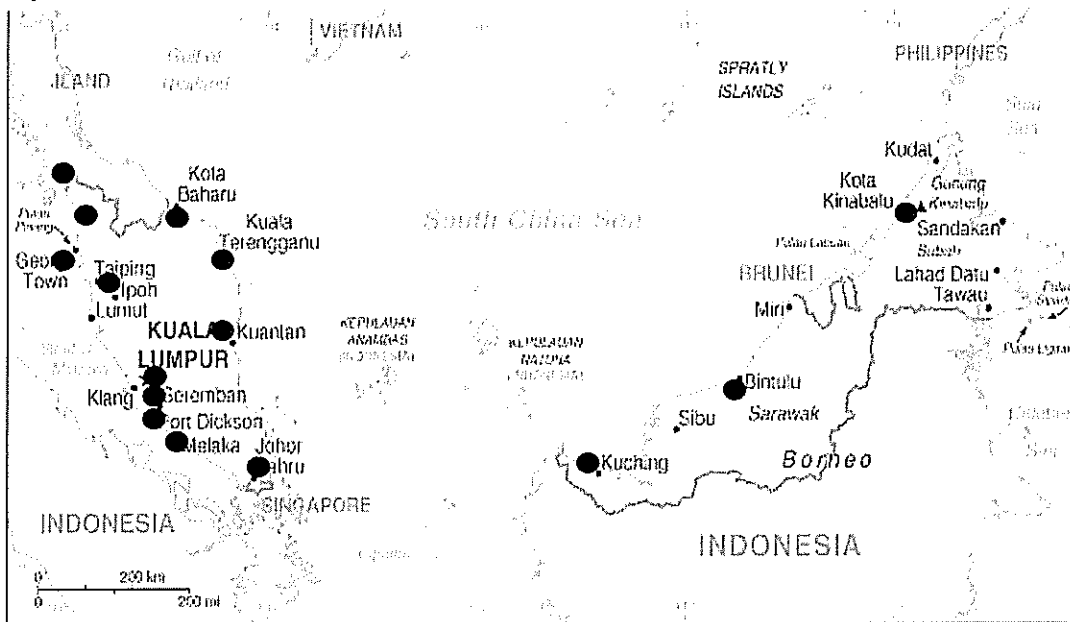
Knowledge been captured from using the ICT application at work place is a significant measurement because transforming the knowledge of using ICT application may promote innovation. Indicators should be explored are, to what extent they gained knowledge from using ICT at work place rather than training and how significant the knowledge can improved their performance at work place. These indicators will show the effect of knowledge been captured from the usage of ICT application at work place.

The ultimate issue of this paper is to study the involvement of public servant in innovation by transforming the knowledge captured from ICT application at work place. Indicator used for the measurement is experience gained through using of ICT used for improvement of working procedure because improvement of procedure is part of innovation through improvement of service. To study the relationship between the ICT usage at work

place and the innovative activity with knowledge captured as the mediator, questionnaire was designed consist of 5 points Likert scale. The organization that used ICT application had been chosen and random member of the organization respond to the questionnaire.

3.2 Source Of Data

In this study, primary data collection was conducted where questionnaires were distributed through e-mail, postage and by hand to the agencies within public service in Malaysia, namely those agencies using the application of ICT at work place. Geographically, the sources of the data are well distributed through out Malaysia. The data collected from 15 different locations to represent the public servant present nationwide in 15 different states. The geographic distribution of the respondents shown in Figure 2 represents 6 different departments from 5 different ministries.



Source: The World Factbook

Figure 2: Geographical distribution of respondent

The respondents represented the public servant of different nature of job, such as policy maker, operation and enforcement, management, finance, training, information system and lecturer. They also vary in the level of management namely office assistance, clerk, executive officer, officer and manager. This fact is important because information about ICT usage, knowledge and innovation from different level of management hierarchy is important since creative innovation may initiates form different level of management, as far as the innovation promotes value added. From 15 different geographical distributions of sampling, 430 sets of questionnaire were distributed.

4. ANALYSIS

4.1 DEMOGRAPHY

From the questionnaire distributed, 77.6% (326) responded to the questionnaires where 53.7% (175) are male and 46.3% (151) are female. The distributions of the respondents according to their academic qualification are shown in Table 1.

Table 1: Distribution according to academic qualification

Academic Qualification	Percentage (%)
Non- degree	16.6
Bachelor degree	58.9
Master degree	16.3
Doctorate	0.9
Others	7.4

Academically, it is found that 58.9% having a bachelor degree. From 326 respondent, the total of 14.7% of the respondent have computer and ICT related major with 54.2% of them having a bachelor degree level. The significant of this finding is that the respondent with computer and ICT related field is expected to be the pacesetter toward the usage of ICT and ICT related innovation project at work place.

4.2 Usage Of ICT

From the result, 89.2% of the respondent perceived that they are at the high level frequency of using ICT (frequently, very frequently and almost always) and the frequency of using ICT application is independent to academic major. This findings shoes that public servants involve in using ICT application at work place is independent to academic major and background

Working experience	Percentage (%)
Less than 5 yrs	94.0
6 - 10 yrs	87.7
11 - 15 yrs	82.9
16 - 20 yrs	94.7
More than 20 yrs	85.7

Table 2: Working experience with high level of frequency of ICT usage

The findings also show that high level of ICT usage at work place is independent to experience of working as public servant as shown in Table 2. The result indicates that public servants at all level of experience were familiarized with the ICT application.

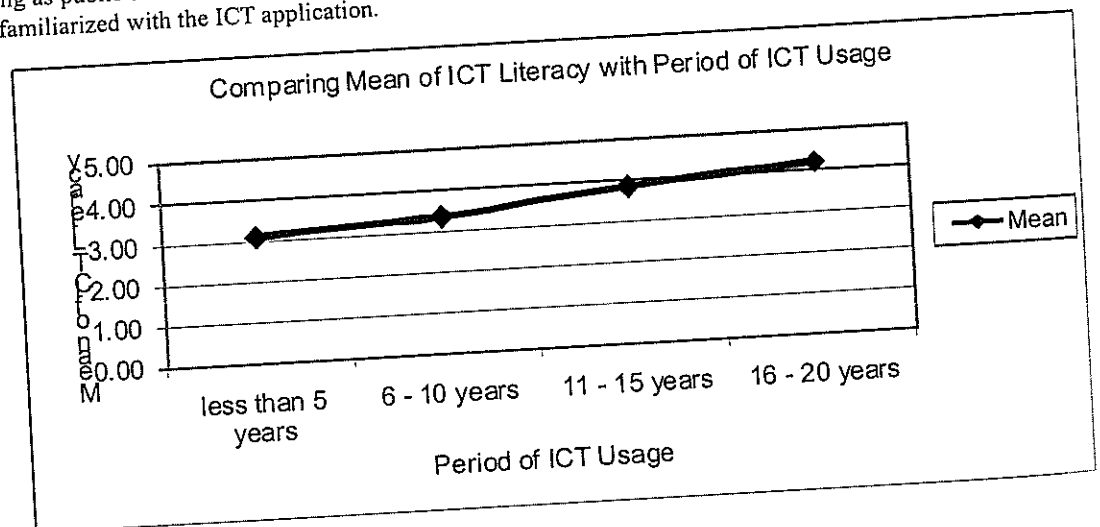


Figure 3: Distribution of mean of ICT literacy



On issue of literacy, 91.1% respondents are moderate to very high level of ICT literacy. Looking at the movement of mean of the ICT literacy, clearly shows that the mean of the ICT literacy moving from 3.10 to 4.20 as the period of ICT usage increase from less than 5 years to 16 – 20 years which means that literacy is dependent to period of using ICT application as shown in Figure 3.

Comparing academic major to literacy, it was found that literacy is independent to academic major except respondent with computer and ICT related that was concentrated at the moderate level (25%), high level (50%) and very high level (25%) respectively. Respondents irrespective to academic major are getting familiar with ICT. This shows a good indication of interest in using ICT application at work place.

### 4.3 Issues of Knowledge

To study whether the respondent is capturing knowledge from the usage of the ICT, 2 indicators were used namely, how significant the knowledge gained from using ICT improved the performance and

more knowledge gained through working experience compare to training and knowledge gained can be used anywhere within the organization.

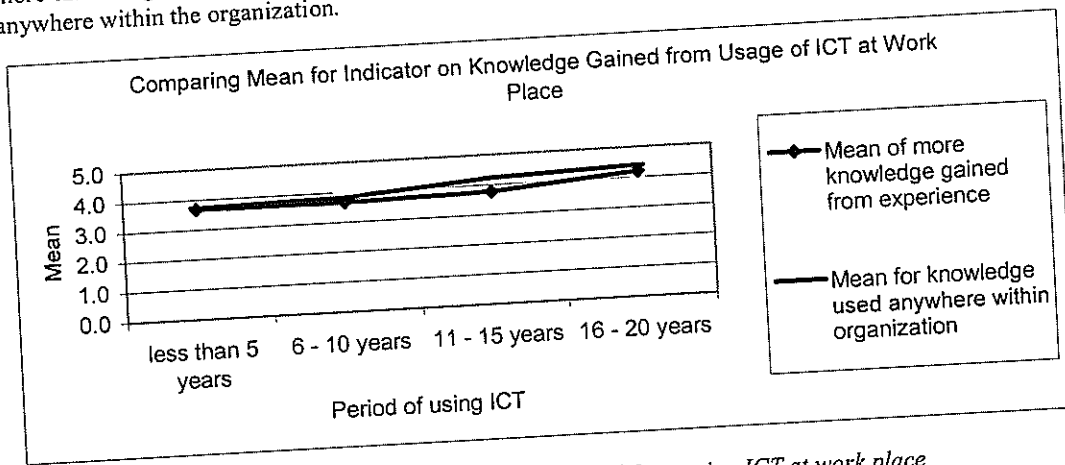


Figure 4: Mean of knowledge gained from using ICT at work place

By comparing the mean as shown by Figure 4 below, it shows that the mean of knowledge captured for both indicators increase as the period of usage of ICT at work place increase. The increase of mean was contributed by 100% of the respondent with 16 – 20 years experience using ICT perceived that the knowledge they gained from ICT usage is at high level (somewhat significant, significant and very significant) to improved their performance at work place. Data also shows that improvement of performance is independent of academic major as shown in Table 3. Study about the source of knowledge shows more than 90% of the respondents from different academic qualification perceived to gained knowledge through experience of using ICT at work place as compare to training.

Table 3: Percentage of respondent who improved performance from knowledge gained

Academic Major	Percentage (%)
Computer, ICT or related field	97.9
Economics, accountant, management or related field	97.7
Science or science related field	100
Engineering or engineering related field	90.9
Others	96.0

The most significant is that 100% of the computer and ICT related field perceived the same. Study about the transferability of knowledge, it was found that more than 95.7% of the respondent perceived that the

4-1-1.3h

knowledge they gained from using ICT at work place can be used for the scale of sometimes effectively, effectively and highly effective anywhere within the organization.

Table 4: Transferability of knowledge

Knowledge source from work place	Percentage of Transferable (%)
Not at all	50
Minor extent	75
Moderate extent	94.5
Major extent	98.7
Great extent	100.0

Comparing the transferability of the knowledge with the source of the knowledge, it was found that those respondent who gained knowledge at higher level from work place, will tend to be more transferable as shown in Table 4.

4.4 Issue of Innovation

In this section, discussion about the transformation of knowledge captured from using the ICT at work place into a creative innovation that improved the working procedure which benefit the organization and customer. To study this issue, indicator used namely the involvement of respondent toward improvement of procedure by using the experience of using ICT because improvement of procedure is part of innovation in public service.

From the study, it was found that the mean of used of experience gained through ICT usage for improvement of procedure increase as the period of using the ICT application at work place increase as shown in Figure 5.

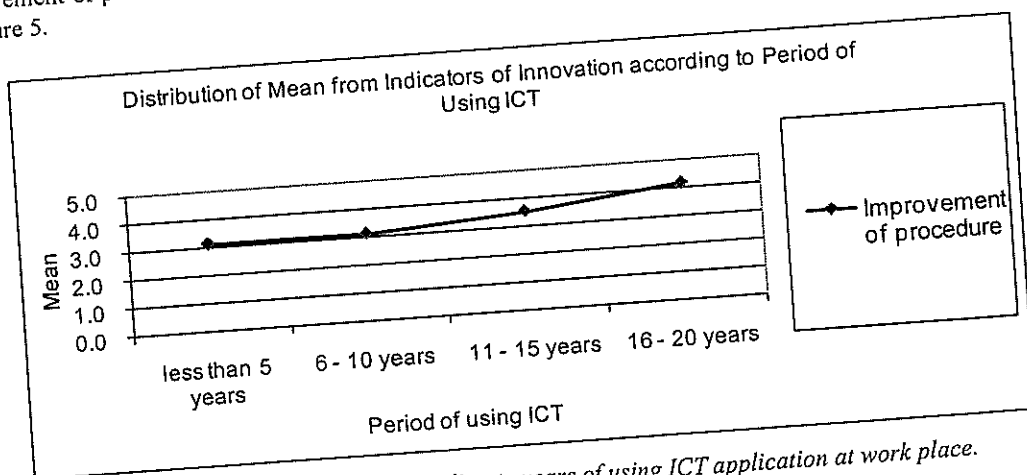


Figure 5: Level of innovation according to years of using ICT application at work place.

The respondent perceived that their experience is frequently to very frequently used (mean of 3.1) for the period of using ICT for 6 – 10 years increase to very frequently to almost always used (mean of 4.2) for the period of using ICT for 16 – 20 years. For the respondents having 16 – 20 years experience of using ICT, 80% perceived that their experience are very frequently used for improvement and 20% almost always used for improvement of working procedure.



4.1.1.3

*Table 5: Level of usefulness of experience according to academic qualification*

Academic Qualification	Percentage (%)
Computer, ICT or related field	95.8
Economics, accountant, management or related field	78.0
Science or science related field	76.5
Engineering or engineering related field	54.5
Others	78.2

From the study, it shows that 95.8% of respondent with computer, ICT or related field contribute to high level of usefulness of their knowledge for improvement as Table 5. From the data, it was found that use of experience gained from usage of ICT for the improvement of working procedure is independent to the qualification of the respondent. The data also shows that the respondent with higher level of literacy have high level of usefulness of experience for improvement as shown in Table 6 where 95.8% of the respondent with very high level of literacy contributes to high level of usefulness of experience for improvement of working procedure. This means that literacy plays an important role for the usefulness of the experience for improvement of working procedure.

*Table 6: Level of literacy according to the usefulness of experience*

Level of ICT Literacy	Percentage (%)
Very low	57.1
Low	59.1
Moderate	78.0
High	86.6
Very high	95.8

Study shows that more than 70% of the respondent from every period of usage of ICT contribute somewhat significant to very significant involvement in innovation. For the respondent using ICT for period of 16 – 20 years, 20% of respondent contribute somewhat significant, 40% significant and 40% very significant to the innovation.

*Table 7: Involvement in innovation at work place according to academic major of respondents.*

Academic Major	Percentage (%)
Computer, ICT or related field	83.3
Economics, accountant, management or related field	69.7
Science or science related field	76.5
Engineering or engineering related field	81.8
Others	75.2

Academically, the respondent shows no significant different for high level involvement in innovation as shown by Table 7 which means that involvement in innovation within the organization is independent of the academic major of respondent.

Table 8: Percentage of high score for significant involvement in innovation at work place

Level of Literacy	Percentage (%)
Very low	85.7
Low	63.6
Moderate	70.2
High	80.5
Very high	95.8

The involvement in innovation shows a positive trend to ICT literacy. The respondent with higher literacy will tend to involve more significantly toward innovation at organization. But, significant different shown by the 85.7% of the respondent whose literacy is very low but tend to involve at high significant level to innovation as shown in Table 8 which means that in innovation, some other factors other than ICT related, such as experience, are important for the creation of innovation.

As argued that even an innovation is autonomous, certain complementary capabilities or assets will be needed for successful (Teece, 2003). From Table 8, 85.7% of the respondent with very low level of ICT literacy, respondent with 16 – 20 years of using ICT application contributed 14.5% of them.

### 5. TWO ORDERED MULTIPLE REGRESSION MODEL

A two ordered multiple regression analysis was conducted to predict the presence of knowledge that promotes innovation from ICT usage at work place after transforming the data to z-score. The result of this analysis shows that ICT usage at work place accounted for a significant amount of innovation variability,  $R^2 = 0.287$ ,  $F(3, 322) = 43.137$ ,  $p < 0.001$  with t value is significant at  $p < 0.05$  indicate that usage of ICT at work place promote innovation as Model 1 in Table 9. Those with higher literacy, higher utilization of ICT at work place and ICT can improved their productivity tend to have contributed to innovation.

Table 9: Result of the Two Ordered Multiple Regression

Model	Standardized Coefficients	t	Sig.	
	Beta			
1	Frequency of using ICT	0.21	3.90	0.00
	Level of literacy	0.14	2.65	0.01
	ICT improve productivity	0.33	6.20	0.00
2	Frequency of using ICT	0.19	3.77	0.00
	Level of literacy	0.10	2.07	0.04
	ICT improve productivity	0.19	3.48	0.00
	Knowledge improve performance	0.29	5.54	0.00
	Knowledge gained at work place	0.12	2.51	0.01

Dependent Variable: Experience of using ICT at work place used for improvement of working procedure

Second analysis was conducted to evaluate whether knowledge captured from ICT usage predicted for innovation as Model 2 in Table 9. Two measurements of knowledge accounted for a significant proportion of innovation variance after controlling for the effects of ICT usage at work place and the result is  $R^2$  change = 0.10,  $F(2, 320) = 24.768$ ,  $p < 0.001$  with t value is significant at  $p < 0.05$ . This result rejects the hypothesis null

and suggests that 10% of the variance of knowledge captured is associated with creation of innovation. The coefficient ( $\beta$ ) of the two indicators of knowledge are ( $\beta_1 = 0.29$ ) for knowledge gained improved performance and ( $\beta_2 = 0.12$ ) for knowledge gained from using ICT at work place rather than training. From the result, it suggests that with the same condition of ICT application usage, the more the knowledge captured will increase the creative innovation capability

The result shows that involvement of knowledge from ICT usage is in a small quantum, this study is important since effort had been put by the government for ICT application in the public sector, namely the funding. Considering the 1996, the establishment of Multimedia Super Corridor as the ICT hub of Malaysia, as the starting point, the percentage of knowledge is expects to increase as the period of using ICT application get longer.

## 6. CONCLUSION

The public servant in Malaysia had been involved and cultured by ICT application. Their literacy is independent of their academic qualification and it is positively dependent to the period of using the application at work place. They manage to capture knowledge as the result of using the application and it is also positively dependent to the period of using the application. The source of knowledge they captured was from working experience that are highly transferable and can be used in a highly effective manner within the organization.

They benefited the knowledge captured and manage to transform the knowledge to innovation. The involvement in innovation within the organization has a positive relationship with the period of using ICT application where the level of literacy is the most significant indicator for transforming the knowledge to innovation. Innovative ICT environment is crucial for the capability of public servant to capture knowledge. With such environment, innovation can be created and established. The stickiness of knowledge acquired from the usage of ICT application at work place can be utilized for value added activities in the present system.

## REFERENCE

- [1] Andrew B. Hargadon, 2002, *Brokering Knowledge: Linking Learning and Innovation*, Research in Organizational Behavior, Volume 24, Elsevier Science Ltd.
- [2] David J. Teece, 2003, *Profiting from Technological Innovation: Implication for Integration, Collaboration, Licensing and Public Policy*, Essays in Technology Management and Policy, World Scientific Publishing Co. Pte. Ltd. Singapore
- [3] Everett M. Rogers, 1995, *Diffusion of Innovations*, The Free Press, New York, London, Toronto, Sydney, Tokyo, Singapore.
- [4] Faiz Gallowj, 2002, *Innovation in the Service Economy: The New Wealth of Nations* Edward Elgar Cheltenham, UK. Northampton, MA, USA
- [5] Jomo Kwame Sundaram and Gred Felker (edited), 1999, *Technology, Competitiveness and the State: Malaysia's Industrial Technology Policy*, Routledge, London.
- [6] Juergen H. Daum, 2003, *Intangible Assets and Value Creation*, Wiley, England.  
National Information Technology Council Paper (NITC): K-economy and Its' implication,  
<http://www.nitc.org.my/k-economy/K-economy%20and%20its%20implications.pdf> (retrieved on 24 Jan 2009)
- [7] Suresh Narayanan and Lai Yew Wah, 2000, *Technological Maturity and Development without Research: The Challenge for Malaysia Manufacturing, Development and Change*, Volume 31, Number 2, March 2000, Blackwell Publisher, Oxford.
- [8] Stoneman, P., 1995, *Handbook of the Economics of Innovation and Technological Change*, Blackwell Oxford UK & Cambridge USA
- [9] Zvi Griliches, 1998, *R&D and Productivity: The Econometric Evidence*, The University of Chicago Press, Chicago and London.