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The Impact of Knowledge Enrichment through ICT Usage on Innovation Capability in the Malaysian Public Sector

Md. Nor Hayati Bin TAHIR* and Hitoshi MITOMO*

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. Our objective is to identify the presence of knowledge captured from the use of ICT in the workplace. The analysis shows that the public sector captures knowledge from the information available from ICT applications and later uses that knowledge for innovation activity. It is found that the frequency of ICT usage in the workplace contributes most to the innovation capability of the individual public servant. The knowledge enrichment that contributes to the increase of innovation capabilities is positively related to the length of experience of using ICT in the workplace. It is also found that interaction with the customer contributes to the enrichment of knowledge and skills, which is positively related to the length of service of the employee.

1. Introduction

The private sector in Malaysia plays an important role in sustaining economic growth. Further intensifying the product-based economy will only increase the gap between Malaysia and the world's more advanced economies. As a result, the private sector has to transform the economic development of Malaysia from a product-based economy to a knowledge-based economy, since advanced economies are already active in the K-economy. To reduce the gap, a non-incremental approach is needed, which will come about by intensifying research and development (R&D), innovation and the application of ICT.

This study is an attempt to explore the influence of knowledge enrichment, through ICT usage in the workplace, on the innovation capabilities of public servants in Malaysia. The study looked at three variables, namely ICT application, knowledge and innovation. By

* Graduate School of Global Information and Telecommunication Studies
  Waseda University, 29-7 Building, 1-3-10 Nishi Waseda, Shinjuku-ku, Tokyo 169-0051 Japan

identifying the significant indicators of the variables, the relationship between knowledge enrichment and the innovation capabilities of public servants can be established.

2. Literature Review

As explained by Narayanan and Wah [17], a well-developed and mature technological base is the characteristic of a fully industrialized nation, which should be propelled by self-sustaining innovation and R&D. Lall [14] argued that the presence of high technology imported by foreign-based investors is countered by the slow pace of innovation activity on the part of local players, due to their lack of knowledge and networking and failure to internalize the spillover effects of knowledge and skill creation. Hence, concerned attention must be given to the innovation and R&D activities that are supported by ICT applications, so that information exchange from external domains can be enabled.

Linkages between actors (government, business and industry), and within those organizations, will result in more sharing of information and lead to the enrichment of knowledge. As a result of these interactions, the actors will be able to co-produce innovation [7]. While using the information and knowledge for innovation leading to finished products or processes, individuals will gain an intimate working knowledge of their capabilities, and hence knowledge can be increased [11]. For further sharing, the captured knowledge must be collated, stored, disseminated, generated and utilized for downstream discoveries [18]. To further enhance the sharing of information, organizations must interact with a wide range of knowledge generating institutions to provide skills and information about enhancing and guiding internal innovation activities.

Innovation is defined as any change that affects one or more terms of one or more vectors of those characteristics (technical, service or competence) that are brought about by the mechanisms of evolution or variation, disappearance, appearance, association, dissociation or formatting. Gallouj [7] further maintains that innovation may comprise programs that are either intentional, like the products of R&D, design and innovation activities, or emergent such as the result of natural learning mechanisms. In this study, the innovation activity is the emergence of new processes and procedures in the public services contributed by public servants. To clarify the relationship between captured knowledge and innovation, it is important to understand the concepts of data, information and knowledge. The user of the ICT application will receive transported data in an informatics system. The data received will be categorized as information, which is the result of the cognitive capacity of the receiver who works with the data. Carvalho and Ferreira [2] explain that the data may immediately generate either new knowledge in one receiver, merely temporary information in another, or noise (lack of sense) in a third. Gisela [8] defines knowledge as being aware of something or having information. The information value is inherent in its use, and its effective use depends on the ability of an individual to see the meaning and significance of the information, thus creating new knowledge. Knowledge, on the other hand, is equally lacking in value unless used [1]. ICT is not the only source of information for the creation of knowledge. As noted by Nonaka, Konno and Toyama [20], knowledge emerges as a result of interaction in the environment, and shares space and time either by means of one or a combination of physical, virtual, and mental processes. It also includes sharing with cus-

tomers through interaction and experience. Jae and Suk [12] further stress that knowledge can be measured by accessing how much the knowledge contributes to the actual performance, which is the result of applying the knowledge. Cohen, Nijkamp and Montfort [3] stress, in their study of the role of ICT in the city, that the measurement can be determined by the perceptions, beliefs and attitudes of the relevant actors.

3. Study Methodology

3.1 The Scenario in Malaysia

To initiate the K-economy in Malaysia, the sharing of knowledge-capturing activities through the involvement of the public sector in ICT applications should be promoted to generate new skills and experiences. New ideas generated in-house through innovation activities have to be encouraged, and then followed accordingly by implementation. Steps to encourage public servants to generate ideas and innovate willingly within the workplace have already been taken. The Prime Minister's Award, introduced in 1990 and governed by the Malaysian Administrative, Modernization and Management Planning Unit, is an example of appreciation for the best organizations in terms of innovation and quality management. The Malaysian Knowledge-based Economy Master Plan included innovation, creativity and ICT application among its criteria. The Innovation Award, introduced in 1992, is given to individuals, groups or agencies that have successfully implemented innovations that are beneficial in terms of reducing operational costs and time, increasing work productivity and enhancing customer satisfaction. The Joint-Research Innovation Award, also introduced in 1992, recognizes good practice in joint-venture R & D, training and education, information technology, consultancy and publishing between public and private sector organizations, so as to enhance and promote better working relationships.

Generating new ideas in-house is influenced by the capability of the public servant to innovate. In this study, innovation capability is defined as the capability of the public servant to innovate which requires resources, infrastructure, and skills to be embedded in the individual. The capability to innovate is the results from process through which economic and social value is created from the information acquired by using the ICT application. The result of that capability being exercised is the creation and transformation of ideas to produce new products or processes.

ICT application is defined as the electronic means of capturing, processing, storing and communicating information. The framework of this study is the usage of ICT applications where computer technology is a tool for the application's interface, excluding mobile communication. In the light of these scenarios, the problem statement is: does the enrichment of knowledge from ICT usage in the workplace by public servants have any impact on their innovation activities?

3.2 Model and Measurement

Our chosen conceptual model, as shown in Figure 1, explains that by using ICT applications in the workplace, innovation activities will be created and a certain amount of knowledge will be captured from ICT usage by the public servants acting as mediators. Knowledge is captured as the result of translating the information available in the ICT

Innovation activities

Innovation capabilities

Knowledge
- Improvement
- Experience
- Skill

Usage of ICT Application

Enrichment of knowledge

Figure 1: Relationship between enrichment of knowledge and innovation capabilities

application into innovation activity. Innovation capability is assessed by the intensity of ICT usage and the amount of knowledge captured as the result of information acquired from using the ICT application.

From the relationship explained by the model, the hypothesis that is going to be tested is that knowledge captured from ICT usage in the workplace by public servants is significantly involved in innovation activities. The presence of significant indicators of knowledge means that knowledge is involved as the mediator for innovation. Knowledge enrichment may have a relationship with the length of experience of using the ICT application.

To show how the model relates to practice, three indicators of ICT usage and three indicators of knowledge were tested. To measure the indicators, a questionnaire was developed to disclose the performance of the respondents relating to ICT usage as perceived by the respondents [3]. The frequency of using an ICT application, ICT_F, is the measure of how frequently public servants use an ICT application in their workplace, implying the level of exposure to information made available by the ICT application. Identified ICT applications are Intranets (private networks), Electronic document management (repositories of documents), Groupware (e-mail, e-group), Workflow (standardized processes), and portals (functioning as home pages for departmental intranet sites and linked internet resources). In this survey, the measure used to indicate the degree of frequency of using ICT applications ranged from 1 to 5, where 1=Almost Never and 5=Almost Always. Level of literacy, ICT_L, is the measure of capability of the respondents to penetrate the ICT application and retrieve the available information. In this survey, the measure used to indicate the level of literacy of the respondents ranged from 1 to 5, where 1=Very Low and 5=Very High. The ICT usage that improves job performance, ICT_P, is the measure of how the respondents perceived that the use of ICT applications could improve their job performance by enabling them to retrieve and share information and help in their decision-making. In this survey, the measure used to indicate the significance level of the information obtained from the ICT application that can improve job performance ranged from 1 to 5, where 1=Not Significant at All and 5=Very Significant. A higher level of significance means a higher perception on the part of the respondent that they are capable of using the information to improve their job performance.

Information can be acquired from the use of ICT in the workplace, and it can be

converted into knowledge to create other products, or processes. Knowledge that contributes to improving a working system, Kn_I, is a measure of how the knowledge captured by public servants from the information is significant for contributing to new processes and procedures in the working system. The measure used in this survey ranged from 1 to 5 where 1=Not Significant at All and 5=Very Significant. Knowledge from ICT can be captured either through experience of using the ICT application or training for using the ICT application. Knowledge captured by experience rather than training, Kn_E, is the measure of the extent of the knowledge that is captured from experience of using ICT applications and is used for the creation of innovation. Compared to training, knowledge captured from the experience of using ICT applications is accumulated and is an ongoing process. Captured knowledge varies according to the experiences of the respondents. The measure used in this survey ranged from 1 to 5 where 1=Not At All and 5=To a Great Extent. The higher the level of knowledge captured, the better the innovation capability of the respondents. Information can be used in many ways depending on the kind of innovation (product or process) and how it is used. Skill is needed to use the knowledge for creative innovation, and knowledge that is captured through ICT usage may contribute to the creation of skills for innovation activity. Knowledge that contributes to skill creation, Kn_S, is the measure of how significant is the skill that is used for innovation activity. The measure used for the creation of innovation in this survey ranged from 1 to 5, where 1=Not Significant at All and 5=Very Significant. The higher the level of significance of the skill created, the more developed is the respondent's innovation capability that has contributed to the innovation activity.

To examine the relationship between the length of experience of ICT usage in the workplace and the innovation activity, the second hypothesis to be tested is the presence of a positive relationship between the innovation activity and the length of experience of using the ICT application in the workplace. By applying the analysis of mean between the length of experience of ICT usage and the innovation activity, differences between the mean values for innovation activity and length of experience of ICT usage can be identified.

3.3 Source of Data

The primary data collection was conducted through questionnaires that were distributed by hand, post and e-mail, to agencies within public services in Malaysia. 60 sets of questionnaires were distributed in Johor Bahru and Kuala Lumpur, 90 sets in Putrajaya, the Federal Government Administrative Centre, and 20 sets were sent to 12 other different locations. Questionnaires were also e-mailed to five different agencies. The duration of the data collection was from October to December 2003.

The respondents from five different ministries represented public servants from different types of job, such as policy making, operations and enforcement, management, finance, training, information systems and education. In the Malaysian public service, the general management hierarchy can be determined by looking at academic qualifications. In this survey, the respondents were from several different levels of the management hierarchy, namely office assistants, clerks, executive officers, officers and managers, who used ICT applications in the workplace. Out of 450 sets of questionnaires distributed, there were 320 responses to the printed questionnaires and six respondents answered the questionnaires
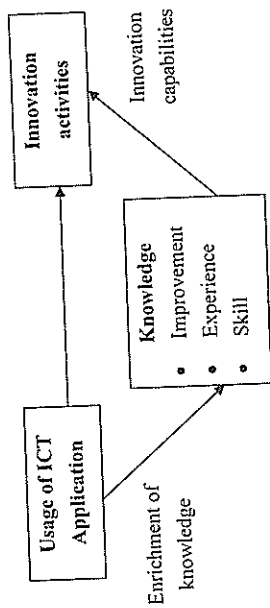
4.1.1.f

Table 1 : Gender, academic qualification and academic major

		Respondent (%)	Population 2002 (%)
Gender	Male	54.3	53.8
	Female	45.7	46.2
Academic Qualification		Respondent (%)	
Non-degree		15.6	
Bachelors degree		59.6	
Masters degree		16.6	
Doctorate		0.9	
Others		7.3	
Academic Major		Respondent (%)	
Computer or ICT related		14.1	
Economics, accounting, management related		40.2	
Science related		10.4	
Engineering related		3.4	
Others		31.9	

Legend:
- ■ Network
- ☐ Multimedia
- ☐ Website
- ▨ E-mail
- ▨ Word processing

1- Almost never
2- Occasionally
3- Frequently
4- Very frequently
5- Almost always
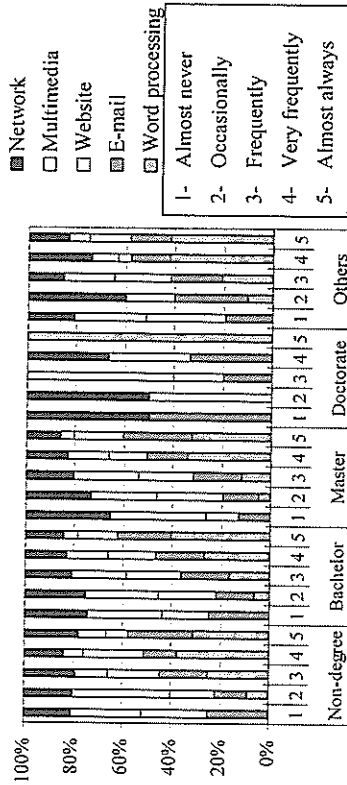
Figure 3 : Level of usage of ICT applications according to Academic Level

1 = Almost Never and 5 = Almost Always, measures the innovation capabilities of the respondents. A higher score signifies that the respondents have better developed innovation capabilities. The results show that the three indicators of the independent variables for ICT usage are significant for innovation activity, namely ICT_F, ICT_L and ICT_P. The three indicators for knowledge, namely Kn, Kn_E, and Kn_S, are also significant for innovation activity.

Adjusted $R_2^2 = 0.56$, with the t-value significant at $p < 0.05$ where $F_{(7,318)} = 60.06$ at Sig. = 0.001. The reliability analysis as performed shows that the coefficient alpha for the
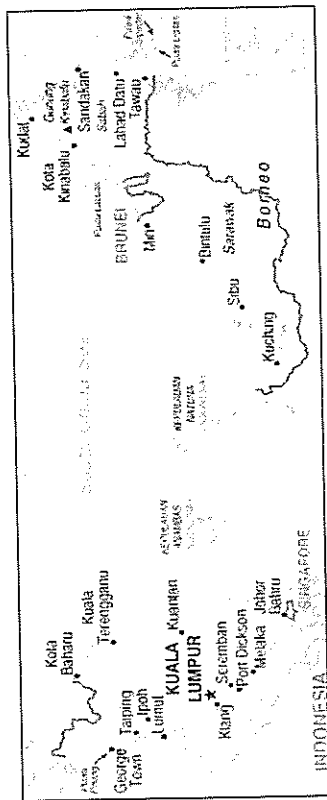
Figure 2 : Geographical distribution of respondents (Source : Nationmaster.com)

through e-mail.

4. Analysis

Analysis was done using SPSS software version 11. Reliability analysis was done on the individual cases and the results showed that the coefficient alpha was 0.92, which indicates a high consistency in the respondents' questionnaire answers.

4.1 Descriptive study

Of the 326 respondents, 54.3% (177) were male, while 45.7% (149) were female. Distribution of the respondents according to gender, academic qualifications and majors are shown in Table 1. It was found that 59.6% held a bachelors degree, which means that these respondents were working as officers in their workplace.

Comparisons made according to academic majors showed that 40.2% of the respondents had specialized in economics, accountancy and management related majors, while 14.1% had specialized in computer and ICT related majors.

Descriptive analysis was undertaken to examine the role of management level and nature of job in influencing the use of ICT in innovative and creative ways.

Figure 3 shows that the level of usage of ICT (measures 1 to 5) is well distributed among different academic levels and types of ICT application. It was found that usage of ICT is independent of the academic level and type of ICT application used. This implies that management level, as identified by academic level, and nature of job, as identified by type of application used, do not substantially influence the usage of ICT in innovative ways.

4.2 Two Ordered Multiple Regression Model

Two ordered multiple regression analysis was conducted to predict the magnitude of knowledge that promotes innovation from ICT usage in the workplace. After transforming the data to a z-score, analysis was conducted to evaluate the knowledge captured from ICT usage predicted for innovation. In the multiple regression process, the dependent variable used is the level of involvement of the public servants in contributing their ideas for newly emerged processes or procedures at their workplace. The scale, ranging from 1 to 5, where

Table 3 : Percentage of respondents with high scores according to academic level

Academic Qualification	% of respondents with high scores		
	ICT_F	ICT_P	ICT_L
Non-degree	88.24	98.04	80.39
Bachelors degree	85.57	100.00	91.24
Masters degree	98.15	100.00	92.59
Doctorate	100.00	100.00	100.00
Others	91.67	100.00	95.83

significant indicators is 0.74, indicating consistency on the part of the respondents answering the questionnaire. Further analysis found that there is an absence of multicollinearity among the variables used in the multiple regression. This result rejects the null hypothesis and implies that the variance of captured knowledge is positively associated with the creation of innovation. Public servants manage to convert the information gained from the ICT applications into knowledge that is used for innovation activity. The highest contributor towards innovation is the frequency of using the ICT application in the workplace. Results suggest that with the same condition of ICT application usage, more capture of knowledge will increase the innovation capability that can be represented through the following function:

Innovation Capability

$$= 0.27\ ICT_F + 0.14\ ICT_L + 0.10\ ICT_P + 0.25\ Kn_h + 0.18\ Kn_E + 0.16\ Kn_S$$
$$\quad (6.30) \quad\quad (3.16) \quad\quad (2.35) \quad\quad (4.47) \quad\quad (4.47) \quad\quad (3.09)$$

where the t-value is in parentheses.

The constant value from the results of multiple regressions is eliminated in the innovation capability function because the value is so near to zero (-6.556×10^{-10}). As the constant is near to zero, this means that the respondents have no ICT-based innovation capability if they have no experience of using the ICT application. Even if the infrastructure and ICT application are available in the workplace, without any experience of using the ICT applications, the respondents are still reluctant to innovate by using the information available from the application.

4.2.1 Explanation of the variables

From the survey, it was found that there was a high percentage of respondents with a high score for the significant indicators contributing to innovation capability, as shown in Table 2. In this study, a high score means that the respondent has a score of 3 to 5 for every indicator mentioned.

ICT_F, which carries 27% weight for innovation capability, shows the smallest percentage of respondents (88.6%) with high scores. The distribution of respondents contributing high ICT_F scores is shown in Table 3. The result shows that the frequency of usage is independent of academic qualifications, implying that the nature of the job and the management level are not influential. Overall, increasing the ICT_F will increase the innovation capability in an organization.

From Table 2, the result for ICT_P shows that 99.7% of respondents perceived that use of ICT applications will improve their performance. This implies that using the ICT applications will contribute to information sharing when performing tasks. In turn, the information will promote the innovation capabilities of the public servants. Only one respondent, a female with two years' experience as a public servant, very low ICT literacy and who had almost never used ICT in the workplace, had a low score for this indicator. Again, this indicator is independent of the academic qualification held, as shown in Table 3, which implies that the information transformed into knowledge for innovation activity is unrelated to the nature of the job. Respondent perceived ICT_L carries 14% weight for innovation capability.

In this survey, 90.2% of the respondents had a high ICT literacy score whereas the respondents with non-degree qualifications contributed the lowest scores (80.39%). Literacy will lead to the capability to make best use of the information available in the ICT application. This information can be transformed into knowledge for innovation activity. Continuous training is needed by the public servants to improve their literacy in order to promote their capability to utilize the applications available to best effect [15].

The public servants transform the information available in the ICT application as knowledge for the creation of innovation. The innovation capability of the public servants depends on their capability to use the information as knowledge. Kn_h, Kn_E and Kn_S are assigned the weights of 25%, 18% and 16% respectively for innovation capability. More than 95% of the respondents perceived themselves as having a high score for each indicator. From the relationship between the indicators, the more information that can be transformed into knowledge, the higher the innovation capability of the public servant.

The implication of the findings is that more content and applications offering various services should be introduced in the public sector. These will contribute to the intensification of ICT usage that will in turn contribute to the enrichment of knowledge. The information and knowledge that they capture can enhance the innovation capability of the public servant.

The process of transforming the information into knowledge is influenced by factors of internal capital, customer capital and decision-making [15]. The elements of internal capital that contribute to furthering the transformation are motivation, open concept management, ICT training and easy access to networks. These factors promote the creation

Table 2 : Respondents (%) with high scores for significant indicators

Indicator	Respondents with high score
Frequency of using ICT application, ICT_F	88.6%
Level of literacy. ICT_L	90.2%
ICT usage improves job performance. ICT_P	99.7%
Knowledge to improve working system. Kn_h	96.8%
Knowledge captured by experience rather than training. Kn_e	95.0%
Knowledge that contributes to skill creation. Kn_S	95.1%

4.1.1.h

of ideas and concepts of new products and processes as innovative ways to replace old systems of working. Customer capital is influenced by the presence of ICT infrastructure that supports the customer's needs. Applications that can be accessed by the customer will promote virtual interaction and increase the experience of the public servant, thus resulting in more information being acquired for knowledge creation. To enhance the use of information as knowledge for the creation of innovation, suggestions from public servants at all levels must be taken into consideration during the decision-making process. Through considering the influential factors, public servants will have the opportunity to be involved in innovation activity as the result of using the information available in the ICT applications used in the workplace.

4.3 Analysis of Mean

An analysis of mean was applied to test the relationship between innovation capability and the respondent's experience of using the ICT application. In this survey, the scale used for the experience of using the ICT application is : less than 5 years, 6-10 years, 11-15 years, 16-20 years and more than 20 years. It is argued that the development of ICT applications is moving at a fast rate and the usage itself is changing. From the survey it was found that a high percentage of the respondents had experience of using ICT applications that was similar to the period of their working experience, that is, 5 years (100%), 6-10 years (38%), 11-15 years (58.5%) and 16-20 years (45%). This means that most of the respondents had experience of using ICT applications throughout their professional careers, and had worked with the technology as it developed and became more sophisticated. Unfortunately there was no respondent in the category of more than 20 years' experience, given that the intensification of applications of ICT in the public service only began in the 1980s.

From the analysis of mean, it was found that there is a significant difference of value of the mean and it is positively related to the length of experience of ICT usage and innovation capability where $df(3,322)$, $F=5.634$ at $p<0.05$. From the result, the null hypothesis is rejected and there is a positive relationship between innovation capabilities and the length of experience of ICT usage in the workplace.

From looking at the relationship between the length of experience of ICT usage and the innovation activity, the mean score of each indicator of the independent variable of the innovation capability function for every period of using the ICT application is computed. As a comparison, the same computation is done for the mean score according to the period of working as a public servant as shown in Figure 4.

From the result, it was found that the innovation capability is positively related to the length of experience of ICT usage in the workplace. The innovation capability increases from 4.06 to 4.86 for respondents who have used ICT for a period of less than 5 years and 16 to 20 years respectively. This explains why, as the experience of using an ICT application increases, public servants capture a certain amount of knowledge from the information available in the ICT application and this knowledge increases their capability for the creation of innovation activity. In contrast, the absence of any identified trend, when we examined the innovation capability by using the period of working as a public servant, shows that the innovation capability fluctuates unevenly. Comparing the two cases clearly indicates that
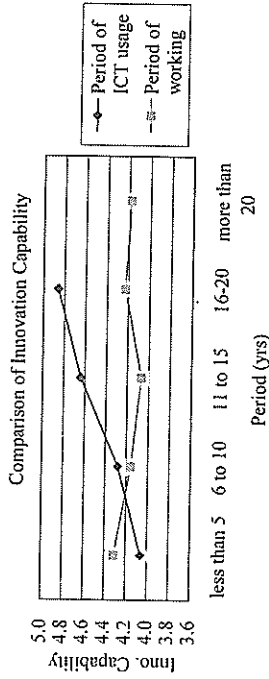
the use of ICT applications in the workplace contributes to the enrichment of knowledge for the creation of innovation proportionately as the period of using the ICT application increases.

From the results shown in Figure 4, a study of innovation capability by using the length of working experience contributes to the score ranging from 4.07 to 4.31. The presence of a high score shows that there are other sources of knowledge apart from what is captured from ICT usage in the workplace. In this survey, a question was put to the respondents about how effective the interaction is between respondents and their customers as regards knowledge creation. The interaction to be considered is the face-to-face interaction between the public servant and the customer. During the interaction, the information from the customer is delivered to the public servant and is used as an input for the innovation of processes and procedures.

From the descriptive study, it can be seen that interaction with customers at a high level of effectiveness (sometimes effective, effective and very effective) had a positive trend in relation to the length of working experience as shown in Figure 5. From the result, it is clear that interaction with customers contributes effectively to the enrichment of knowledge. A high percentage of respondents who had worked for no more than ten years perceived a high level of effectiveness for interaction with customers because they were among the public servants who worked at the operational level, providing services and interacting directly with the external customers.

The percentage is lowest for respondents who had worked for 11 to 15 years because of their position in the workplace. Hierarchically, they were at the level of middle managers,

Comparison of Innovation Capability

Inno. Capability: 5.0, 4.8, 4.6, 4.4, 4.2, 4.0, 3.8, 3.6

Period (yrs): less than 5, 6 to 10, 11 to 15, 16-20, more than 20

Legend: Period of ICT usage — Period of working

Figure 4 : Comparison of Innovation Capability

Percentage with High level of Effectiveness

Percentage: 100, 95, 90, 85, 80, 75

Period of Working: Less than 5 yrs, 6-10 yrs, 11-15 yrs, 16-20 yrs, more than 20 yrs

Legend: Interaction with customer
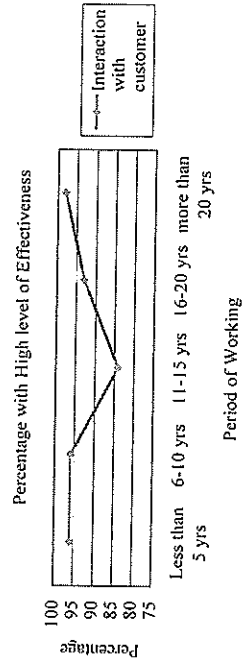
Figure 5 : Percentage of respondents with a high level of effectiveness

supervising the subordinates rather than dealing directly with external customers, which is a general phenomenon in Malaysia. The result of this analysis supports the result of the multiple regressions where the value of the constant is near to zero. Even when the respondents were not involved with using ICT applications, they could still innovate by using the information available from their customers.

5. Conclusion

Knowledge intensification is crucial for promoting creative innovation activities in the public sector. From this study it is found that as the public servants execute their daily work, they manage to acquire information from two sources, namely use of ICT and as the result of interactions with their customers. Both sources of information can contribute to the knowledge enrichment of public servants in Malaysia, and further contribute to the increase of innovation capability in the public sector.

The knowledge captured from use of ICT applications, which is positively related to the length of experience of using the applications in question, is transformed into innovation activity. The frequency of using ICT applications and utilizing the knowledge captured contributes to the introduction of new processes and procedures, and is the highest contributor to innovation capability. It is also found that innovation capability is positively related to the time spent using the applications. From these findings, intensification of content and applications that can serve the public sector itself, and the general public, should be promoted to enhance their usage, which should be at the earliest possible time in the public servant's career. The earlier that public servants use ICT applications, and the wider the range of applications that they use, the faster will knowledge be captured, which in turn will increase employees' innovation capability at an earlier stage of their professional careers, irrespective of the nature of their jobs and their management level. These findings support the strategy in the ICT policy of intensifying the content and applications to be used by the public.

Interaction with customers contributes to information gathering and hence enriches the knowledge of public servants. Knowledge from customers, as the external domain of information, can be utilized as input for creative innovation. Through interaction with customers, the implemented innovation allows for optimal consideration of the users' needs, which is one of the determinants of successful innovation. Examples of mechanisms that can be institutionalized to enhance information gathering are meetings with customer representatives, round table discussions and face-to-face interactions. The information should be stored by means of an ICT application, to be disseminated and shared by other members of the public sector for future innovation activity. Virtualizing the needs of customers through the use of ICT will promote information sharing for knowledge enrichment.

As the mechanisms of information sharing enhance the use of ICT, these will in turn contribute to the shifting of the growth mechanism from capital-based value-added processes to knowledge-based value-added processes. These findings will hopefully help the public sector to contribute towards further developing the Malaysian economy. As a result, the public sector, as one of the actors for the development of the nation, can play an active role in complementing other actors to transform the nation from a product-based, capital and

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labor intensive economy to one that is a knowledge-based economy with intensive use of, and reliance on, knowledge and skills.

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