The Status of Innovation Value Chain in One of
Malaysia Public Research Institutes and Government Agencies

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Abstract—**Innovation is an important aspect for organization to succeed in the competitive environment. Although innovation in organization can be seen through many perspectives, innovation value chain is helpful to view innovation. As sometimes organization could not find what are the reason and weaknesses that affect unsuccessful innovation implementation, innovation value chain assessment can help to identify these weaknesses. This paper presents the status of innovation value chain in one of Malaysia Public Research Institutes and Government Agencies and provides guidance to help solving an organization's weaknesses. A survey questionnaire was sent to 170 staffs in an organization representing one of Malaysia Public Research Institutes and Government Agencies. The findings of the study show that the organization had innovation culture that cultivates innovation in their organization. However, the organization needs to improve in idea generation and idea conversion phases. The research recommends a guideline that could also benefit organization that have same problematic scenario.**

Keywords-innovation; innovation value chain; innovation management improvement: research institutes; government agencies

I. INTRODUCTION

Innovation is the process of change which results in wealth creation and growth and also helps improving organization practice. Over the past decade, there has been a continuous discussion of government concerns, media reports, corporate comments, and business school writing and research on the critical need for more "innovation" at every level of corporate and government management. Malaysia government emphasizes the involvement of research institutes, government agencies and all communities to pursue innovation in their organization. Even though Malaysia government provides a substantial budget to cultivate and nurture innovative culture in their organization, there are several weaknesses that still need to be scrutinized and improved.

The objectives of this study are to assess the innovation value chain at the Public Research Institutes and Government Agencies (IPA) and to identify the strength and weaknesses of innovation value chain. This study recommends a guideline on how to improve the innovation value chain weaknesses in the organization. Besides that, this research also reveals that IPA which used information technology to encourage innovation do have a good innovation value chain practice established in the organization.

This article defines innovation and describes innovation perspectives. It analyses several innovation value chain frameworks and identify three main phases of innovation value chain. Further, the article also examines the status of innovation within Government Agencies and Malaysia Public Research Institutes (IPA) context. In addition, it describes previous research results about IPA that uses ICT

for promoting innovation in its organization. Subsequently, it explains the research methodology conducted in this research. Finally, it discusses the research results and conclusion.

II.   INNOVATION PERSPECTIVES

Innovation is any method or new material that is useful and practical made to bring great changes to various aspects of thinking, products, processes and organizational improvement. Innovation can improve service levels and help to solve a problem through using a better method [1][2][3]. Further, innovation can be seen from different perspectives. Among the innovation perspectives that were observed by researchers are an innovation field perspective [4][5][6][7][8], innovation approach [6][7][9][10][11][12][13][14], the perspective that demonstrates how ICT can promote innovation[15][16][17][18], innovation process model and innovation measurement frameworks [6][19][20][21][22][23].

There are several measurement frameworks or models that are already developed and available for measuring innovativeness which are Innovation Funnel [6], Diamond Model [19], OSLO Manual Innovation Measurement Framework [20] and Innovation Value Chain[21][22]. Most of these frameworks or models have considered the majority of innovativeness dimensions, however they provide different perspective of focus and how to view innovation process. Nevertheless, most of the frameworks or model considers linkages as an important element in innovation process. Some of the propose linkages are collaboration within departments and external collaboration with customer, partner, supplier and vendor. With these linkages organizations can look forward for continuity in innovation.

The Innovation Funnel focuses on technology and product innovation. This model view research and development as core activity in innovation. In this case, innovation will be kept alive and contribution towards industries advancement will be updated. On the other hand, Diamond Model in Innovation Audit Framework focuses on innovation process, enabling factor (strategy, process, and learning) and linkages. Using this model, the organization can identify key dimensions of innovative process as well as its enabling institutional factor. In contrast, the Oslo Manual Innovation Measurement Framework focuses on output, innovation (product innovation, process innovation, marketing innovation and organizational innovation) and linkages. This framework is suitable to measure country level international comparisons because it also consider infrastructure and institutional frameworks, demand, innovation policies and linkages. Conversely, the Innovation Value Chain focuses on idea management, output performance and linkages. In this value chain, it emphasis on how culture and human collaboration factors affect the innovation values chain success.

Reference [6] analysis agrees that Diamond Model is adequate to measure innovation when the innovation process is at the infancy level. The model highlights the key dimensions of innovativeness process as well as its enabling institutional factor. In contrast, the Innovation Funnel is adequate when there is an extensive innovation process in the organization. Innovation Value Chain emphasizes on the assessment of the output of the innovation process. On the other hand, the Oslo Manual Innovation Measurement Framework is perceived as more beneficial when considering country level international comparisons.

The innovation value chain emphasizes on the assessment of the output of the innovation process. This assessment measures were chosen as the innovation measurement framework for this research since this is in line with the objective of this research. The innovation value chain will provide the scenarios within Government Agencies and Malaysia Public Research Institutes (IPA) context where the processes and activities were being compared.

According to [21], the organizational innovation value chain consists of three main phases: idea generation, idea conversion, and idea diffusion. In these phases, there are six tasks performed across phases; namely internal collaboration across units, external collaboration, and cross-units collaboration, the selection of ideas, development of ideas and the dissemination of ideas. On the other hand, reference [22] suggested that the innovation value chain consists of three main phases. It starts with the organization's efforts to obtain the necessary knowledge for innovation. Then the next chain is to transform the knowledge into the physical innovation. Finally, the innovation value chain will be linked to the exploitation of the firm's innovation. Consultants 'Management Centre' had adapted an innovation value chain from Harvard study [23]. They divide the innovation value chain into seven phases: idea generation, idea development, integration across the region, information acquisition from external sources, identification and selection of ideas, development of ideas, diffusion and learning about things that need to be improved.

Based on the comparison of the three innovation value chain frameworks, three main phases of innovation value chain were identified as follows:

- The first phase - information acquisition activities that will generate ideas from internal resources, external and cross-section.
- The second phase - knowledge transformation into strategic product, service or business process
- The third phase - implementation and exploitation of innovation product, services or business process.

III.   MALAYSIA PUBLIC RESEARCH INSTITUTES

According to MASTIC, there are 33 Government Agencies and Public Research Institutes [24]. Public Research institutes (IPA) play a critical role in forging the interface between science advancement and the industry sector. One of the roles of IPA is to carry out R&D, provides technical and consultancy services, offers diagnostic services, business joint-venture and licensing.

Previous research conducted showed that the IPA had been using ICT strategies to produce ICT Strategic Plan to encourage innovation in their organization [4]. Table I show the analysis of ICT strategic application that used to support

the innovation in the organization. The table shows that there are ten ICT applications in Organization A which are used to support four area of innovation: creativity area, product development area, process and capability area and strategic area. In strategic area, the ICT applications had helped the organization to reach consumers where that most competitors cannot serve profitably and provide value propositions to consumers that other organizations cannot deliver the services requested by consumers in a cost efficient-way.

Keywords: C=Creativity Area, PD=Product Development Area, PC=Process and Capability Area, S=Strategic Area, SR=reach consumers that most competitors cannot serve profitably, SV=offer radically new value propositions to consumers that other firms cannot deliver in a cost-efficient way, SVC=put in place value chains that no other firm could do efficiently, SI=allows strategic innovators to scale up their business models quickly and so protect themselves from competitive attacks.

TABLE I.   ANALYSIS. OF ICT INNOVATION APPLICATION IN ORGANIZATION A

Number of ICT Innovation Application in Organization A	Innovation Area						
	C	PD	PC	S			
				SR	SV	SVC	SI
10	/	/	/	/	/		

IV. METHODOLOGY

The first phase of this study is to design the questionnaire. The study adapted Reference 21 questionnaire's to evaluate the Innovation Value Chain (IVC) in organization. The questionnaire objective was to gather data about the strength and weaknesses of IVC in an organization.

The second phase of the study was the data gathering process. One organization was selected (in this article will be referring to organization A) based on previous study conducted (Refer Table 1). The criteria used were based on the reputation of the IPA as among the highest IPA that have ICT strategic application which support innovation. A random sampling technique was used to select the sample in this study. Organization A has 1030 staffs in total, however only 450 staffs working at the main headquarter. This study focuses on respondents at headquarters only. The minimum sample size identified was 170 staffs. The minimum sample size has been derived from five percent margin of error and at confidence level of 90 percent [25]. The researcher had put an effort to include all Headquarter staff to participate in this survey. The cooperation from all staff was gain through the involvement of an officer from innovation section. The innovation section officer requested to prepare an on-line questionnaire survey.

However, the on-line questionnaire survey can be accessed by all the staff including that staff that work in branches. This would enable all staff either at the headquarters or branches to respond to the on-line questionnaire. As such, filtering process was conducted to assure only questionnaires answered by respondent from headquarters were processed.

The third phase was the data analysis part. The objective of this phase is to analyze the data gathered using statistical technique. The outcome of the analysis is the descriptive statistical analysis. The final phase is about the result documentation of IVC and evaluation of IVC status. The result shall be forwarded to administrator officer for them to improve their innovation approach.

V. RESULT AND DISCUSSION

A total of 41 percent of 170 respondents from Organization A had participated in the Evaluation of Innovation Value Chain (IVC) survey. The respondents were from seven different departments at the headquarters. Previous studied approved that 15 percent of respondent is acceptable for organization based research [26][27]. There are a few factors that contributed towards the low responds. One of the factors is because the questionnaire was distributed at to the work place. Here, where people tend to be more focus on work and would ignore to respond, prefer to keep things as private and confidentiality, and choose to avoid with tip toeing with rules and regulations of the organizations [28].

Overall result shows that Organization A have a strength at all the three IVC that consists of generation of idea from internal, external and cross department; transformation of knowledge to strategic idea; and implementation and exploitation of innovation idea.

Based on the evaluation of information acquirement for idea generation as in Fig. 1, staffs at organization A work in a culture that stimulate staff to propose new idea. Only 19.3 percent respondents agree that the culture in the organization did not support them in proposing a new idea. However, the result also shows many staffs in the organization did not generate their own idea. This was based from only 10.5 percent respondents agreed that very few ideas came from their own staffs. This shows Organization A should encourage their staff to participate more in courses that would improve their creativity and innovative skills.
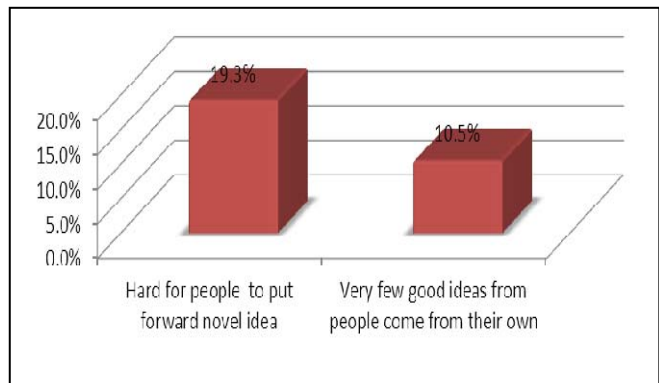

Figure 1   Organization A in-house idea generation

In the aspect of acquiring idea from other unit or branches, Organization A innovation project has been involving group teamwork from different unit and branches (refer to Fig. 2). Only 10.5 percent of the respondents agreed that innovation project has not been involving different units and branches. Hence, in Organization A, the result indicates that there exists collaboration on projects between and across units and branches.
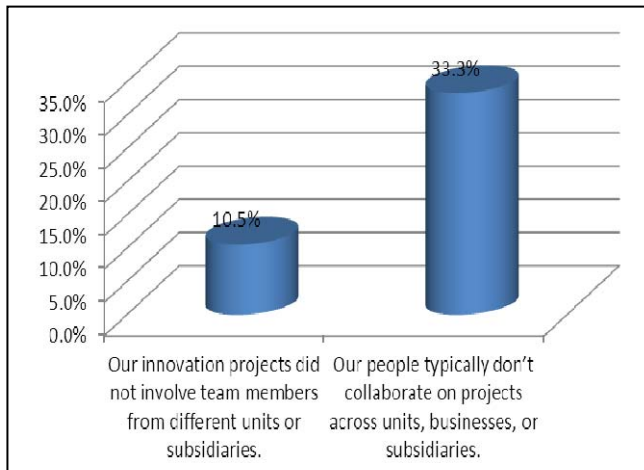

Figure 2   Cross-pollination of idea among unit and branches

Some of the ideas in the organization were acquired from external organization (refer to Fig. 3). This was based on that only 22.8 percent of respondents agreed that the new product idea does not come from external organization. The organization also appreciated ideas from external organization. This demonstrates Organization A have strength in the development and generation of idea from external sourcing.
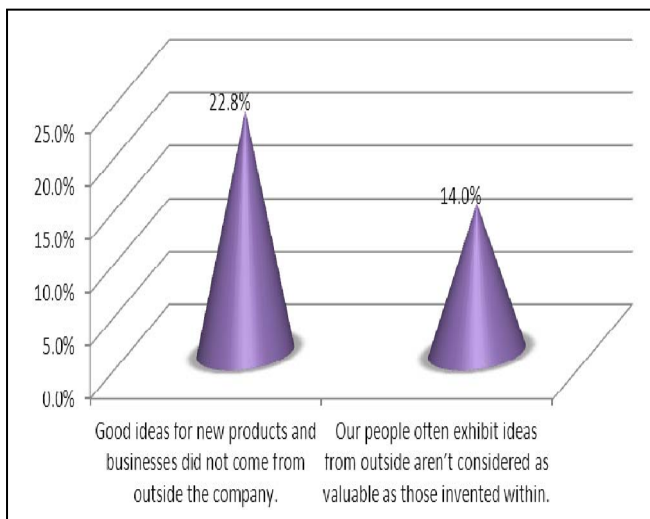

Figure 3   Idea generation from external sourcing

From the perspectives of selecting innovative idea, it was found that Organization A had allocation in investment for new idea generation. However the organization has being shown to apply a strict terms and condition to get the allocation for a new project. Only 29.8 percent of respondent agreed that Organization A has soft rules for investment in new project. However, only 28.1 percent respondents agreed that the organization has been invested in a risky new project. The tough rules on investing in a new project can demotivate the staffs that would like to implement innovation in the organization.
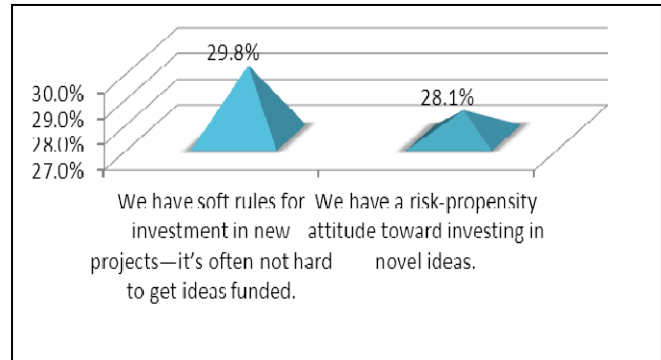

Figure 4.   Organization A selection of innovative idea

Evaluation towards knowledge transformation activities to strategic idea shows that the developments of product usually complete in the time frame (Refer Fig. 5). This was based on that only 23.8 percent respondent agreed that new product project was not completed in the planned time frame. This reflects that the manager in the organization also has the ability to improve and propose new processes, product and services. In general the organization has to improve on allocation and approval of innovation project in organization.
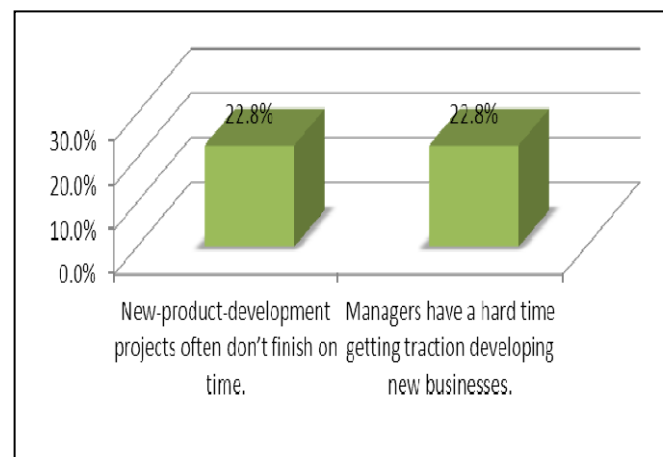

Figure 5   Development of innovation idea in organization A

From the aspect of implementation and exploitation of innovation idea, organization A was found launching their new product as on scheduled and introduced new product

through all customer channel at all branches (Refer Fig. 6). Since the organization is based on services and do not have competitors, the organization does not face problems of copyright related to their product.
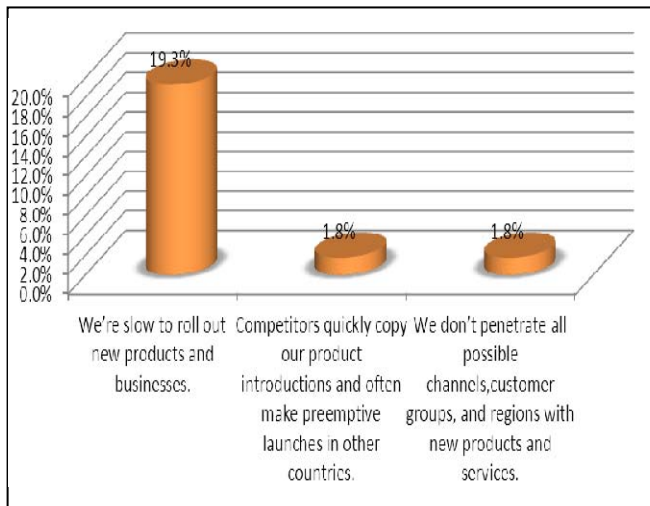

Figure 6   Implementation and exploitation of innovation idea of organization A

VI. CONCLUSION

Based on the results, Organization A are found to have strength at all three of Innovation Value Chain (IVC) phases in terms of generation of idea from internal, external and cross department; transformation of knowledge to strategic idea; and implementation and exploitation of innovation idea. However, Organization A have to improve the number of idea generated from their own staff and selecting innovation investment rules during knowledge transformation to strategic ideas phases. In order to improve the situation, reference [21] offer some suggestions and advices.

For example, for idea generation phase, Organization A should encourage their staff to generate creative and innovative ideas. Organization A can send their staff to appropriate training to enhance their staff creativity and innovative skills. The key performance indicators to see whether the staff is able to generate their own idea should be based on the number of quality idea of every unit or each section can generate.

Organization A can also learn from Procters & Gamble (P&G) idea generation initiative to improve the organization idea generation. One the ways is to build linkages with cross-unit and outside networking. In order to build outside networking, P&G suggest that the product developer need to acquire user requirement, analyze the problem and find the solution through technology research, acquire information from supplier and research lab. For building cross-unit networking, organization can create a community of practice where staff can participate in idea generation as what has been by P&G practices. The community of practice at Organization A could have similar activities like as in P&G i.e. solve specific problem and attending monthly

technology summit with representative of P&G business unit or add her own activities which are appropriate for idea generation.

Effort that can be taken to improve the phase of knowledge transformation to strategic idea is to focus on how to improve the tough or strict rules on the investment in a new project and a risky investment scenario. One of the organizations that have successfully implemented innovation by allocating certain amount of budget for innovation was Shell Oil's GameChanger. Shell Oil's GameChanger unit has been awarded seed-funding of RM40 billion for development of radical idea.

Organization A can also form a separate business unit that is responsible to develop new idea to support organization strategy. The business unit should be given some freedom to have activities that will encourage idea generation and innovation. In addition, managers that had successfully lead a collaboration project should be awarded a bonus or other form of rewards. This will in turn encourage more collaboration internally or externally. Hence, perhaps with these there will be more opportunity being open and more profit could be generated each year.

Organization A may also conduct self-audit by focusing on two main questions which are:

1) *Does this organization have a good approach in selecting and awarding allocation to new ideas? and*

2) *Does this organization have a good approach in transforming new idea to product, opportunity and good services?*

The organization should also revisit their Key Performance Indicator (KPI) for transformation from activity idea generation to implementation of innovation project that are:

1) *How many percent of innovation idea that has been generated by staffs and external parties will be selected and will be given allocation?*
2) *How many percent of idea that give allocation generate profit to organization and number of months before product or services innovation being implemented?*

In supporting the organization to decide on innovation ideas, the organization is highly recommended to refer to both of these books: "Bringing Silicon Valley Inside" by Gary Hamel(1999) and "Corporate Venturing Creating New Business Within the Firm" by Zenas Block and Ian C. MacMilan (1993).

The important advice from Hamel book is on the strategy to strengthen the external discovery network [29]. The strategies must be done by gearing not toward finding a solution but to discovering new ideas within a broad technology or product domain. Besides that, organization also needs to develop different "tentacles" in relevant geographies. The tentacles terminology means to establish a center like Technology-to-Business Center (TTB) that have about 20 team members and the main objective of the TTB

is to focus on commercializing technologies from outside the organization. This center should be located in Technology Valley and the team members in this center need to develop numerous personal relationships with scientists, PhD students, venture capitalist, entrepreneurs, governmental labs, universities' excellence and company research centers. This relationship is important for identifying new technologies that can be used by organization and its branch.

On the other hand, despite focusing on strengthening the external discovery network, Block and McMillan proposed a venturing process model and provide advices on venturing process attempt [30]. The venturing process model stages are; 1) formulating the corporate venturing strategy, 2) generating new-business ides, 3) analyzing and selecting new business ideas, 4) designing the venture, and 5) launching and monitoring the venture. One of the advice is do not venture unless venturing is integral part of your organization's strategy and is seen as essential to survival and the achievement of organization objective.

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