



Planning innovation orientation in public research and development organizations: Using a combined Delphi and Analytic Hierarchy Process approach



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ABSTRACT

Planning innovation orientation in public research and development (R&D) organizations presents a number of challenges exacerbated by continuous changes in citizens' social aspirations. These challenges are further amplified by the unstable and complex socio-cultural and socio-organizational characteristics of any developing economy. The paper explores and devises an adapted orientation for future innovation using a combined Delphi and Analytic Hierarchy Process (AHP) approach, applied to a developing country, i.e. Thailand. A set of generic influencing factors for innovation management in public R&D, emerged from a non-country specific review, are refined by a three-round Delphi consultation involving experts from various Thai national research centers. These factors were further utilized to establish an AHP-based model applied to a Thai public R&D organization to investigate impacts of three hypothesized innovation orientations: "knowledge", "societal" and "commercial". The AHP-based model reveals that the "commercial orientation" has the highest impact score on innovation factors. However, a sensitivity analysis is conducted as a result of which a suggestion is made to increase the priority of collaboration-related factors to improve the impact of the "societal orientation". The findings from the combined Delphi and AHP approach have a generic dimension that can be adapted and tested in other contexts.

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1. Introduction

The current economic climate has had a substantial impact on organizations worldwide. Innovation is a key to providing long-term sustainable economic growth [1,2]. The role of government stimulates considerably innovation, for instance, establishing national innovation system (NIS) which states policy of governmental involvements in subsidizing and encouraging collaborative projects, or even conducting public R&D in organizations [3,4]. Nonetheless, most of existing studies to develop innovation model have been devoted to private as opposed to public R&D [5,6].

Developing innovation models in the context of public R&D would thus be useful for public R&D. Nonetheless, innovation development in R&D is a part-dependent process; it cannot be separated from local societies and national contexts within which the R&D is operated [3]. Thus, there is a need for country-specific studies which allow for deep exploration of a particular phenomenon. In addition, understanding innovation management in developing countries, where technological innovation is relying on public R&D organizations, may present a clear perception of governments' roles in innovation systems. Thailand is an interesting developing country; although the governmental funding has been paid to public R&D than private organizations, the contributions of public R&D in driving the national competitiveness remain ambiguous. Unlike the tigers in regional countries, Thailand is classified in the stage two of competitiveness development; whereas, the others are in transition or already in the mature stage.

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Innovation policies of Thailand are considered weak. The scope of policies lacks focus in relation to innovation factors. Policy-makers seem to rely on the linear model of innovation assuming that results from basic research are conveyed through academic and related publications. Furthermore, a lack of clear implementation strategy is reflected in the government approach to channel funds to support basic research to public R&D and universities. Nevertheless, it has been found that the linear model is too optimistic to face a complex and dynamic reality, such as the bottleneck resulting from transferring scientific knowledge into new products or services, and commercializing resulting innovations. Thailand's innovation policies should be broadened to cover other dimensions which are accepted as the influencing factors in the modern innovation model such as knowledge assets, strategic networks between public and private R&D and commercialization [7–10].

It would be a challenge to study how Thai public R&D could intervene in bridging the large gap of catching up the forerunners. The authors argue that developing an innovation model confined to public R&D in Thailand could shed some light for managing innovation in public R&D of developing countries, or even that of developed countries that experience technological competitiveness decline. Furthermore, the innovation model should be designed to guide innovation management since the early phase of the innovation process such as planning innovation orientation.

Thus, the purpose of the paper is three-fold: (a) to investigate a set of influencing factors on innovation management of public R&D in both developed and developing countries; (b) to refine influencing factors in a particular country; (c) to establish a management model which hierarchically arranges factors involving multiple dimensions as criteria in planning orientations for future innovation in a case study. The paper first reviews innovation planning in public R&D, including a consolidation of the two multi-criteria decision support tools: the Delphi method and Analytic Hierarchy Process (AHP). A proposed methodological framework for systematic innovation planning and its application for refining innovation factors based on a selected country, Thailand, is then presented. This is followed by establishing a planning model in a Thai public R&D, namely "MEC". The final section discusses limitations, provides directions for generalization of research findings, and draws out the contribution of the paper.

2. Innovation planning in public R&D

To foster economic growth, many developed countries invest considerable research funds to public R&D [11]. In the same fashion, the majority of R&D in developing countries is conducted in universities and governmental R&D laboratories [7,9]. Nevertheless, due to the current economic crisis, many countries face the problem of resource allocation; funding and supporting R&D need more evidence to inform and demonstrate their economic impact. However, a harmonized system of performance measurement for research activity is still being a controversial subject in both private and public R&D [3,12,13].

Whatever the performance criteria for R&D, conceptual frameworks or models for managing innovation in R&D are essential for improving R&D performance. An innovation model could enable users to tailor innovation ideas to better fit with their organizations and the environment [14]. Furthermore,

public R&D organizations need systematic management tools for long-term innovation strategic plans. Long-term planning could be projection of the future orientation: what will be the organizational vision prepared for an uncertain future? To answer the question, an effective management tool should have the ability to translate the vision or innovation policy into action [10,15].

The review of the literature on national and organizational innovations reveal that the Delphi method, an expert-based judgment, has been employed to compare two national innovation systems in order to obtain a taxonomy of future technologies [16]. Moreover, the Analytic Hierarchy Process (AHP) has been employed to select government-sponsored R&D projects [5,6]. However, innovation planning should focus on not only project selection, but also the other organizational dimensions as innovation is the management of all activities ranging from new idea generation to marketplace exploitation. Innovation planning needs more efforts to develop innovation models which span multiple dimensions such as individual, organizational, and environmental [3,17]. Nonetheless, previous employment of the Delphi method and AHP to solve complex problems highlights the possibility of applying the two methods as systematic management tools to cope with innovation planning in public R&D involving complex missions such as conducting internal R&D, funding external R&D projects and supporting scientific communities.

The Delphi method deals with a complex problem by constructing an effective group of participants having expertise in the particular problem; solving the problem involves a series of intensive questionnaires interspersed with controlled opinion feedback [18–20]. The concept of the Delphi method has been widely applied to other complex decision solving related to technological change, economic and social pressure such as assessing the critical factors concerning new product development, and selecting potential innovations for national system of innovation [16,19,21,22].

Although the Delphi method is a helpful tool for brainstorming and assessing critical factors, findings from the Delphi may need follow-up research in dealing with moderate consensus among experts. The AHP, first introduced by Saaty [23], can be the follow-up research for a Delphi study. The AHP is a widely-used tool in multi-criteria decision making. Breaking down a decision problem into an analytic hierarchy structure makes decisions easier to manage than rating the large number of items [23]. In addition, the Delphi consultation may be performed before the AHP to refine a set of factors. This enhances the validity of the AHP because the number of factors in an AHP-compared set should be seven plus or minus two [24].

3. Methodological framework

The authors identify a gap in innovation research in that there is a need for an innovation management model taking all dimensions of public R&D into account. However, the model proposed in this paper focuses on practical issues that may act as blockers to public intervention in transforming governmental resources (such as public R&D organizations, and research funds) into national innovation. *What and how public intervention should be launched* [10]? It is essential for a public organization to design and select an oriented plan

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