

IMPROVEMENT OF PROCEDURE OF DEVELOPMENT AND COMMERCIALIZATION OF NEW TECHNOLOGIES

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Abstract:

The paper is focused on description of the procedure of development and commercialization of technologies in form of a theoretical model. This study offers certain helps to researchers and administrators for a better understanding of phases in the process of development and commercialization of new technologies. The procedure is proposed in a synthesized approach including the whole process from scientific ideas up to commercialization of new technologies. The process of development of new technologies includes many phases where the one of R&D holds the dominating roles. This study focuses main attentions on present possibilities to forecast successful outcomes of R&D projects from point of vision of development and commercialization. In addition, the proposed procedure of development and commercialization of new technologies gathers potentials to be used as a model for implementation of R&D projects in science and technology (S&T) organizations in Vietnam.

Keywords: *New technologies; Commercialization of technologies; R&D.*

Code: 15031001

1. Introduction

Research and development of new technologies are main and self-evident tasks of S&T organizations where researchers create, develop and improve new technologies, administrators promote processes and efforts to introduce new technologies into application. The process from scientific ideas to commercial markets of a new technology includes a series of activities, such as: conceptual formation, research activities, tests, improvements, completion, prototype manufacture, production and business [1, 2]. The phases in the process of development of new technologies can be seen as a function of production with many parameters to save time, to reduce costs and to improve quality of products.

Practice of commercialization of new technologies shows that the links between scientific research, technological development and production of valued products have become a very important postulate that governments

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and organizations implement big efforts for realization [3, 6]. The process from research to business is considered always as a non-linear process which is based on activities of scientific research and product commercialization. By other words, the process from research ideas to product commercialization is a complex process. During recent years, we are observing an increasing trend of the level of attention of the whole society. State sources, organizations and individuals for investment in field of scientific research and technological development. From another side, however, so many barriers exist obviously in all the stages from conceptual ideas to market application. Majority of administrators talk about the promotion of R&D as a global solution but rarely talk about concrete measures to help scientists to overcome these barriers and to come to commercialize their research results, to complete technologies and to get certain positions in domestic and overseas markets.

While so many publications deal with the term of “*commercialization of research results*” or “*innovations*” in global senses of words as attractive motto, this paper introduces a procedure for completion of development and commercialization of new technologies in form of a theoretical model from conceptual ideas to market business which is different from the actual procedure of management and exploitation of results of State-budget-sourced R&D activities in Vietnam. The model includes 5 steps, namely:

Step 1: Proposal of research themes/projects (set-up of R&D tasks).

Step 2: Identification of the list of research themes/projects.

Step 3: Selection of organizations/individuals to host project implementation.

Step 4: Acceptance of research results.

Step 5: Publication of research results.

Also, the paper provides hints to scientists and administrators the ways and joint actions for commercialization of produced new technologies.

2. Objectives of the paper

The main objective of this study is to present the measures to encourage and to motivate innovations through the description of the process of commercialization and the promotion of successful commercialization of new technologies.

The second objective of this study is to guide and to propose the moments of rising needs of finances to support R&D activities in these steps.

The final objective of this study is to maintain the way to recognize a valued procedure of development of new technologies for all the stakeholders.

This study also provides some very important notes, namely:

- To check barriers of infrastructure against the creativity and possibilities of commercialization since the phase of establishment of conceptual ideas;
- To indicate in details the process of commercialization, from conceptual ideas to production, business and application;
- To identify stakeholders and their roles in the process;
- To clarify the phases of development of ideas, evaluation and identification of markets, development of prototypes and production;
- To provide guidelines for activities of business, management, marketing, financing and etc.

3. Process of formation and development of new technologies

The process of formation and development of new technologies can be divided into three phases, namely:

- Phase 1: “Scientific creativity”;
- Phase 2: “Development of new technologies and creation of new products”;
- Phase 3: “Commercialization”.

First of all, researchers get a new idea of a “product” with certain useful features on basis of theoretical researches or practical activities. The question is that this idea can be developed into a form of commercializable products or is a starting point of wrong remarks or get stuck afterward. In order to make a check for that, researchers need to carry out S&T activities. But, above of all, the first things researchers would put into their agenda are the estimation of costs of time and sources, though other steps are also important for formation and development of a new technology.

In Schemes 1, 2 and 3 shown under here, the author proposes and describes the process of development of completed new technologies which include the following main phases.

3.1. Phase of emergence of a creative idea

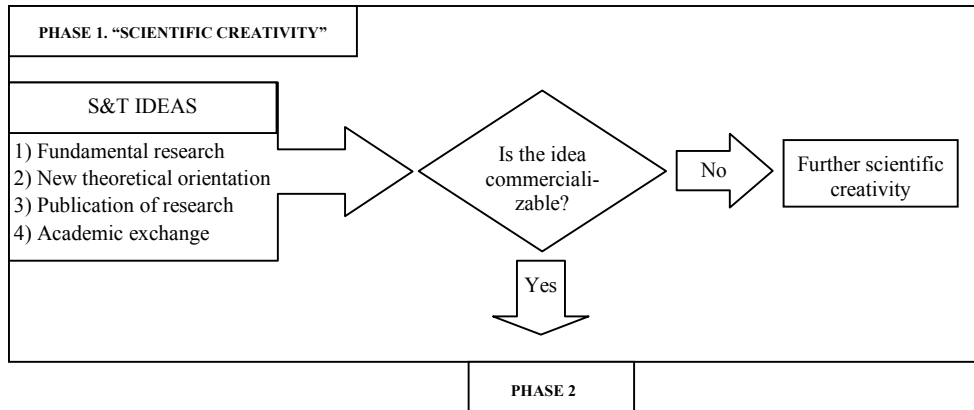
The emergence of a creative idea (I) (*see Scheme 1*) is the first phase in the process of creation of a new technology. Researchers may have already

certain knowledge in the field and then they link them to new knowledge and initiatives to make a new idea linkable to markets. We need admit that the pure researches made in this phase have the nature of public articles, and all supports offered in this phase appear necessary. Therefore, the Government, universities, organizations, NGOs, State-owned enterprises, private enterprises should provide financial supports for fundamental research activities.

This phase is simplified and described in Scheme 1. First of all, on basis of S&T activities, creative ideas can be developed into new theoretical orientations, fundamental researches of theoretical nature, scientific publications or reports of scientific conferences and workshops. Among those creative ideas there exist many scientifically conceived ones which would be selected and examined if they can be developed into commercializable products (II) (*see Scheme 1*). It is a difficult problem which is forwarded to scientists to get the answer “Yes” or “No” for the possibility to develop the creative idea into the S&T market.

If the answer is “No”, the owner of the idea should come back to the original point of emergence of the idea and try for a more realistic idea.

If the answer is “Yes”, it would open chances to develop new technologies and new products. Here we pass into the next phase.



Scheme 1. Commercial perspective of S&T creative ideas

Here we may have some loops. Namely, when some ideas emerge, it is necessary to collect information and to conduct initial market analysis. If the analysis outcomes shows some market perspective potentials, it is necessary to collect further information and to conduct initial analysis of technical feasibility. When the decision is made for a new product, it is necessary to pass these data to research units for development into a

product. Here, the additional information should be gathered, processed and implemented for trial of products. When the process is finished by a complete prototype, the information flow would come to sections of management where they will decide the scale of products. As it is seen, the cycles of collection, assessment and application of information are repeated up the appearance of the new product.

3.2. Phase of development of technologies and creation of products

When an idea is identified as to have potentials to be commercialized, it has to be studied further to create new technologies (*Scheme 2*). The top importance in this phase is the capacities to mobilize capitals (III) (*see Scheme 2*) to follow the development of technologies and the creation of new products. The different financial sources, however, have different features of volume, type, intensity and success rate for this R&D process. In addition to that, the R&D projects to be implemented are different by their feasibility and the time of generation of benefits from targeted S&T products.

Here we have assumptions that researchers manage to mobilize full capitals to maximize the benefits expected from their efforts of technological development. In practice, every support source has its own binding conditions required by capital providers. It is practical that once researchers can develop an idea full of potentials to be commercializable they can search for support capitals for development of their technologies and products.

As it is shown in *Scheme 2*, when the full capitals are gathered for R&D activities, researchers can start conduct R&D activities (IV) to create new technologies. During the whole process of R&D activities, researchers can obtain various results some of which have potentials to be commercialized. Therefore, the results obtained in this phase should be assessed (V) to identify the ones which have the highest potentials as well as the ones which need to be studied further for completion. The target of this assessment is to indicate which ones are new technologies (VI).

When the selection is completed and the potentially new technologies are indicated, further studies are required to explore core technologies (VII) and their know-hows. R&D activities, however, do not stop here. In Vietnam practice, not only researchers but also administrators have an error when thinking that, at this step, (*Step (VII) in Scheme 2*) the new technology has been completed.

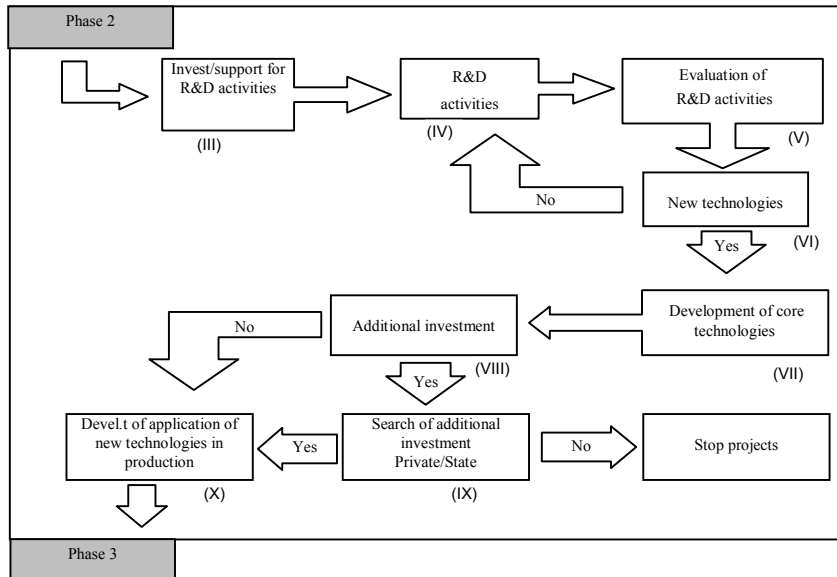
In management practice of S&T tasks in our country, administrators get relatively satisfied when they get S&T results in form of so-called “new-

born technologies". In actual view, it means that researchers have completed their assigned S&T duties. But, in fact, the next steps put down more complex tasks with numerous risks and challenges.

In its nature, at this step (VIII) (*see Scheme 2*), S&T results themselves require a huge additional investment source for development and completion. These investment sources are compulsorily needed for implementation of new technologies in production practice (X). The required additional investment sources are so big that they need the involvement of many sectors or big sized investors (State sources or private groups) (IX) to introduce developed technologies into production and business activities.

Once the investments for implementation of ideas get successful on basis of R&D activities or new technologies to produce break-through products for markets, the process automatically moves to the step of commercialization.

If R&D activities demonstrate that the ideas are not feasible or it is impossible to sell developed technologies, it means the end of projects.



Scheme 2. Process of development and completion of new technologies

Here, outcomes from R&D activities fall into two categories:

First category includes ideas which are realized but their market potentials remain far to be successful. In this case, researchers need to carry out more additional technologies and/or development of products to identify the success or the failure of projects;

Second category includes those R&D activities which are not enough credible or do not find out suitable technologies to develop new products.

In this step of R&D process, researchers may need to promote fund rising activities (*calling*) to carry out supplement works. Thanks to these supplement works, a considerable number of research projects get completed or researchers get better information and improve their S&T visions to market reality. By upgrading the features of technological products and their potentials, researchers can change their vision on sources of supports.

3.3. Commercialization of technologies

When researchers pass the step of R&D to create new products or to open new markets, they move to the step of commercialization. This process includes the ways they look to sell their products. In order to fit various industrial sectors and possibilities of application they need to look for suitable markets. So, the question is which procedure or techniques can make them shift from a position of “technologies” to a position of benefit earning “business”.

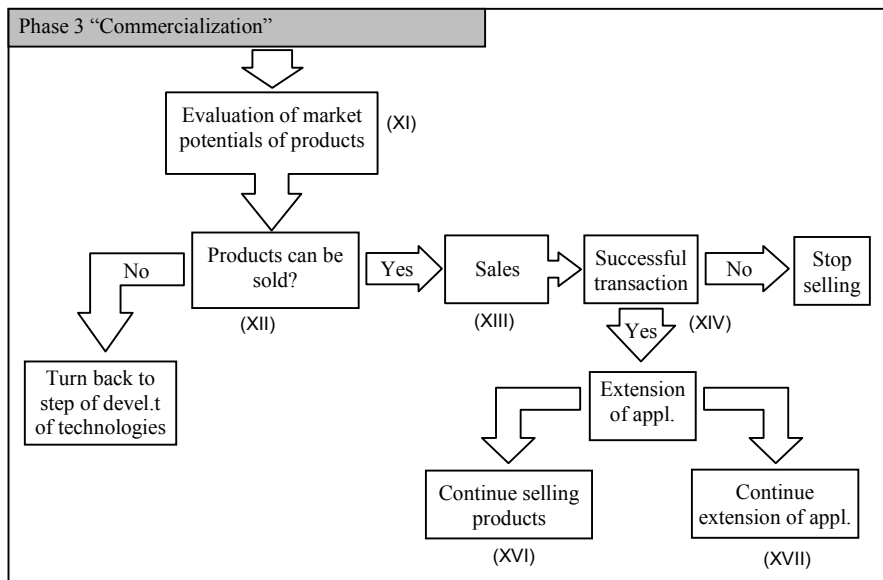
In practice, the commercialization of technologies itself is the pre-condition to create products to fit markets of commercial goods. The problem is to identify the suitable price rate and to meet market demands. As noted above, the process of development of new technologies is not simple and linear (*straight line*) but complex and non-linear which requires interactive links of many factors and depends on capacities of scientists and administrators. The process of commercialization requires different skills such as: development of products, market assessment, product marketing strategies, financial sources, production planning, accounting services and etc. All of these skills are considered as weak points of scientists.

When entering the step of commercialization of research results (*see Scheme 3*), it is necessary to evaluate market potentials of products (XI) (*including technologies as well as products made by these technologies*). By other words, how does the market accept these products (XII)? The answer has two scenarios:

First, it is impossible to sell products made from R&D activities. Scientists, administrators and businessmen need to cooperate to find out the reasons of failures to sell these “new technologies”. Once the right answer gets provided, scientists continue their R&D activities to improve performances and utilities of S&T products;

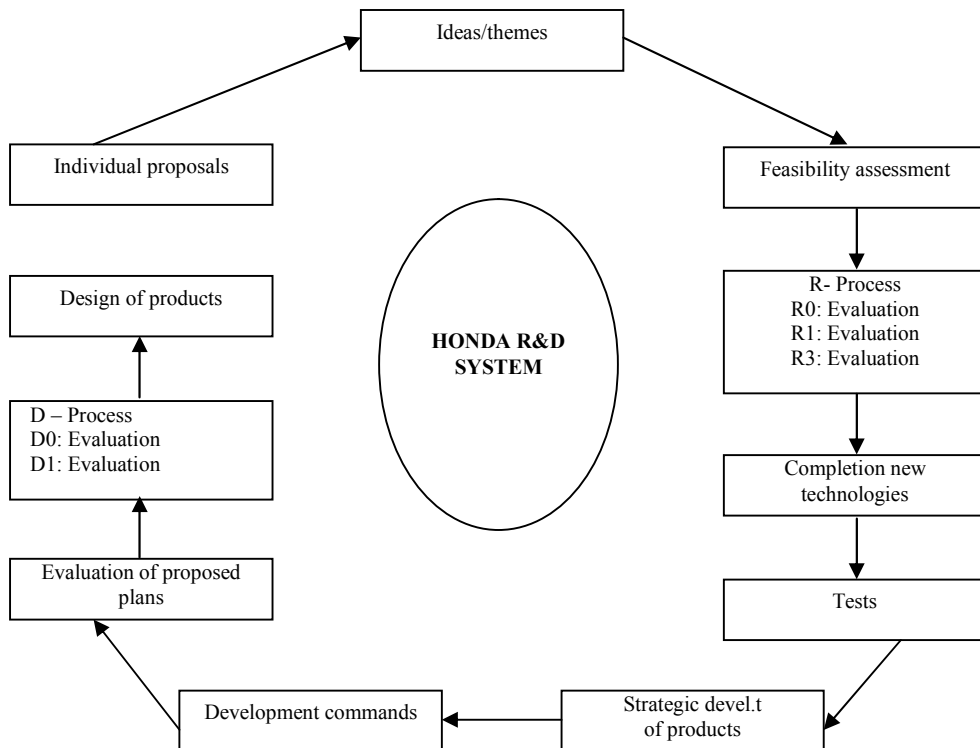
Second, products made from R&D activities are commerciable and get introduced to sales (XIII). At this step, a series of activities are conducted for transfer of technologies which target successful transactions (XIV). In case of large gaps of disagreement between the transferer and the transferee transaction fails to be concluded. In case of successful transaction the transferee is to receive technologies and to start activities of investments for practical production or extension of applications (XVII).

During the whole production process, R&D activities can be kept on for purpose to extend production scale or to develop required secondary/derivative technologies. From another side, researches should be conducted further to produce a bigger volume of products or to escalate the production activities (XVI). The matter here is who, the transferor or the transferee, should conduct researches to create secondary/derivative technologies. In order to clarify this aspect, it is necessary to carry in-depth analysis for many aspects, such as techniques of technology transfer, consulting for technology transfer, contracts of technology transfer and etc.



Scheme3. Development of the process of commercialization of S&T products

In order to understand better the above noted interpretations, we can refer hereunder to the procedure of development and commercialization of new technologies introduced by Honda.



4. Some barriers to the process of development and commercialization of new technologies and related problems

Barriers to the process of development of new technologies can rise at any step, from the emergence of ideas up to the introduction of products to markets. The barriers may include the lack of information, low capacity of human resources, lack of capitals, high costs of transaction, lack of full valuation of costs, lack of understanding of local needs, limited business skills and capacities, concerns of risks of financial institutions, overlapping and high cost regulations, failure to meet environment regulations and other barriers of political, economical, commercial and policy natures.

In addition to that, there exist specifically so many barriers to the R&D process for development of new technologies [4,5,7]. Researchers admit that it is needed to have a comfortable environment in many aspects for the successful process of formation, development and stability of a new technology. This environment includes macro-economic factors, participation of socio-economic organizations, national organizations of technological innovations, human resources and institutional capacities which should be suitable for selection and management of technologies,

reduction of risks, protection of Intellectual Property Right, introduction of bare code systems, standards for research and development of technologies, respect of Intellectual Property Right and provision of tools to settle fairly disputes.

Some tools, such as the index for evaluation of commercial capacities and the index for successful commercialization, were developed and applied in many countries to settle specific aspects of commercialization of technologies [5, 6]. They are, however, absent in Vietnam.

Though the design of this study is based on constructive approaches, it deals with some aspects which need to be held in strategic mindset. Further studies should be considered in practical context of S&T organizations in Vietnam. This means that the presented process remains limited in interpretation of our real practice where we observe a low rate of successful commercialization of completed technologies. This study had been formed and developed as an intended and systematic project. The study also provides the author with possibilities to extend research ideas in future. The exactness, integrity and importance of these theoretical concepts would represent the contents of next studies. This leads to recommend that the procedures published for development of new technologies and new products have to be reviewed to fit the actual practical context of Vietnam. The development and the implementation of such a procedure would require many other proposals and many pilot research models.

Conclusion

In this paper, the completion procedure of development and commercialization of new technologies is described. For administrators, this procedure shows that the administrators themselves should assess the necessary problems related to development and commercialization of new technologies. For successful development of, event, a single new technology, the balance between unstable elements of technologies and potential benefits of technologies is found crucial.

In addition to that, the procedure of formation, development and commercialization of new technologies, as actual tool for measurement, also creates an effective approach to meet objective demands of the market of new intellectual goods as we have actually in Vietnam./.

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