COMMERCIALIZATION STRATEGIES OF INNOVATIONS IN CENTRE OF EXCELLENCE

Case of Centre of Excellence Polymer Materials and Technologies – CoE PoliMaT

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ABSTRACT

The paper deals with commercialization strategy choices of a publicly funded research institute founded by 22 partners – Centre of Excellence Polymer Materials and Technologies, Slovenia – established in 2010. Despite its size, it is in a start-up phase of development. Therefore it has a dominant technological orientation but is lacking in competencies needed for commercialization what has been confirmed also by an internal survey. The presented model adapts existing new product development and commercialization models in such a way that through the process of decision making on final commercialization strategy further competencies are being developed within the organization along the way. The decision is made between cooperation and competition as commercialization modes and no commercialization.

Keywords: Commercialization strategy, competencies, cooperation, competition, centre of excellence

INTRODUCTION

Centres of excellence present a measure of scientific-technological policy in Slovenia that is a part of the broader EU policy. They are based on strategic partnerships between industry and academic institutions. Their aim is to provide incentives for knowledge concentration in leading technological fields and to encourage horizontal collaborations in the chain of knowledge development. This is to be achieved by employing a critical mass of researchers, providing them with modern research equipment while promoting knowledge and technology
transfer into the economy. The main purpose is to generate and gather ideas, knowledge, experience, products, services and technologies that can be used in Slovenia while increasing the mobility of researchers and maintaining a competitive position internationally. It is an interdisciplinary research program with an emphasis on the horizontal goal of supporting transition into energy efficient society with low carbon emissions (European Research Area, 2011; MVZT RS, 2011). It is a part of the European initiative closely aligned with the goals of the Lisbon Strategy (Kok, 2004).

The Centre of Excellence Polymer Materials and Technologies (CoE PoliMaT) was established in 2010. It was one of the selected centers of excellence from a public tender by Ministry of Higher Education, Science and Technology of Republic of Slovenia. It is a research network with 22 co-founders from industry, science and education. Out of 84 researchers, 42 come from the industry sector. It operates as an independent research institute. Interdisciplinary research is being carried out in several priority development areas: technical products for advanced applications and energy; coatings and adhesives; renewable resources, degradation and stabilization; and polymers for health care and medicine.

The mission of CoE PoliMaT is to create conditions for technological breakthroughs of industrial partners. The centre promotes development of products in high-tech niche markets, creates conditions for new jobs and high-tech spin-off companies. Its vision is to become an internationally renowned and recognized centre of excellence in the fields of polymers, while assuring flexibility, internationally accepted standards of scientific excellence and synergies in management of scientific and research work linked to excellence in industrial development.

Many of the CoE PoliMaT’s goals are directly linked to technology transfer and commercialization, namely contributing to a more dynamic business environment, creating conditions for technological breakthroughs of industrial partners, establishing high-tech spin-off companies and generating revenues on the market. That is why CoE PoliMaT as a research oriented and project-based organization needs to start developing a strategy of how to best exploit and commercialize the technologies being developed in this initial phase of its operations and at the same time support continuous R&D efforts in the future while sustaining the organization.
Theoretical background

Knowledge transfer is a process through which organizations learn from one another. In the case of centres of excellence the main aim is to encourage knowledge transfer from the side of academic and research institutions to industry, namely firms. A constituent part of knowledge transfer is technology transfer, which means that the technology in question needs to be recreated in all its complexity and causal ambiguity of a routine set in a new setting while kept functioning (Szulanski, 1999). The aim of technology transfer is to commercialize this knowledge – technology – and thus introduce it to the market. Commercialization is considered to be the last stage of new product development (Cooper, 1993) and can refer to commercializing final products, materials, substances or processes. Management of intellectual property rights is tightly linked to the process of technology transfer (Yang and Maskus, 2001).

For a start-up firm the main problem is not new product development or invention itself but commercialization as these promising technologies need to be translated into a stream of economic returns (Gans and Stern, 2003) what requires the appropriate commercialization strategy, namely a cooperative or a competitive one. While a competitive one means that a firm enters market alone, the modes of cooperation between a research-oriented innovator and downstream market player can take form of licensing, acquisition joint venture or alliance.

Commercialization and new product development

According to Cooper (1993), a product development process within a firm can be broken down into common activities of a stage-gate system (see Figure 1). The idea is first assessed during the initial screening (Gate 1) from the viewpoint of different alternatives and the decision is made whether to go ahead with the project. Stage 1 is preliminary assessment, including market and technical assessment. Market assessment is a rough version of a preliminary market study, including assessment of the marketplace, possible market acceptance and competitive assessment. Technical assessment provides questions whether the idea is technically feasible so that is can be further developed and manufactured. Second screening (Gate 2) is based on these assessments. What follows is a detailed investigation (business case) preparation (Stage 2) with a detailed market research. Studies are carried out on user’s needs and wants, concept tests are made together with positioning studies and competitive analyses. A business analysis along with projected financial indicators is performed. Before moving on to the development stage (Stage 3) a decision is made on the
proposed business plan (Gate 3). Development leads to an actual prototype. After the development is reviewed (Gate 4) tests are being carried out and the innovation is validated (Stage 4). Tests can encompass in-house testing, customer field trials, and also test markets, if viable. At Gate 5 pre-commercialization business analysis yields a final business and financial analysis. Stage 5 includes full production and market launch with the implementation of a thorough marketing plan.

Stages 1-4 are referred to as the innovation stages, while Stage 5 is a commercialization stage. Clearly, many of the inputs for the commercialization and market launch have also been considered at prior stages. Namely, Stage 1 already includes market assessment, during stage 2 a business case is prepared and the innovation is tested for the market in Stage 4.

To gain a more detailed insight into the commercialization stage alone, we present here the steps to commercialization as designed by the MIT Technology Licensing Office (2005, 4-6) which is a University technology transfer office (see Figure 2). Step 1 is research that leads to an invention of a process, machine, composition of matter or improvement thereof. Research is often carried out by multiple researchers. Pre-disclosure as Step 2 is a reminder for researchers to step in contact with the technology licensing office early to roughly point out the following steps. At Step 2 invention or technology is disclosed and the formal technology transfer process thus begins. Assessment (Step 4) includes review of the invention disclosure and analyses of the market and competitive technologies as to determine the commercialization potential of the invention. It provides and input for the strategic decision whether to license the technology to an existing firm or to create a new business start-up. Next, a patent application is filed (Step 5). Together with the researchers are indentified
candidate companies that have the expertise, resources, and business networks to bring the technology to the market at Step 6 - Marketing. Step 7 goes in two directions, either in the formation of a start-up or entering a relationship with an existing business. In the case of a start-up, the founders gain assistance in planning, creating and finding funding. Similarly, forming a relationship with an existing business requires finding potential licensees and identifying mutual interests, goals and plans. At step 8, licensing agreement is agreed on, either in the case of a start-up or existing business. Step 9 is called commercialization and requires the licensee company to pursue further development, to seek regulatory approval, perform sales and marketing activities, provide support, training and alike. Last step (Step 10) refers to generating revenues and their distribution in accordance with the internal policy.

Figure 2: 10 steps to commercialization (MIT TLO, 2005).

The above two practices show completely different approaches in new product development with respect to applying either the technology push or the market/demand pull strategy. Since commercialization is not the primary goal of R&D at MIT, they operate on technology push. For this approach it is characteristic that R&D supplies to the innovation process and market information is incorporated only late in the process. Since the invention is of technical nature it is often not adapted to the market (Rothwell, 1994). On the other hand, companies cannot afford to ignore the market, therefore they are more open to market/demand pull or other integrated models. These models add focus to responding to market needs.
Competencies in new product development

Along these lines developed the theory of key competencies in successful new product development, encompassing technological, marketing and complementary or integrative competencies (Rajković, 2011). Competencies as such refer to the ability to utilize resources that spread across multiple functions, products and markets in a sustainable and synchronized manner. Their main constituents are capabilities, a portfolio of capabilities, respectively. Capabilities are repeatable patterns of actions in the use of assets to create, produce and/or offer products to a market (Grant, 1991). Technological competencies incorporate practical and theoretical know-how, as well as the methods, experience and equipment necessary for developing new products (Wang et al., 2004). Companies with well developed marketing competencies are well aware of customer needs and are capable of value creation on all elements of a product or service that are relevant to the customers (Day, 1994). Constituent marketing capabilities are therefore an interwoven system based on knowledge and skills that allow the company to generate customer value and also facilitate timely and effective response to the marketing challenges (Vorhies, 1998; Vorhies and Harker, 2000; Song et al., 2005). Complementary competencies reflect the degree of fit between the two groups. The role of complementary competencies according to Wang et al. (2004) is to: 1) integrate different technological specialties; 2) combine different functional specialties; 3) exploit synergies across business units; 4) combine in-house resources with external capabilities required and 5) integrate the dynamic competence building process for superior performance when governments set forth policies to support technology transfer the inherent and inadequate technological push strategy leads to a product orientation aligned with the philosophy that customers will come automatically (Piper and Naghshpour, 1996). Therefore, market orientation with the pull impact can facilitate the technology transfer process. Nagel (2003) points out that R&D should however not develop what market asks for when new products are in question, since it is almost impossible. Still, when incremental innovations are in question, this is a prerequisite. Balancing of the market pull and technology push should therefore be considered a strategic orientation of a firm or organisation.

COMMERCIALIZATION STRATEGY MODEL OF CoE PoliMaT

We begin this part of the paper by first presenting the results of our empirical research, namely an internal survey that was carried out among the researchers of CoE PoliMaT. It confirmed the initial observations of the management that with existing competencies CoE
PoliMaT is not yet well equipped for pursuing commercialization goals. For this purpose we checked for internal knowledge on existing innovations and their markets and researchers’ experiences with similar endeavours.

Empirical part is followed by a synthesis of the theoretical background with the requirements and needs of a start-up research network that CoE PoliMaT is. The model of commercialization strategy is devised to address these requirements and enable the organization to implement an effective commercialization model that will also help it further develop its processes.

**Internal survey**

In April and May 2011 an internal on-line survey was carried out among the researchers of CoE PoliMaT with the purpose of identifying commonalities and differences in commercialization potential of innovations being developed at CoE PoliMaT and their underlying existing competencies. The aim was to establish a portfolio of innovations and potential entrepreneurial teams or individuals that could both manage these innovations in the R&D process and beyond as well as take part in active commercialization. The survey was sent out to 80 researchers. 53 respondents submitted their answers, thus yielding a response rate of 66,25%. The questionnaire was divided into several parts where we collected the following information:

- Names of up to three innovations per researcher that are being researched at CoE PoliMaT,
- Level of newness and final stage of the development that is expected,
- Interest and intention within the research groups to introduce innovation to the market and reasons for not introducing them if there is no such intention,
- Composition of research teams,
- Advantages and potential value propositions of innovations,
- Research team competencies (technological, marketing and complementary competencies),
- Industry and demand factors (technological and market factors),
- Skills and knowledge required by the research teams to engage in commercialization efforts and to make their research market oriented,
- Personal interest, commercialization experience and demographics of the researchers.
53 respondents provided answers on 66 innovations as they can work on more projects than one. After grouping the same innovations together and eliminating those with unclear naming, 33 distinct innovations in the R&D pipeline of CoE PoliMaT were determined and assessed. Data were analyzed using SPSS 17.00 software.

With regard to commercialization plans, 40.9% of the responses were given for innovations for which the plan is to introduce them to the market. 47.0% are uncertain, while for 9.0% of the innovations no commercialization is planned. 2 responses were missing. The commercialization step becomes even more unclear when taking into account differences in answers for the same innovation between different respondents. In this regard, it is also discouraging that in the case of 25.8% of the responses for listed innovations researchers cannot provide any insight into whether a competitive solution already exists either on a domestic or international market. 31.8% are to be new to the European market but not globally, 21.1% new to the domestic market and 1.5% not even new to the domestic market.

The researchers wish to gain the most support with financing of the subsequent development stages, with preparation of the patent application, training in commercialization strategies, promotion of technology, carrying out a market research, and setting up a start-up company. All of these variables were assessed on a 5-point scale with resulting average scores between 2.5 and 3 what means between little support and support to some extent. It is interesting and a bit contradictory to the findings above that the researchers believe they need the least support with commercialization, that encompasses introducing the innovation to the market and choosing the most appropriate business model, since beforehand they expressed poor knowledge of the markets.

In Table 1 are presented the descriptive statistics for competencies of aggregated innovations, meaning that the final score for an innovation reported by multiple researchers was obtained by averaging their individual scores. Answers were given in a form of self-assessment as researchers were asked to evaluate the provided relevant technological, marketing and complementary competencies relatively to their main competitors in their field, which they know of, be it a research institution or a company. Such comparative evaluations are recognized as an effective tool in measuring organization’s competencies in new product development (Wang et al., 2004). They self-reported their benchmark assessments on a 5-point scale ranging from a lot worse (value 1) to a lot better (value 5).
The results most of all show that many researchers are not familiar with the activities of their competitors. This is especially true for marketing and complementary competencies where the response rates (N) are extremely low. Among the innovations there is a great variability of the competitiveness of the competencies in the research teams involved in them. However, this can be expected within a large portfolio of innovations in the pipeline. Paying attention to the number of responses (N) from the total of 33 reveals that what is truly lacking is familiarity with the competitive environment in general.

Table 1: Descriptive statistics of competencies’ competitive positions

<table>
<thead>
<tr>
<th>Competencies</th>
<th>N</th>
<th>Min.</th>
<th>Max.</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Technological competencies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Availability of financing for R&amp;D of select innovation</td>
<td>28</td>
<td>0.50</td>
<td>4.00</td>
<td>1.7039</td>
<td>.85300</td>
<td>.728</td>
</tr>
<tr>
<td>Capability of gaining external funding</td>
<td>28</td>
<td>0.50</td>
<td>5.00</td>
<td>1.8711</td>
<td>1.05153</td>
<td>1.106</td>
</tr>
<tr>
<td>Technological equipment at your disposal at labs you have access to</td>
<td>30</td>
<td>1.00</td>
<td>4.00</td>
<td>2.5130</td>
<td>.77998</td>
<td>.608</td>
</tr>
<tr>
<td>Breadth of knowledge (related knowledge)</td>
<td>29</td>
<td>1.00</td>
<td>4.00</td>
<td>2.8702</td>
<td>.80679</td>
<td>.651</td>
</tr>
<tr>
<td>In-depth knowledge</td>
<td>29</td>
<td>0.50</td>
<td>5.00</td>
<td>2.8065</td>
<td>.91755</td>
<td>.842</td>
</tr>
<tr>
<td>Number of researchers working on the project</td>
<td>27</td>
<td>1.00</td>
<td>5.00</td>
<td>1.7714</td>
<td>.94818</td>
<td>.899</td>
</tr>
<tr>
<td>Speed of development</td>
<td>26</td>
<td>0.50</td>
<td>4.00</td>
<td>1.9126</td>
<td>.94929</td>
<td>.901</td>
</tr>
<tr>
<td>Technological advancement of research</td>
<td>29</td>
<td>0.75</td>
<td>5.00</td>
<td>2.5615</td>
<td>.86976</td>
<td>.756</td>
</tr>
<tr>
<td><strong>Marketing competencies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knowledge of the needs and tastes of customers/users</td>
<td>9</td>
<td>1.50</td>
<td>4.00</td>
<td>2.8633</td>
<td>.75728</td>
<td>.573</td>
</tr>
<tr>
<td>Access to information on invention by competition</td>
<td>11</td>
<td>1.00</td>
<td>3.00</td>
<td>2.3190</td>
<td>.86212</td>
<td>.743</td>
</tr>
<tr>
<td>Information on market activities of main competitors</td>
<td>10</td>
<td>1.00</td>
<td>4.00</td>
<td>2.4979</td>
<td>.85472</td>
<td>.731</td>
</tr>
<tr>
<td><strong>Complementary competencies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scope of strategic partnerships with suppliers in R&amp;D</td>
<td>8</td>
<td>1.00</td>
<td>4.00</td>
<td>2.3705</td>
<td>1.01499</td>
<td>1.030</td>
</tr>
<tr>
<td>Scope of strategic partnerships with buyers in R&amp;D</td>
<td>10</td>
<td>1.50</td>
<td>5.00</td>
<td>2.7113</td>
<td>.89119</td>
<td>.794</td>
</tr>
<tr>
<td>Access to missing knowledge through external partners</td>
<td>29</td>
<td>0.50</td>
<td>5.00</td>
<td>2.5736</td>
<td>.97745</td>
<td>.955</td>
</tr>
<tr>
<td>Recognition of the members of the research team in the select research field</td>
<td>25</td>
<td>1.00</td>
<td>5.00</td>
<td>2.9560</td>
<td>.88021</td>
<td>.775</td>
</tr>
</tbody>
</table>

The proposed commercialization model for CoE PoliMaT

In this section, we present a commercialization strategy model for CoE PoliMaT that roughly follows the stages of the previously described models of new product development and commercialization. It is developed to address the needs and specifics of the centre of excellence in accordance with the following facts:
- CoE PoliMaT is a start-up organization which did not develop its operations organically to their current scale,
- There is predominant technological orientation with missing marketing and complementary competencies necessary for successful commercialization,
- CoE PoliMaT still does not have a long-term business strategy, therefore, opportunities need to be explored on the level of each innovation.

In Figure 3 the proposed model is presented. It follows a stage-gate approach while allowing for expansion and upgrade of existing competencies in terms of the weaker marketing competencies and partly also complementary competencies. In the continuation these steps are presented in more detail.

Figure 3: Proposed commercialization strategy model

**Innovation report**

The commercialization strategy model begins with the submission of innovation report to the Scientific Council, an internal scientific body. This is a short form for reporting finalized innovations coming to life under the original research projects and tasks of CoE PoliMaT. The report is submitted by the head of the research project. Internal disclosure needs to be performed before the findings are either published or publicly presented. The reason is that public pre-disclosure of innovation precludes later protection of intellectual property rights, i.e. patent registration. From the viewpoint of centre of excellence this means that projects need to be monitored, especially the outcomes, and research teams need to be encouraged to view their innovations in the light of potential commercialization.

At this point, several factors need to be exposed. Research projects are based on prior knowledge of the research teams involved. Not only that, as this is a research network,
ownership of the innovation is to be clarified. This may require breaking down a complex innovation into individual parts and assigning them to different project phases. Secondly, all partners in the development of the innovation have to be listed, relating to both prior and current research.

**Market assessment and the decision to commercialize**

Once the basic technological features of the innovation are defined, the market view needs to be brought in. This part of the market assessment is approached in the sense as if organization – CoE PoliMaT – is entering the market alone. This will provide at this point the most in-depth understanding of the market. If CoE PoliMaT may later come to a conclusion that it cannot commercialize the innovation alone, it will have all the information needed at hand to identify the most suitable partner and understand its requirements.

The innovation is thus assessed from the point of view of the market on the elements of a business model, which according to Chesborough and Rosenbloom (2002) are the following:

- Articulation of value proposition – what technology offerings create value for users;
- Identification of the market segment – the users to whom the technology is useful and for what purpose plus specification of the revenue generation mechanisms for the firm;
- Definition of the structure of the value chain within the firm that is required to create and distribute the offering, and determine the complementary assets needed to support the firm’s position in this chain;
- Estimation of the cost structure and profit potential of producing the offering, given the value propositions and value chain structure chosen; this defines the market value of innovation and depends also on market size;
- Description of the position of the firm within the value network linking suppliers and customers, including identification of potential complementators and competitors;
- Formulation of the competitive strategy by which the innovating firm will gain and hold advantage over rivals.

The innovation at hand needs to be positioned in terms of its unique selling proposition that differentiates the product form competitive ones on the market and thereby wins itself a sustainable competitive advantage. It is defined as benefits that can be offered and also not offered to a select target market. It is important to point out that this is not a matter of product
features but benefits. When companies commercialize a product based on their technological leadership (technology leaders), they deliver a novel value proposition that is competitive with respect to incumbents. On the other hand, innovators tend to leverage existing value proposition by cooperating with established firms (Gans and Stern, 2003). These innovators are technology followers. They develop abilities to use existing technological solutions in a more efficient manner. Therefore they need to possess extremely good knowledge of the market and especially competitive products, including their benefits (Forbes and Wield, 2000). Important factors are also market maturity and differences in business-to-business and business-to-customer marketing1.

We present several more tools than can help in gathering information inputs for the required business model elements. Porter’s so called driving forces or the macroenvironmental trends determine the attractiveness of the industry (Porter, 1980) which will also help determine future trends in the industry. They include: (1) changes in the industry’s long term growth rate, which directly affect decision on investment and intensity of competition; (2) changes in key buyer segments, which affect demand and strategic marketing programs; (3) diffusion of proprietary knowledge which controls the rate of entry at which products become more alike and the entry of new firms; (4) changes of cost and efficiency which are derived from scale and learning effects that have the potential of making entry more difficult; and (5) changes in government regulation that can have an impact on entry, costs, bases of competition, and profitability.

The picture on industry’s immediate attractiveness is made more complete by adding the long-term aspect that can be analyzed by assessing Porter’s five interactive competitive forces (Porter, 1979) which vary in their relative strength among industries. These are: (1) rivalry among present competitors, (2) threat of new entrants or the potential competitors, (3) bargaining power of suppliers, (4) bargaining power of buyers, and (5) threat of substitute products.

In this part of the decision process on commercialization strategy the marketing competencies are brought in which in a way add to the technological push also some ‘internal’ market pull. Technically speaking it is not a real market pull but more an ex-post market research. As the

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1 For more on market maturity see Robertson et al., 2009, and for differences between business-to-business and business-to-customer marketing see Kotler et al., 2010, pp. 20-33.
scientists/researchers are most familiar with the technologies and technical features of their innovations, they need to take part in this assessment and become familiar with the basic concepts. They can be assisted by market researchers or market analysts. Information can be collected also from industrial co-founders of CoE PoliMaT and their knowledge of related markets. This way CoE PoliMaT will also start developing its own marketing competencies.

Based on these inputs a decision is to be made whether the industry and the market are attractive enough and have enough potential to yield positive returns on investment. This is also strongly linked to whether the innovation offers the right array of benefits to be eventually adopted by the market\(^2\). If the decision has been made not to commercialize an innovation, then internal competence mapping will be the final step.

**Internal competence mapping**

As already mentioned, CoE PoliMaT does not yet have a clear business strategy since it is organized as a project based organization with well defined research projects from the field of polymer materials and technologies but no marketing strategy. Therefore, it needs to best exploit innovations at hand and in the pipeline and construct a solid foundation of technological competencies. For the time being, these competencies will define its ‘technological identity’ that must have long-term orientation.

In order to construct the map for CoE PoliMaT, competencies inherent in an innovation first need to be broken down into separate capabilities, more specifically tasks and activities that include specific resources in the process of generating the select innovation (Hafeez et al., 2002). These are than mapped together with specific capabilities of other finalized innovations as well as those in the pipeline. Chiesa et al. (1999) developed a methodology for evaluating firm-specific technological capabilities for competitive advantage achieved through R&D. Capabilities are evaluated based on their relevance and success. Relevance is measured as the estimate of their relative contribution to the market value of potential future products. Probability of success of technological capabilities depends on technological risk, which is estimated as a function of the resource adequacy, the level of progress of the technology and the difficulty of the objectives, as well as commercial risk. Prašnikar et al.

\(^2\) Rate of adoption of innovation or diffusion of innovation depends on 5 characteristics of innovation: relative advantage, compatibility, complexity, trialability, and observability (Rogers, 2003).
(2008) in their methodology used probability of technological success and competitive position of technological capabilities.

The aim is to eventually produce a competence map or matrix that would point to aggregations of all capabilities and competencies as well as show the synergistic and complementary links while preventing duplication of R&D activities. Clusters of capabilities with highest density, which means that this area is best covered by the researchers of CoE PoliMaT, are then used to define potential future products and relevance of these competencies. At the same time, these are the competencies with the highest technological success probability in the future as most knowledge is gathered there.

In the strategic sense, the map would present a starting point for defining the core of CoE PoliMaT’s R&D, namely its core competencies could be identified. For those innovations which have been put through the market assessment phase, it is important to also map competitive positions of these competencies and capabilities in relation to the main competitors and thus evaluate their competitive position. These assessments should be eventually made also for the innovations in the pipeline. The competencies’ map should be a complete summary of organization’s competencies. Innovations which have not been considered for commercialization are therefore still brought to this phase.

This step is very different from other models of commercialization, as CoE PoliMaT yet needs to build its portfolio of competencies along with the business strategy of the organization as a whole.

*Commercialization through cooperation or competition*

In the absence of a clear business and marketing strategy, CoE PoliMaT’s primary guidelines for its commercialization activities as a start-up organization are goals set for individual projects, its mission and its vision as well as competencies at hand. Even though establishing spin-off companies is among the project goals, formation of a new legal entity still does not imply that competition is the only possibility, as spin-off can also license technology or enter joint ventures and alliances.

Research by Gans and Stern (2003) suggests that the crucial factor in determining the patterns of competitive interaction between start-up firms and established firms depends on the environment, namely do assets of the established firm contribute to the value propositions
from the new technology (control of key complementary assets) and can innovation by the start-up preclude effective development by the established firm. Teece (1986) formulated this decision as a choice between contracting with an established product firm to perform the commercialization activities and integrating downstream into the supply chain to commercialize the innovation alone. If the established firms have tight control over the complementary assets while the start up firm has strong appropriability over its innovation, then the optimal strategy is to enter an alliance with an established firm and to cooperate. The alternative to commercialize alone is expensive, however, inexperience is likely to dramatically increase the time to market and risk of failure. On the other hand, in exchange for access to the established firm’s complementary assets, the start-up firm must share the returns from its innovation. If it has to do this repeatedly with successive innovations, it is unlikely to earn superior profits over the long term (Teece, 1986).

Firms which control key complementary assets are most likely and/or most effective potential product market imitators. Commercialization strategy for start-up firms thus represents a decision between establishing a novel value chain and competing against established firms on the one hand, and on the other hand leveraging an existing value chain and earning return through the market for ideas. When the innovator controls formal intellectual property rights (e.g., a patent) the potential for expropriation will be reduced and cooperation strategy will be more attractive to the innovator. Informal mechanisms such as secrecy most often do not offer a strong appropriability environment like formal ones (Gans and Stern, 2003). When promoting ideas to potential buyers the paradox of disclosure can arise. This means that potential buyers will value ideas higher when they are more familiar with them. However, simultaneously they will have less need to buy these ideas as they will have a better understanding of them and will find it easier to replicate them (Anton and Yao, 1994). This is very much the case when selling innovations to potential buyers on a business-to-business market and in absence of good protection of intellectual property rights. That is why the decision regarding the protection of intellectual property rights stemming from it, is left to be defined along with the decision regarding commercialization strategy.

A possible partner to look at among the established firms, especially for commercializing complex products, are lead users (Tidd et al., 2005, p. 267). They demand new requirements ahead of the general market of other users. They also own complementary assets and are positioned in a way that enables them to reap high levels of benefits. They are quick to
recognize new requirements, are able to contribute to the development of innovation at hand and are generally perceived as pioneering and innovative.

On the other hand, evidence shows that about 80% of innovations from research labs tend to be suitable for established companies and 20% for start-ups (Venture Hype, 2011). In this article, Breit states that in the past, university technology transfer managers predominantly used traditional licensing model. These days they are no longer reluctant to taking equity deals in start-ups and reducing or waving royalty rates (while introducing new mechanisms and fees) as they are recognizing that start-up firms are most effective when it comes to translating university inventions into commercial products or processes.

It is therefore up to CoE PoliMaT to assess whether its marketing and also complementary competencies required for commercialization are sufficient. Market assessment provides a good picture of the factors that it has to manage in order to successfully commercialize select innovation. Especially in the beginning, when marketing and complementary competencies, which are key for commercialization, are extremely weak or non-existent and difficult to acquire, cooperation may offer not only access to them but also a valuable learning experience. Commercialization decision always includes a trade-off between the firm’s need for immediate cash and the value of obtaining commercialization capabilities in the field of the alliance (Wakeman, 2008).

Market assessment data will also help CoE PoliMaT determine which established firm has the necessary absorptive capacity and market position to most effectively commercialize the innovation. Industrial partners of CoE poliMaT (co-founders) need to be evaluated similarly as well. Understanding of the market is key when promoting innovation to a potential buyer, namely existing firm. When a decision is made between different modes of cooperation (licensing, acquisition joint venture or alliance), it has to be based on the incentives to maintain control over the technology for future development (Gans and Stern, 2003).

**CONCLUSION**

The main difference between Cooper’s model of new product development and R&D activities at CoE PoliMaT is that at CoE PoliMaT they are currently strictly research and project based. Although monitoring of the research projects is on-going and may resemble a
stage-gate approach, the steps prior to the development were neglected, namely the idea assessment was made predominantly on technological terms, while a business plan was performed for the centre of excellence – research centre – as a whole in the scientific field of polymer materials and technologies.

Thus the projects are first and foremost academic, with only predictive functionalities and possibilities of application. Exploitation or the commercialization strategies for these innovations are left to be developed in the final stages of scientific research. As centres of excellence as a policy measure are not typical start-up companies that grow organically, there is a need to structure the approach according to which innovations are effectively assigned the most appropriate commercialization strategy. This was also supported by the results of the internal survey on competencies and the exploitation strategy potential. Best developed competencies in new project development are the technological ones, with marketing and complementary competencies lagging behind.

The model of commercialization strategy begins by internally reporting innovation. Marketing competencies are brought in ex-post through market assessment which provides inputs in order to make an informed decision on whether to commercialize innovation or not. Later, the technological competencies are broken down into separate capabilities and positioned on an internal competence matrix to define their success, relevant and external competitive position. This step is the final step for innovations which are not going to be commercially exploited, however, they still form the technological core of CoE PoliMaT. Technological capabilities can be seen as strategic assets of CoE PoliMaT. At the last step, a choice has to be made between commercializing through competition and cooperation what depends on the nature of the competitive environment and the ability of CoE PoliMaT to compete alone. The role of the model is not only to reach the final decision, but also to provide necessary information that facilitates also future decisions regarding commercialization, namely selection of a cooperation partner and mode of cooperation or the appropriate business model for competition.

The model, although referring to CoE PoliMaT, can be instructive also for fellow centres of excellence and other research based organizations seizing commercialization opportunities despite of their current lack of competencies required for successful commercialization. Even when competition (pursuing commercialization alone) is not the commercialization strategy
of choice, a certain level of marketing and complementary competencies is nevertheless required.

REFERENCES


