

ACADEMIC SPIN-OFFS WITH THE ASPECTS OF ACADEMIC ENTREPRENEURSHIP IN MARITIME UNIVERSITIES

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ABSTRACT

Transfer of technology and knowledge from academic institutions to social environment can take place through various channels; such as disseminations, publications, education, interaction, co-operation, licensing and the establishment of new business entities based on academic technology and knowledge, so called academic spin-offs. When we focus on the maritime universities, we can see that the academic entrepreneurship and the process of academic spin-offs also can become a key issue for these entities. Gaining competencies in the process of academic spin-offs by accelerating entrepreneurship in maritime universities can provide the linkages between maritime academic centers and maritime industrial sectors and can be a barrier for core rigidities in maritime education and industry.

By the view of point, in this study it is aimed to understand the process of spin-off firms in maritime universities with the encountered problems and their possible effects in maritime industry.

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I. INTRODUCTION

For a sustainable marine future, marine research should achieve three main goals in the future: increase the knowledge of the marine world, explain the economic, social and political stakes which the ocean represents, bring scientific and technical expertise to policy-makers in ocean related activities and enhance technological competitiveness of maritime industry. Thus we can say that technological developments and knowledge become key concepts.

As the technological innovation is a rising evolutionary process for the maritime industry, the maritime researches and their results which are the driven components for the innovation process, are being important phenomenon. The originators of researches and innovations are mostly the research centers such as universities, academies and institutions. Accordingly, innovation policies of government support the universities and research centers to commercialize their research results. The acceptance of commercialization as an academic task constitutes the triple helix concept that originates from the processes of transferring academic technology into application through the linkages between university, government and industry (Etzkowitz & Leydesdorf, 1997; Rasmussen & Borch, 2004). So academic technology transfer of the maritime research results can be important for the sustainable maritime industry.

Academic technology transfer can be referred as the process of transferring laboratory discoveries out of the academic institutions to the other entities for development and commercialization. Transfer of technology and knowledge from academic institutions to social environment can take place through various channels; such as disseminations, publications, education, interaction, co-operation, licensing and the establishment of new business entities based on academic technology and knowledge, so called academic spin-offs. However licensing, meeting, patents, publications and spinning out ventures are not only introduced as mechanisms of technology transfer but also presented as the kinds of academic entrepreneurial activities (Rogers *et al.*, 2001; Antonelli & Consiglio, 2001). Accordingly, academic spin-offs can also be identified as the only one type of the academic entrepreneurship.

Moderating entrepreneurial activities and academic spin-off process in the same entity may lead conflicts and problems. There are several challenges related to the formation of spin-off companies such as applied research vs. basic research, publications vs. patents, individual working vs. group working. Internal conflicts can also arise amongst the academic members in the weak entrepreneurial environment. This may cause additional problems for the growth potential of academic spin-offs (Rasmussen & Borch, 2004; Degroof & Roberts, 2003). The congruent points between the academic structure and entrepreneurship directly influence the creation of academic spin-offs.

This study orients to the formation of academic spin-offs through the perspective of academic entrepreneurship in maritime universities or academies. In the next sec-

tion of the study, the maritime educational concept is in research centers are taken and then academic spin-offs literature is reviewed; the third part is about the effects of academic entrepreneurship and challenges on academic spin-offs. After that a case study is given for the academic maritime spin-offs and finally some concluding remarks are presented.

2. MARITIME ACADEMIC RESEARCHES

Research in maritime policy and management is concerned with solving problems in the maritime industry and advancing knowledge that is industry specific. Thus to have a greater contribution and to achieve greater recognition outside industry boundaries, there is potential for research outcomes to inform theory outside the maritime realm. Furthermore technology is one of the factors driving the globalisation of economies, and maritime work processes have an important role in this picture. From the perspective of maritime technologies, three issues should be emphasized. These are shipbuilding, maritime transport and undersea exploration and exploitation (Roseta, 1998)

Shipbuilding has kept important technical competence. Technological research is necessary to improve tools to conceive and produce ships using particularly new materials and information technologies, to develop techniques for new ships. *Maritime transport* has been accelerated steadily and provides the development of specific technologies to improve multimodal transport (sea, road, rail), to develop high-speed sea connections between harbours for passengers and freight traffic, to introduce new techniques for traffic control and management to provide new services for shipping and to modernise harbour logistics. *Undersea exploration and exploitation* of hydrocarbon and mineral resources require the development of appropriate technologies. The possibility of exploiting deep-sea off-shore oil and gas fields represents a real technological challenge which has to be met (Roseta, 1998)

The technological programmes that are these three major issues which have great importance for the competitiveness of maritime industries and its economy and which should be at the core of technological programmes, one must acknowledge the fact that other areas call for technical progress and breakthroughs (Veenstra, 2002)

As there is an increasing interdependence between marine science and technology, scientific research opens new opportunities for the technological developments and maritime services that bring together different perspectives. The fundamental research is originated from the academic research centers, the academic spin-offs become an important entities to convert the fundamental research to applied research, stated in Figure 1 (Caron et al., 2004).

Nowadays, the maritime industry faces numerous challenges with respect to technological innovation. Marine scientific research will be driven in the future as in the past both by curiosity and by the needs of society. Marine science and technology will bring new knowledge to the maritime industry from its exploitation in a sustainable manner.

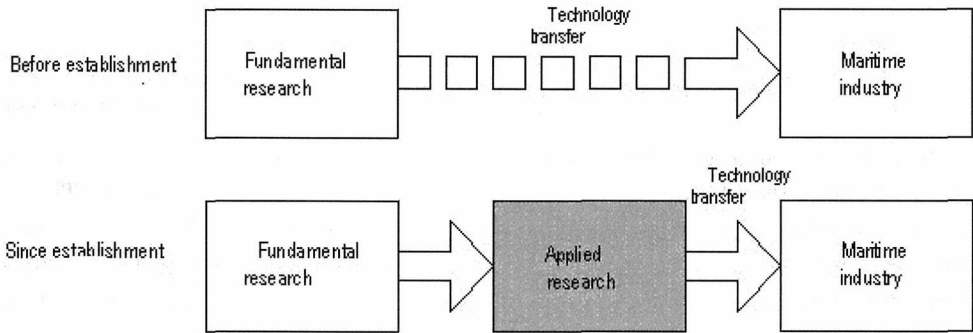


Figure 1. Applied research as a bridge between fundamental research and maritime industry

From the point of view academic spin-offs will be an effective mechanism to solve the challenges of maritime linkages between the technology and industry by: the mobilisation of scientific and technological competence, the constitution of research networks associating academic laboratories, national institutes and private companies, the building and peration of large common research infrastructure (Roseta, 1998). Thus understanding academic spin-off concept and applying to the maritime universities or academic research centers will provide more dynamic maritime sector.

3. ACADEMIC SPIN-OFFS

Generally, spin-off is taken as a process that involves the division of an existing company into two, usually a bigger one (parent company), and a smaller one (the spin-off) through sharing the human resources, assets and intangibles.

Elfring and Foss (2000) identify the spin-off as the individual or the team who uses the competencies of parent organization to begin a new business. A spin-off can also be evaluated as a process of transfer of technology with the entrepreneurial activities from the parent organization (Dahlstrand, 1997).

Roberts and Malone (1996) identifies four principal entities which can be seen in the spin-off process:

- The *technology originator*, the person or organization that brings the technology from basic research through the stages of the innovation-development process to the point at which the technology can begin.

- The *parent organization* in which the R&D is conducted by the technology originator.
- The *entrepreneur* (or the entrepreneurial team) who takes the technology created by the originator and attempts to create a new business venture centred on the technology.
- *the venture investor*, who often represents a venture capital organization that provides funding for the new company in return for partial equity ownership in the new company.

According to Carayannis et al. (1998), two factors are often seen in spin-off firms:

- The entrepreneur who usually leaves the parent organization.
- A technology which is also transferred from the parent organization as a base of the new entity.

Furthermore, types of spin-off can vary due to their parent organizations. Spin-offs can be classified according to which organizations they are spun-off and which entities the entrepreneurs come from (Perez, Sanchez, 2002). One of the major originators of new firms is higher education institutions, namely, university or academic spin-offs.

Academic spin-off is a mechanism of transferring the technological knowledge or the know-how from academia to marketplace (Mansfield, 1991; Consiglio & Antonelli, 2001). Pirnay et al. (2003) conclude that academic spin-offs are the new entities which utilize commercially the research results and the technology of academic organizations.

Consiglio and Simoni (1998) identify two agents for the academic spin-offs. One of the agents is the characteristics of the academics of the research group and the second one is the way of the exploitation of the research results. The introduced agents support a commercial stage from laboratory (Consiglio & Antonelli, 2001) and provide knowledge flow dynamics between the academic institutions and industry (Rappert, 1999).

The effective use of knowledge production that takes place in universities and other research organisations requires the performance of a transformation process that includes the application of new scientific concepts. Furthermore the different scope and purposes of academic institutions and industrial organizations make this transformation process a complex matter. Thus there is also a need for translator between academic and industrial contexts (Chiesa & Piccaluga, 1998). Academic spin-offs appear to be well positioned for this task as they can match the knowledge of research organizations and the needs of market (Fontes, 2005).

Thereby the creation of academic spin-off firms are effected from many factors such as the economic climate, demand and market conditions, existence of knowledge base, business culture and business environment (Bálazs, 1996; Antonelli & Consiglio, 2001). The market orientation of academics is a critical factor as innovative determinants come from the demand-side. So the academic spin-offs should be more dynamic in network

before and after their formation to produce a circulation of market orientation and technical capabilities (Perez, Sanchez, 2003). This circulation requires the people and the technological map of the region to be evaluated as a type of local network. From the regional economy perspective, it is identified that the academic spin-offs evolve under financial pressures and in response to changing market conditions, based on both academic knowledge and local knowledge.

Stankiewicz (1994) classifies the academic spin-offs with three modes. One of the modes is consultancy and R&D contracting for technology transfer and competence shortages; the second is product oriented mode that have well-improved product concept; the third of them is technology asset oriented mode which is relevant of the development of technologies.

The academic spin-offs are also categorized by Thornburn(1997) as;

- Direct research spin-off companies which are originated by commercializing intellectual properties through protecting the rights of the individuals, from the research institutions to the new firm.
- Technology Transfer Companies that are created for exploiting commercially the university's tacit knowledge and know-how.
- The Direct Spin-off Companies that are established by university staff or students who have no formal intellectual property licensing or similar linkages between the universities.

4. ACADEMIC ENTREPRENEURSHIP IN ACADEMIC SPIN-OFF CONCEPT

The formation of the academic spin-off is not an instantaneous phenomenon; it is a process, which constitutes the transformation of knowledge and technology into application. The creation of academic spin-off is a long way from the technology development to the exploitation of technology. The pathways of the academic spin-off process require the involvement of different approaches of the academic members during different stages of the spin-off process. The exploitation of technology benefits from entrepreneurial activities for utilization of the opportunities of market place. When the technology exploitation time comes, the research group of the development stage turns into an entrepreneurial team (Balazs, 1996). So the entrepreneurialism of the academic behavior becomes a key point for the creation of spin-offs.

Entrepreneurship is a process by which individuals create opportunities without regard to resources they currently control (Stevenson & Jarillo, 1990). Academic entrepreneurship can be taken as a behavior of modifying patterns of research in academic structure. Tyson et al. (1994) state that academic entrepreneurship is a knowledge-base activity which is consisted of taking risk, technology and being a bridge between

the knowledge and industry. Louis et al. (1989) introduce the five types of academic entrepreneurship as

- engaging in large scale of science that can be externally funded.
- supplementing income
- gaining industry support for university research
- obtaining patents or generating trade secrets
- commercialization

Accordingly, the academic spin-off concept coincides with entrepreneurialism. When Freeman's (1986) conceptualisation of entrepreneurship is examined, the academic entrepreneurship and academic spin-off concepts come together. He claims that the formation of the new establishments is generally the outputs of the other organizations and the academic spin-off is one of the genetic interpretations of the organizational entrepreneurship. By the context, the entrepreneurial alertness is an important behaviour for sustaining the enterprising mindset and culture for emergency of new ventures.

Drucker (1985), states that innovation is the specific tool of entrepreneurs, the means by which they exploit change as an opportunity for a different business or service. He also emphasises that innovation is capable of being presented as a discipline, capable of being learned and capable of being practised. That's why the transformation of an invention to a product can be taken as a three-phase entrepreneurial and innovative process. The first phase is the origination phase which includes genesis of the spin-offs and identification of the opportunity. This is followed by concept-testing phase that the opportunity is tested with a technical, intellectual and business point of view. Then the third phase, start-up support phase, starts (Degroof & Roberts, 2004). As a result of the integration of entrepreneurship and innovation concepts during the phases, the academic spin-off process is driven by the mission of capitalization of knowledge which is directly related to management of innovation through the academic culture (Etzkowitz, 1998; Ndonzuau *et al.*, 2001).

While executing the all phases of innovation, the management skills of the academics get importance (Balazs, 1996). Management of innovation requires the entrepreneurial qualities of drive, creativity, vision and ambition. (Consoglio & Antonell, 2001). Based on this, it can be claimed that if the conflicts that are encountered at the generation of the new ideas are overcome, the entrepreneur mindset can be spread to the other stages of the academic spin-off. As a result, scientists of the academic entities will be transformed to academic entrepreneurs who can manage the innovation during the spin-off phases through the academic concept.

Once the innovative activities and academic spin-off process are presented in the same organization, moderating these activities may lead conflicts and problems. When the core abilities in management of innovation are analysed, the congruent points of its concepts with the academic structure are experienced mostly at the origination phase

(Ndonzuau *et al.*, 2001). Generating new business ideas includes having the ability to create some aspects of the technology or the scientific knowledge in-house. Origination of innovative ideas provides to make the correct internal identification and assessment of the new opportunities which constitute the backbone of the academic spin-off process. Roberts (1991) suggests that the early choices during the initial phase impact the subsequent growth potential of the spin-off ventures. It is important to pay attention to the early phase of the academic spin-offs as the venture development is path dependent (Degroof & Roberts, 2004).

Furthermore the academics become the key individuals as they are the determinants of the organizational behaviour. The successful academic spin-off activities require the presence of the motivated academic entrepreneurs who have team building and management skills in addition to the traditional tasks of being an academic (Consoglio & Antonelli, 2001). But understanding the corporate organizational realities within the academic structure requires two opposite approaches in the same medium, namely, the scientific conception and the economic conception (Ndonzuau *et al.*, 2001). It is difficult to find the persons who carry these two concepts at the same time. We have to know why the scientific and economic conceptions are opposite to each other to avoid the barriers for the infancy of academic spin-offs.

Generally the scientific conception includes the basic research instead of applied research because the main goal of this conception is the enhancement of the human knowledge. Furthermore the academics of scientific conception transfer the research results and the knowledge mostly by publications (Callon, 1994; Etzkowitz, 1998). Publications are very important for academicians to get status in the academic structure. But from the perspective of academic spin-off process, the publication of a research result is not an effective way of knowledge transfer. Because a publication can cause loss of the originality of the new scientific knowledge. Nevertheless the legal issues such as patents can not be under control in the public domain. So the commitment of the academics to the publications can be presented as one of the conflicts between the scientific and economic framework (Ndonzuau *et al.*, 2001).

The other barrier for the formation of new academic spin-offs is the attitude of the academics to the money. While the economic conception uses scientific knowledge to make assets such as money, the scientific conception uses money to produce new scientific knowledge (MacMillan *et al.*, 2000). So universities or other academic structures are not interested in the potential of the commercialization of the research results. Therefore new ideas that can be a trigger for an academic spin-off, aren't emphasized within the academic structure.

It is also important to identify the market-oriented results. Generally the scientists in the academic entities are often pictured as isolated from the realities of the business world. A perspective that is far away from the real world, sets a barrier to the realization of an market opportunity for the creation of successful academic spin-offs. The busi-

ness idea characteristics should be in touch with the realities of the market potentials (Grandi & Grimaldi, 2000).

As the conflicts arise due to the non-entrepreneurial mindset, entrepreneurship should be made compatible with the academic structure by overcoming the conflicts. The dualisms of the scientific conception and economic conception -patents vs. publication, basic search vs. applied search, scientists vs. businessmen-, should also be accepted in the academic structure (Etzkowitz, 1998). As the academic spin-off process is an element of the triple helix concept, the supports of the government, the industry and the academy make the academic structure and entrepreneurialism coincided. Therefore the governments, universities and the industry carry out sustainable policies.

The governments can motivate the academic spin-off process by relaxing anti-trust regulations, developing co-operative research centres, and protecting the intellectual property (Bozeman, 2000). Industry develops well functioning financial markets. The local industry can provide suppliers, partners and buyers for the new academic spin-offs (Djokovic & Souitaris, 2004; Looy *et al.*, 2003; Porter, 1990). In the academic institutions, the policies are generally made on focusing to the organizational culture. Many universities establish Technology Transfer Office and work with technology incubators and technology parks. To integrate the academic entrepreneurship and academic structure, universities also offer entrepreneurial courses, organise network events to create linkages between scientific, economic and technological fields and develop procedures for the spin-off formation (Birley, 2002; Mustar, 1997).

5. A CASE STUDY: EMATAK – THE SPINNO PROJECT OF THE ESTONIAN MARITIME ACADEMY

The aim of EMATAK - the Spinno Project of the Estonian Maritime Academy is the development of co-operation between Estonian Maritime Academy and Estonian maritime enterprises and organisation of the knowledge transfer to the outside of the Academy. It also offers competitive training, research and development and innovative services at the international level to the Estonian maritime enterprises for their sustainable development.

The goal of the Estonian Maritime Academy as an internationally recognised professional higher education institution is provide quality maritime education, supervise and co-ordinate the maritime training and R&D activities and organise applied marine research. The objective of EMA research and development activity (R&D) is the promotion of the required co-operation between the Academy, public sector and enterprise for the sustainable development of the Estonian maritime enterprises and public sector, the arrangement of knowledge transfer and finding the solutions to the environmental

issues of the Baltic Sea region bordering with Estonia. According to the R&D strategy, a favourable environment for the commercialisation of R&D activities is going to be created; knowledge transfer and business related training for the lecturing staff and the students is going to be carried out; the lecturers and students are consulted on the identification and testing of ideas, finding co-operation partners and sources of financing; the competence, provided services and intellectual property of the Academy will be introduced to the marine enterprises and joint research is carried out in the field of knowledge and technology transfer both with Estonian higher education institutions, R&D institutions and foreign partners.

The Centre was formally created in the Academy in December 2003 with a main objective to carry out tasks prescribed by the R&D strategy. Academy finances the Centre by means of its net assets earned by contractual work and paid Refresher Training service to the personnel of marine enterprises. The implementation of the set of tasks, established by the R&D strategy as a whole, is a time and resource consuming process.

The Centre creates a favourable and motivating environment for the lecturers and the students to carry out R&D activities and co-operate with enterprise. Raising the awareness of the members on commercialising the R&D results and co-operation opportunities with marine enterprise are another aim of the centre. The other activities are

- development of the support services, required for encouraging the knowledge transfer. Their application would considerably contribute to the increase in the volume of research contracts and projects, creating the preliminary conditions for the development of the spin-off enterprise;
- active introduction of the Academy competence, provided services, co-operation opportunities and its intellectual property by distributing the information materials and arranging partnership activities, creating an objective image of the opportunities to provide the required and useful services for the enterprise by means of Academy aid
- development of knowledge and technology transfer related co-operation, exchange of experience with Estonian R&D institutions and professional higher education institutions and foreign partners with marine enterprises.

In the course of the realisation of Spinno project the volume of enterprise oriented projects and contracts will increase in a sufficient scope to transform EMATAK into a self-sufficient enterprise in its activities (www.ematak.emara.ee).

6. CONCLUSION

Maritime research centers and maritime academies are the backbone of maritime industry. To have a sustainable maritime environment, the linkages between the maritime academies and industry should become a strategic issue for the national and international maritime policies. The academic spin-offs can be one of the most productive ways of linking the maritime technology to maritime social system. To understand the dynamics and organizational characteristics of academic spin-offs would accelerate the maritime industry developments from the academic institutions. Thus further researches are suggested on the concept of spin-off firms in maritime education.

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