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COMPETITIVE SUSTAINABILITY WITHIN RESEARCH INSTITUTIONS. CASE STUDY: CENTRE OF COMPETENCE FOR SPACE TECHNOLOGIES - STARWALKER

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Abstract

This article provides a comprehensive solution for achieving competitive scientific and technological sustainability at the national level within the flourishing space sector through the establishment of multi/interdisciplinary collaboration platform between scientific sector and industry in the form of a Centre of Competence for Space Technologies entitled STARWALKER and hosted by Institute of Space Science (ISS), Romania. The herein case study presents the opportunity identification, leading objectives and benefits of STARWALKER addressed to a unique technological niche in the field of Countermeasures for Human Space Flight, centre which envisages achievements of particular national scientific and industrial capabilities and competencies in this field for capitalizing them in European Space Agency (ESA) Programmes participation, in national economic benefits and, as well, in fulfilling societal needs with respect to human performance. Furthermore, the paper expresses also the connection between the internal development concept within research institutes with Corporate Entrepreneurship (CE) phenomenon.

Keywords: competitiveness, Centre of Competence, STARWALKER, space sector, Corporate Entrepreneurship (CE).

Topic Groups: Technology and innovation management; Change management and organizational development; Social sciences and business

JEL Classification: L20, Q01, M10

INTRODUCTION

The current century is characterised by an innovation revolution whereby innovation and knowledge bring value in original ways, and implicitly generate huge impact on economic and social environments (Kuratko, 2009; Bratianu, 2011). In this context, the space sector represents one of the most flourishing industries which despite its high activities costs, it stunningly influences both the globalized economy through a tremendous high return on investments, but also the society by providing scientific knowledge, technological know-how, and, of utmost importance, the essential spin-offs with respect to sustainable operational solutions based on space assets and so beneficial for humanity, as follows: telecommunications, weather, environmental and person safety and security (ESA, 2005; Vizitiu et al., 2013).

The principal actors involved in the space economy consist in *governmental bodies*, with decisive roles in investing, regulating and operating the space and relevant terrestrial infrastructures*; research institutes*, with essential roles in research and development within the space economy value chain, by contracting space agencies and/or industry in order to advance basic research and not merely; *business corporations* and, as well, *small and medium enterprises*, targeting space based manufacturing and operational services (OEDC, 2012).

On the other side, Sathe (2003) warns the fact that opportunities which involve large capital investments on middle-long strategic time slots and whose output adds real value for society by fulfilling new needs and establishing new end user communities, need not an ordinary individual entrepreneurial approach, but specific organizational attitudes to promote innovativeness, proactiveness and risk taking within private entities (Antoncic and Hisrich, 2001), and furthermore, added through the herein authors' conception, within research institutes when it is taking into consideration an emergent country as Romania.

The herein research presents an important case study, namely representing a space based organizational solution in the form of a centre of competence for space technologies in order to achieve the right innovative, proactive and risk taking attitude in the frame of research institutes, equivalent with the entrepreneurial attitude in the frame of private entities, defined by Burgelman (1983) *corporate entrepreneurship*, or by Antoncic and Hisrich (2001) *entrepreneurship inside existing organizations.*

The present case study brings into the light an avant-garde Centre of Competence addressing to a specific space technologies niche, called STARWALKER and whose purpose is to increase the science and technological competitiveness at national and international levels in the field of Countermeasures, field which is defined as encompassing applications/systems "*designed to neutralize the hazards of the space environment for astronauts' health and performance*" (Clément et al., 2007:2) with huge advantages upon society.

The present study illustrated in an emergent country as Romania is even more important so because Romania was classified by European Commission (EU) in 2014 as a modest innovator country, detaining the rank 27 from 29 European countries (EU-Innovation Union Scoreboard 2014) with a weak competitiveness and capacity of developing research and innovations, but in the same time Romania is considered to have high potential in research and development, and in the overall global space industry since it became the 19th Member State of European Space Agency (ESA) in December 2011.

In the following sections it will be illustrated the space industry with Corporate Entrepreneurship (CE) implications, will be comprehensively presented the case study in the field of space research and innovations, and, finally, the discussion together with the final paper conclusions.

COMPETITIVENESS WITHIN SPACE INDUSTRY AND CORPORATE ENTREPRENEURSHIP IMPLICATIONS

The space economy is defined as encompassing "the full range of activities and the use of resources that create and provide value and benefits to human beings in the course of exploring, understanding and utilizing space" (NASA, 2007 in OEDC, 2012:19). Space investments represent a substantial opportunity given the fact that the world space economy was evaluated in 2012 at over $300 billion, whereas around 40% stood in for commercial space based products and services, other 40% targeted the industries involved in support and commercial infrastructures, and the rest in governments/space agencies budgets (Space Foundation, 2014), and furthermore taking into consideration the economic predictions with respect to space economy trend, increasing at around $600 billion in 2030.

As stated by ESA (2000-2014), space provides competitiveness and economic growth in the world-wide markets, including space adjacent sectors, contributes to innovations through technology and knowledge, and, very important, represents an anchor of stability in the nowadays economic challenges.

Vizitiu and his collaborators (2013) presented a considerable theoretical contribution in this context by underlining a rationale connexion between the space industry expectations with Corporate Entrepreneurship (CE) strategy through the following, but non-exhaustive aspects: creation of new products/services for fulfilling new end-user requirements and even creating new end-user communities, managing large capital investments on long term and stimulating

spectacular innovations for society and economic benefits, fostering interdisciplinary attitude for stimulating research and industrial cooperation.

CE demands "employee initiative from below in the organization to undertake something new" (Vesper, 1984:295), and "diversification through internal development" through "new resource combinations" (Burgelman, 1983:1349). More exactly, CE purpose is to provide sustainable competitive advantages by overcoming the institutions' bureaucracy, complex hierarchies and internal procedures (Thornberry, 2001) through strategic renewal, as relevant dimension for this paper context.

Strategic renewal, also known as organization self-renewal, regards new combinations of organizational resources for acquiring or building novel capabilities and competences which would enable the individuals to further leverage them originally for adding value within economy, implicitly society (Guth & Ginsberg, 1990; Zahra, 1995).

Equivalent with the organizational strategic renewal phenomenon but targeting the public research institutions, the present paper presents a comprehensive solution for obtaining sustainable competitive advantage in the field of space research and innovation. The case study illustrated herewith, namely the STARWALKER Centre of Competence addressing to a specific Human Spaceflight Support niche, provides the roadmap of combining the organizational resources of the centre's institution/laboratory host and more acquiring new resources for seeking proper capacities development, with paramount contribution in spurring the national scientific and industrial community to comply with space grade technology and to add real value to society.

CASE STUDY: CENTRE OF COMPETENCE FOR SPACE TECHNOLOGIES - STARWALKER

STARWALKER Overview and Opportunity Identification

STARWALKER Centre of Competence constitutes a scientific-technologic collaborative platform which gathers both research and industry with the purpose to stimulate and consolidate at the national level the field of Countermeasures for Human Space Flight, namely by means of developing proper solutions for counteracting physiological and psychological impairments inflicted on humans by their prolonged exposure to MICE (Micro-gravity, Isolated and Confined Environment).

The establishment of STARWALKER Competence Centre was based on a project funded by the Romanian Space Agency (ROSA), in the frame of the Romanian National R&D Programme STAR. The legal host of STARWALKER Centre of Competence for Space Technologies is represented by The Institute of Space Science (ISS) through its Space Application for Health and Safety Laboratory, located in Bucharest, Romania. STARWALKER is based on multi/interdisciplinary collaborations with experts both in space engineering and natural/social/management sciences, while performing the whole engineering effort according to Systems Engineering (SE) methodology, as standard approach for European Space Agency (ESA) in balancing between stakeholders' needs and technological advance.

Based on a valuable experience and national/international expertise of the centre's host with regard to space based health and safety research and development, Space Application for Health and Safety Laboratory has decided to involve in the Countermeasures direction in the

context of Romania's new status within ESA Membership. Besides the membership occasion identification for achieving competitiveness as a first mover capability on behalf of the STARWALKER, the real opportunity identification consists in the Countermeasures field, which it is considered in the literature, implicitly by Letier et al. (2012) as being a vast and still more to be discovered domain due to the stringent requirements of space missions (e.g. future Mars exploration etc.) involving increasingly longer exposures of astronauts to MICE and, in the same time, the lack/poor efficiency of the existing countermeasures.

The detrimental effects of MICE inflicted on humans during prolonged Space Flights are physiologically and psychologically, as follows:

Physiological deconditioning caused mainly by bone demineralization, myasthenia, cardiovascular decompensation, but also by imbalances of the neurovestibular, endocrine, and immune systems (Letier et al., 2012; Morphew, 2001);

Psychological problems with negative effects on decision making, mood, and also generating disorders of attention and memory, poor interpersonal dynamics, motivational decline and fatigue (Schneider et al., 2010; Morphew, 2001).

It has to be highlighted the fact that the countermeasure solutions developed within STARWALKER have important spin-off applications terrestrially, namely by enhancing human performance under extreme conditions. Thus, STARWALKER presents paramount importance not merely for space sector, but also for society, implicitly for national economy. The benefits for society, as countermeasure spin-offs, regard higher resistance to physiologic and mental stress of professionals exposed to intentional risks related to extreme conditions, higher motility recovery and increased societal inclusion for disabled persons and trauma victims, increased sport performance, and also, future researches in deepening the informational management in bio-organisms.

STARWALKER Mission and the established unique Niche

The mission of STARWALKER Centre of Competence for Space Technologies highlights the achievements of proper competences in Countermeasures for raising the existent national scientific and technological standards in order to enter to specific ESA Programmes and gain important national scientific and industrial progress. Thus, the mission, as stated in the STARWALKER strategic definition document, targets: *the integration of existing scientific and industrial competences and achievements in countermeasures for Human Space Flight and complementary fields at national level, the valorisation in international context, notably through participation in ESA Programmes, and fostering the progress of the scientific and industrial Romanian space community.*

One aspect of utmost importance in bringing competitive sustainability to STARWALKER is represented by the particular niche identification within the vast domain of countermeasures, niche which is stated in the centre's strategic definition document as follows: *the astronauts' assessment, training and recovery for long exposure to micro-gravity as well as to spatial and social confinement through information-feedback assisted, neuro-muscular control and mental-control training.*

The identified niche is unique both in national and international space context, and is based on the centre's human resource expertise and scientific developments in the human performance frame prior to STARWALKER foundation. Thus, the theoretical basis of the

niche consists in specific visions with respect to information fluxes within the human psycho-soma complex, and as well on a novel methodology called CASINOR (Computer Assisted Informational Orthotics) able to *adjust somatic functions to enhance performance and/or recover it,* through *changing and refining information fluxes within the human being* (Văleanu and Hillerin, 2006:8).

STARWALKER Leading Objectives

The considered leading objectives target comprehensively an important range of activities residing to scientific and technological, but as well, industrial levels, all these in order to provide a sustainable development of STARWALKER and concurrently a competitive sustainability. As stated in the STARWALKER strategic definition document, the leading objectives envisage:

A. *The development of the capacity of participation of the Romanian scientific, technologic and industrial community in ESA Programmes* through the identified unique niche in the frame of human spaceflight related activities.
   This first objective encompasses methods and devices development for countermeasures with respect to MICE physiological and mental-volitional impairments, mainly in the benefit of humans in space, but also for societal spin-offs.
B. *The entrainment and mentoring of the industry to participate in ESA activities.*
   STARWALKER will stimulate and provide consultancy to identified industry in order to enable the private entities in complying with space technological and Systems Engineering (SE) standards, and as well to ESA Programmes requirements. Furthermore, STARWALKER will stimulate through industry the technological transfer to, mainly, space industry, but also to terrestrial spin-offs sector, with benefits to society.
C. *The creation of all level interdisciplinary education and public awareness.*
   The awareness process is undertook at three levels, namely: scientific and technological results publications and presentations within prestigious national/international journals, conferences and seminars in order to increase the visibility of STARWALKER contributions among scientific and industrial communities; continuous professional education through educational and scientific support for students whose Bachelor-of-Science and PhD degrees consists in countermeasures/countermeasures related thematic; outreach activities for promoting STARWALKER activities, and implicitly countermeasures field to the general public including high school students.
D. *The establishment of cooperation with similar entities in Europe and in the world.*
   The objective foresees the opportunity to further identify similar entities as STARWALKER in countermeasures or countermeasures related fields in order to get in collaborations and gaining access to a wider network of research and private entities.

DISCUSSION

The case study presented herewith provide a comprehensive solution of combining organizational resources, acquiring/building specific capabilities and competences in order to be leveraged further in a creative way to add value to economy and society.

The present paper contribution is even more important so because is tackled the space sector characterised by high investments on long time horizons, with high technological advance and uncertainty, where the research institutes and industry have real needs in obtaining competitive sustainability. Thus, the herein case study provides a roadmap of

creating a centre of competence for Space Technologies which at its turn to spur the national scientific and industrial communities to make advances in the international space sector with high benefits also for society.

More than that, the herein paper provides a novel connection of centres of competence establishment with CE strategy, fact which could represent a real benefit mainly for the real competitive practice, but also for the strategic management literature which further could trigger new related researches.

CONCLUSIONS

STARWALKER Centre of Competence for Space Technologies explores an important opportunity in the space sector, namely by creating a particular niche within the Countermeasures for Human Space Flight and organizing a scientific-technological collaborative platform with scientific sector and industry, is going to achieve state-of-the-art capacities and competences to participate to ESA Programmes and Missions, to comply with space grade technologies and more, to provide value for society by satisfying societal needs.

STARWALKER introduces a particular technological niche within the Countermeasures for Human Space Flight and a particular scientific trend at the national level, and by means of its umbrella establishment for scientific sector and industry, it can be achieved numerous important benefits as employing and training new workforce, attracting new space/space related European funds, stimulating technological transfers, serving societal needs etc. implicitly with positive impact on the national economic growth in this sector for the future.

STARWALKER encompasses multi/interdisciplinary experts within its national single site collaborative platform, but it is foreseen, due to its real potential, to become after the present pilot phase funded by a national authority, an autonomous national and international, virtual and widely distributed collaborative platform with the purpose to provide competitive sustainability.

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