

Dynamic and autotelic capabilities in knowledge-intensive, low-tech ventures

Glykeria Karagouni¹, Aimilia Protogerou², Yannis Caloghirou³

¹ PhD Student, Laboratory of Industrial and Energy Economics, National Technical University of Athens, Heron Polytechniou 9 str, Zografou Campus, Athens, 15780, Greece. And: Laboratory of Applied Marketing, Management and Economy Department of Wood and Furniture Design and Technology Technological and Educational Institute of Larissa, Greece. E-mail: karagg@teilar.gr

² Post-doctoral Research Fellow, Laboratory of Industrial and Energy Economics, National Technical University of Athens, Heron Polytechniou 9 str, Zografou Campus, Athens, 15780, Greece. Email: protoger@chemeng.ntua.gr

³ Professor of Economics of Technology and Industrial Strategy, Laboratory of Industrial and Energy Economics, National Technical University of Athens (NTUA), Heron Polytechniou 9 str, Zografou Campus, Athens, 15780, Greece. E-mail: y.caloghirou@ntua.gr

Abstract: Dynamic capabilities have been treated mainly as organisational, firm-specific capabilities in the context of large, established high-tech organizations. However, a small but increasing stream of research suggests the entrepreneurial team as a source of DCs indicating that these capabilities can exist already at the outset of the venture.

The present paper explores the organizational and entrepreneurial dynamic capability perspective by a two-fold study: it examines the existence and significance of DCs in knowledge-intensive, low-tech firms providing answers to questions unaddressed by previous studies. It further introduces the Autotelic Capabilities Framework as a first endeavour to shed light on the unexplored strategic side of the start-up activity in low-tech knowledge-intensive entrepreneurship.

The study revealed that possessing and further cultivating autotelic capabilities can be a major success factor in knowledge-intensive ventures. The dimensions of Autotelic Capabilities, bricolage, improvisational and transcendental capabilities located mainly in the entrepreneurial team, create novel business concepts and establish successful ventures in saturated competitive arenas. The conceptual framework advanced can add to the understanding of core issues of the emerging stage of low-tech ventures and the creation of initial competitive advantage. Regarding Dynamic Capabilities, the study proved that low-tech companies that invest and build their strategy on knowledge intensiveness and innovation, develop relatively strong DCs to gain competitive advantages, usually resulting in niche creation, adding value and surpassing fierce price competition. While the basic micro-foundations of sensing, seizing and reconfiguring were detectable in all sampled companies, there were considerable differences due to sector, size and age.

Keywords: dynamic capabilities, entrepreneurial capabilities, knowledge-intensive, low-tech, competitive advantage, new venture

1. Introduction

Investments in knowledge and innovation are not strange to established or new-to-the –world companies specialised in traditional businesses. Recent research findings show that a significant number of firms in traditionally named low-tech (TLT) sectors enclose a dynamic approach of knowledge in order to flourish in saturated and vulnerable markets (Hirsch-Kreinsen and Schwinge, 2011; Robertson and Smith, 2008). While the importance of knowledge has been well recognised for high- and medium-tech industries, it has long been neglected for low-tech industries (von Tunzelmann and Acha, 2005) which remain a rather unprivileged research topic in the framework of capabilities' development on the basis of knowledge seeking activities and performances.

In particular, theoretical and empirical research on dynamic capabilities has been mainly focused on high-technology industries, while there is extremely limited empirical research on the DCs' existence and role in low-tech firms either in their start-up stage or later on in their lifespan. This study is among the few attempts to link the dynamic capabilities notion with that of knowledge-intensive entrepreneurship in low-tech industries.

Furthermore, there was no effort till now to explore the strategic side of the vulnerable early stages of entrepreneurship or try to understand how and why certain new ventures survive and prosper in today's saturated mature markets of low-tech industries. The Autotelic Capabilities (AC) approach endeavours to explain new knowledge-intensive venture success and failure within low-tech industries. Our definition of ACs and their role for new entrants into the competitive game of so called saturated markets challenges multiple aspects of research and theory grounding. Our approach highlights the major problem of new venture creation under the scope of strategic management and expands the capabilities view to both corporate and KI Entrepreneurship. It further shifts focus from high tech to low-tech, which due to path dependences and mostly incremental innovations have been almost ignored.

2. Theoretical framework

The term Knowledge-Intensive Entrepreneurship (KIE) has been used mainly for technology based firms in high tech sectors and lacks a very clear definition (Malerba, 2008). Literature on knowledge-intensiveness in TLT sectors has been questioned through kinds of knowledge and ways of combining existing codified knowledge with practical knowledge in competitive ways (Pavitt, 1984; Robertson and Patel, 2007; Hirsch-Kreinsen, 2010), and a clear orientation to process innovation (Heidenreich, 2009). Still, there is no definition while there is still a debate on whether KIE can exist and how in low-tech sectors (Hirsch-Kreinsen and Schwinge, 2011).

However, recent findings of case study research emphasize the specific ability of TLT companies to produce innovation (von Tunzelmann and Acha, 2005) transcending the sectoral context and overcoming the existing paths of knowledge and technology. Therefore, Knowledge-intensive entrepreneurship as the act of establishing a new venture is about cognition, heterogeneous knowledge selection and coordination in order to commercialize novel combinations or re-combinations at areas of products, processes, services or models and acquire a first share in an existing or a new market (Karagouni, 2011).

The focus on capabilities undoubtedly has its roots in the field of strategic management, defining the so-called "resource-based" perspective. Initiated by Penrose's (1959) study on firms' growth, this trend of thought has gained tremendous interest in the following decades shifting focus on how some firms can acquire and retain a sustainable competitive advantage. The most popular answer turned around the notion of Dynamic Capabilities which gained rapid recognition (Teece et al, 1997; Zollo and Winter 2002; Teece, 2007; Protogerou et al., 2011). Dynamic capabilities have been referred to as the "capacity of an organisation to purposefully create, extend or modify its resource base" in order to survive and prosper under conditions of change (Helfat et al., 2007) enabling the organization to respond to changes in external environments (Teece et al, 1997) and renew resources (Zahra et al, 2006).

However, DCs have been so far mainly detected and analyzed in high – technology industries, large, multidivisional firms (Zollo and Winter, 2002), established firms (McKelvie and Davidsson, 2009) and multinational companies in international environments (Teece, 2007), ignoring the huge importance and potential of TLT industries. Research efforts so far, both qualitative and quantitative, address issues such as the relationship between DCs and firm performance, innovativeness or change capability (Evers, 2011; Karagouni and Kalesi, 2011; Protogerou et al., 2011). Till now, there is hardly any evidence of whether DCs exist in low-tech companies in their start up stage or any reference to their role in KIE of low-tech sectors (Karagouni and Kalesi, 2011).

Although a growing body of research highlights the importance of entrepreneurial activities for the conception, development, and configuration of DCs in new ventures and their impact on growth and performance (Newbert, 2005; Boccadelli and Magnusson, 2006; Grande, 2011), there is almost no research on whether DCs exist during venture creation. Arthurs and Busenitz (2006) draw a distinguishing line between entrepreneurial and dynamic capabilities. Helfat and Peteraf (2003) claim that an organization in the founding stage cannot have any

DCs. Bocardelli and Magnusson (2006) argue that resource-based theories have rarely considered the early stages of firm development. Such arguments drove to the development of the “entrepreneurial capabilities” notion to explain new venture performance (Arthurs and Busenitz, 2006) or innovativeness (Picot et al., 1994). Helfat et al. (2007) recognized that “Creating, adapting to and exploiting change is inherently entrepreneurial” and Teece (2010), added *Creative managerial and entrepreneurial acts* in his famous microfoundations, calling for studying ‘entrepreneurial management’ to understand how sensing and seizing opportunities arise (Felin et al., 2012). Lately, an extremely limited but rather interesting body of empirical research is emerging towards the exploration of DCs in newly established KI ventures stretching to low-tech sectors (Protogerou and Karagouni (2012)) as well.

3. Methodology

The present research study explores the organizational and entrepreneurial dynamic capabilities perspective by a two-fold study in the field of knowledge-intensive entrepreneurship in low-tech sectors.

The first part examines the existence and significance of dynamic capabilities in KI, low-tech sectors, providing answers to questions unaddressed by previous studies in the contexts of type, age and size.

The second part introduces the Autotelic Capabilities Framework as a framework of original entrepreneurial capabilities which create strong initial competitive advantages and constitute the antecedents of DCs in low-tech but knowledge-intensive firms. It is a first endeavour to shed light on the unexplored strategic side of the start-up activity in low-tech knowledge-intensive entrepreneurship. We argue that possessing and further cultivating ACs is a major success factor when knowledge-intensiveness is engaged.

The logic of grounded theory was followed in the analysis of a multiple exploratory case study (Yin, 2003) with the individual low-tech company as the unit of analysis. Data were collected from sectoral databases, while sectoral experts gave information about new, knowledge-intensive ventures. The most representative low-tech sectors in Greece are the food and beverages, wood and furniture, and textiles and clothing industry, which have also a significant share of employment and value-added for the European manufacturing industry and economy.

The goal was to acquire a sample of knowledge-intensive ventures covering all Greece, which would satisfy the following criteria:

- KI venture creation among 1998–2007
- evidence of being assigned to the most innovative companies in the market or product field through knowledge-seeking activities.

The final sample consists of thirty case studies, ten from each sector with interviews carried out during 2009-2011. Multiple sources were used such as information by different interviewees, plant visits, reviews of company and public documents, reports, internet and press, awards and information from company websites and a standardised questionnaire on hard facts and data of the cases. Triangulation through the use of multiple data sources, theoretical perspectives and methods increased the credibility and validity of the results.

4. Dynamic Capabilities in KI low-tech firms

The present research revealed that dynamic capabilities exist and are quite significant in knowledge-intensive low-tech firms of all sizes, new or established. Innovative products, processes and models are responses to changing market conditions as the textile and clothing production transfer to Eastern Europe and later Asia, and China’s Trade Liberalization.

Knowledge is regarded as a valuable core resource which can be accumulated via internal or external R&D, open innovation, networking, and direct transfer among firms along the value chains even out of sectoral borders. All companies use a multifaceted knowledge transfer literally involving all links of the whole value chain stretching even out of narrow sectoral borders. Most valuable knowledge sources are suppliers and international trade shows. Yet, appropriability issues are under-developed. Firms rely on mutual trust and personal relationships to keep corporate secrets.

The involved KI low-tech firms present in a formal or informal way all three micro-foundations of DCs as defined by Teece (2007) at different however levels. They create competitive advantages by introducing innovations which cause alterations to their mature and traditional business ecosystems. Some innovations are disruptive, as a food company's spectacular entrance to bio-functional foods. Others create new niche markets, or innovative processes and technologies which add to properties and characteristics, such as an established rice producer and an MDF manufacturer, or presenting novel concepts (e.g. the carbon neutral concept for olive-oil production). Most innovators belong to the food sector, coming up with something innovative every two years in average, regardless size or age. Half of the companies of the other two sectors innovate mostly by novel designs (twice a year) for the apparel industry and once a year for the furniture sector or new raw material (fabric and wood industry).

Research revealed significant sectoral differences in the way firms approach *sensing*. Food companies usually establish well organized R&D departments (8 firms out of 10), followed by established large textiles companies (4 out of 10) and develop strong linkages with academic and other research institutes. On the other hand most wood and furniture and apparel firms invest on design (whether creative or imitative) and build information and knowledge diffusion networks.

Networking is deemed important for facilitating access to strands of technology that are alien to firms, such as R&D on bio-functional food, use of innovative fibres in fabric production, or patented processes of innovative material production (e.g. WPC), stretch to new markets, or develop new business models (especially in apparel section). It appears in the forms of joint ventures, exclusive partnerships and contracts. New firms start with informal networking based on personal contacts and former relationships, while established companies use more formal ways of networking.

New-to-the-world firms are micro or small companies. They develop informal and loosely structured DCs and bear the personal touch of the entrepreneur. In accordance with Stam et al (2007) attempts to develop capabilities do not at first take the form of routines, but of trial-and-error efforts, for instance at R&D and alliances. Young firms present a weaker DCs portfolio. They develop strong sensing and seizing capabilities, but they seem to lag behind in reconfiguration. This can be attributed to their short life, and their focus on the exploitation of initial resources and opportunities. Sectoral context is significant when referring to new firms and internationalization. 3 out of 10 start-ups in the food sector strategically chose to start from foreign markets, while exporting is very limited in the wood and furniture sector, and a privilege of the older and well-established firms of the textiles sector.

Table 1: Descriptive statistics of the sample

	Wood and furniture	Food and beverages	Textiles and apparel	Total
Age				
new	6	6	2	14
established	4	4	8	16
Size				
micro	3	1	1	5
small	3	5	1	9
medium	2	3	6	11
large	2	1	2	5
Exports				
0	5	2	2	9
≤20%	1	5	2	8

≤50%	3	-	2	5
<98%	1	1	3	5
100%	-	2	1	3

Established KI companies are medium or large companies. Most present well-developed DCs. Reconfiguration capabilities are strong to address markets which are volatile due to globalization and trade liberalization. They particularly focus on learning capability to attain strategic renewal and identify new production opportunities (mainly in the textiles and wood sector), satisfy niche markets (all three sectors) or create new markets (mainly in the food sector). Large and established companies of the textiles sector have developed strong strategic competitive response capabilities to address the shifting environmental requirements of the last decade after the China's accession to the WT O.

All companies invest heavily on processes to identify target market segments and changing customers' needs proving once again that low-tech sectors are mostly market driven. On the contrary they do not develop processes to tap developments in exogenous science and technology, preferring supplier and complementors' innovations, knowledge and information.

Most companies have presented an annual increase of sales after venture creation. This is in line with the findings of Protogerou and Karagouni (2012), according to which DCs are important in traditional mature markets as significant drivers for sustaining growth. It is worth mentioning that export oriented companies (>98%) have not been affected by the current crisis. Agents comment on strong competitive advantages, investments on knowledge and innovation, nurturing the ability to create new implicit needs for global existing and emerging markets.

5. Autotelic Capabilities in KI low-tech firms

The present research revealed that the creation of new KI venture in low-tech sectors entails mechanisms and processes of selection, association and elaboration that allow an unexplored till now way of combining different and complementary information, technology, tacit and codified knowledge borrowed from various sectors, disciplines and regions in the solution of specific problems set by the agents themselves, which stimulate action through the joint contribution of various stakeholders. Consequently, the emergent innovations are both the media and the results and outputs of applying successful KIE.

We refer to this ability to achieve new forms of initial competitive advantage as "autotelic capabilities" to emphasize two key aspects within strategy perspectives. The term "autotelic" describes perfectly the endogenous character of the agents' capabilities which are responsible for KIE in TLT sectors in accordance with the views of Boccardelli and Magnusson (2006), Helfat et al. (2007) and Teece (in Felin et al., 2012) who suggest the entrepreneurial team as a source of capabilities. The term "capabilities" (replicating the relevant definition by Teece) "emphasizes the key role of strategic management in adapting, integrating, and reconfiguring internal and external entrepreneurial (*instead of Teece's organizational*) skills, resources, and functional competences to match the requirements" of a new, usually strange and ever changing (even if so-called mature) environment.

We define Autotelic Capabilities, the entrepreneurs'/ firm's abilities to engage in non-routine activities, improvisation and a paradox way of collecting and establishing knowledge assets and asset combinations in order to realize transcendent business ideas and address complex entrepreneurial environment through new ventures. ACs incorporate the search for novelty through improvisation and bricolage, and creativity through transcendental thinking to build competitive advantages at the early stages of a venture. They engage in exploration out of the boundaries of the firm and usually of the industry they belong, and are responsible for the shaping of emergent conditions by creating and not simply discovering opportunities.

ACs dimensions, bricolage, improvisational and transcendental capabilities located mainly in the entrepreneurial team, influence the location and selection of resources and skills and

engage a priori knowledge to capture existing knowledge from various domains, create and deploy novel business concepts and establish successful ventures in saturated competitive arenas (Karagouni, 2011; Karagouni and Caloghirou, 2012). TLT KI Entrepreneurs start new knowledge-intensive business, transcending traditional limits and combining several knowledge bases. They develop *bricolage capabilities* to successfully tap distributed competence and knowledge, reemploy and reframe them, and recombine them creatively, or otherwise, create a concept of intuition. This may involve scientific, technological, or practical, codified or tacit knowledge, design competence, or expertise, but it is always a matter of loosely pieces of knowledge, derived by trans-sectoral search and through networks (Karagouni, 2011; Karagouni and Caloghirou, 2012).

The initial entrepreneurial idea as shaped in the mind of the agents is repeatedly reworked in the light of new knowledge or other changes. In all case studies, the ability to create and execute new plans on the fly proved to be an important ability to possess, since all agents were often forced to make decisions extemporaneously, using only the resources available to them in the moment.

However, improvisation and bricolage capabilities, although fundamental, are not adequate to support KIE in TLT sectors. The actual and main question of KIE focuses on why and how TLT entrepreneurs create new opportunities. In entrepreneurship literature there is a common acceptance that entrepreneurs think differently and see new opportunities where most others see either a benign environment or even emerging threats (Alvarez and Busenitz, 2001). This capacity is due to *the transcendental capability*, the ability to see beyond symptomatic solutions (Senge, 1990) or simplistic combinations and come up with innovative opportunities, (Karagouni, 2011; Karagouni and Caloghirou, 2012).

The study revealed that possessing and further cultivating autotelic capabilities can be a major success factor for knowledge-intensive venturing. More specifically:

New ventures with autotelic capabilities are more likely to grow. The transcendental capability leads to the genesis of promising knowledge-intensive business concepts which support distinction and differentiation from the very beginning, by creating the potential to challenge and influence existing business ecosystems. All cases managed to pose changes to the rules of their competitive environment at sectoral, national or even global level, due to innovative products, processes, or novel models. Bricolage Capability, characterized mostly by networking and “dynamic knowledge puzzle” making, played a significant role in such new ventures, while Improvisation proved to affect innovativeness and the underpinnings of new product development. All ventures based on strong ACs presented a significant growth in sales and degree of innovativeness, while the ones that started with weak ACs, presented later a declination in both measures of firm performance.

When a new venture is established, ACs are mainly individual – centric, while later they get incorporated into the organization’s dynamic capabilities. Bricolage capability gets embedded mainly in sensing capabilities, while the transcendental capability is fundamental for all DCs. The improvisational capability, although seems to be replaced by routines and organizational patterns, can still be found in reconfiguration capabilities. Furthermore, it is always there to come up when a new venture is undertaken in corporate entrepreneurship. The relevant cases reveal an intentional shunt of routines when a new novel business concept is captured. All cases presented DCs, starting mainly with sensing and seizing, while companies that started with weak autotelic capabilities did not develop strong DCs either.

The level of human capital and initial knowledge assets of the entrepreneurial team affect the development of ACs and their relationship with the initial competitive advantage and new venture’s growth. Strong ACs presuppose at least a higher education degree, former experience, high involvement in similar activities and a deep and overall knowledge of the entrepreneurial landscape. Lack of one or more of the above characteristics led to weak ACs. This weakness affected both their innovativeness and sales growth. Besides an aspiring initial concept, these companies did not manage to exploit the benefits of the initial competitive advantages they had developed.

6. Theoretical and managerial implications

The present research explored the entrepreneurial dynamic capability perspective in the field of KIE in low-tech sectors. More specifically, we conducted an in-depth case study of thirty knowledge-intensive ventures of three representative low-tech industries and sought to discover the original entrepreneurial capabilities which create strong initial competitive advantages, as well as the existence and role of DCs in low-tech but knowledge-intensive firms.

Regarding Dynamic Capabilities, the study indicates their existence, significance and positive impact in knowledge-intensive low-tech firms of all sizes, new or established. Low-tech companies that invest and build their strategy on knowledge-intensiveness and innovation, develop relatively strong DCs to gain competitive advantages, usually resulting in niche creation, adding value and surpassing fierce price competition. While the basic micro-foundations of sensing, seizing and reconfiguring were detectable in all sampled companies, there were considerable differences due to sector, size and age.

The autotelic capabilities approach is a first attempt to touch the unexplored strategic side of the entrepreneurial start up activity in low-tech sectors. Findings justify relevant theory, such as Boccardelli and Magnusson (2006), who see the entrepreneurial team as a source of DCs and Teece who started incorporating entrepreneurial acts. Still, this research has gone further and defined a capabilities framework to assist in the understanding of how and why certain low-tech KI ventures assure competitive entrances in saturated and vulnerable markets. The iterative but unpredictable stages of selection, experimentation, improvisation and institutionalization result in routines where ACs get embedded and transformed to expressions of DCs, such as networking capability, participation in collaborations, NPD, learning and market-sensing. This is a new direction for the DCs, creating new insights on their origins, the content and development.

The ACs concept contributes to the literature on strategic management, dynamic capabilities and entrepreneurship in several ways, challenging multiple aspects of research and theory grounding. To our knowledge, it is the first attempt to connect the two fields of strategic and corporate entrepreneurship highlighting the major problem of new venture creation under the scope of strategic management and expanding the capabilities view to corporate and knowledge-intensive entrepreneurship. The conceptual framework advanced can assist entrepreneurs/ managers select priorities and make relevant strategic decisions.

In particular, managers within low-tech industries can also use DCs as tools to manipulate their firms' competences enhancing performance, while the ACs framework facilitates the start of any new knowledge-based venture in low-tech sectors. Entrepreneurs should balance all three autotelic capabilities that provide competitive advantage when crafting their strategies which is missing from the relevant literature so far.

7. Implications for Theory and Future Research

The present research is a first endeavour to approach KIE in a holistic way starting from the start-up stage and extending to the firm-level competitive strategy. Although the study bears certain limitations, such as problems associated with the level of the interviewees' objectivity, it certainly creates new and enriches existing frameworks, since it expands to entrepreneurial functions which provide initial competitive advantages to new ventures and then get embedded in DCs i.e. managerial capabilities for sensing and seizing opportunities (Teece, 2007) or human capital and covers low-tech, traditional industries in a national and sectoral context.

Further theoretical and empirical research is needed to establish the existence of ACs, describe dimensions, their measures, the mechanisms of their embedness and existence as DC expressions and construct a compact and comprehensive relevant theory on low-tech KI entrepreneurship. Some other areas of research would be the evaluation of the relationship between ACs and performance, inclusion of the rest low-tech industries, existence of ACs in high-tech and the impact of environment. The findings also raise a plethora of questions on the role and nature of DCs, as well as their relationships with knowledge-intensiveness and specificities of low-tech sectors.

8. Conclusion

The competitive arena in low-technology industries such as textiles, furniture, and food has nowadays become global, demonstrating the need for an expanded paradigm to understand how competitive advantage is achieved at the very outset of a new venture which can promise survival and growth. The present research presented the Autotelic Capabilities framework and highlighted the importance of ACs as entrepreneurial dynamic capabilities in the achievement of initial competitive advantages for KI low-tech enterprises. We have also drawn some attention on the existence of dynamic capabilities in low-tech firms, which is to our knowledge among the first attempts in low-tech arenas. Our discussion sets an agenda for research on several issues and invites future empirical examinations of how KIE is established in both low and high tech sectors as well as relations and interactions among autotelic and dynamic capabilities.

The autotelic capabilities framework comprises a rather aspiring research agenda. The fields of strategic management, entrepreneurship, innovation, knowledge, manufacturing and business management should be engaged in order to unlock the riddles behind the term of KIE in low-tech sectors within today's complex business environments.

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