How to learn right? Commercialization capability development in innovative start-ups

Tuula Lehtimäki

Oulu Business School, P.O. Box 4600, 90014 University of Oulu, Finland.
E-mail: tuula.lehtimaki@oulu.fi

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Abstract: Start-ups with innovative products often struggle with commercialization and run out of resources before they learn what to do. Does it matter in which order and in which areas firm learn? Capability development is examined here as a zigzagging learning process that moves between three areas: strategic commercialization, market creation and preparation, and sales creation and development. In addition, supporting technical, managerial, and operational capability development is examined. The paper presents initial findings from a longitudinal case study focusing on two firms established in 2011. The analysis presents the commercialization processes and commercialization capability build-up. It seems that it is good to start developing capabilities in all three areas early on; especially market preparation and sales initiation cannot be ignored. However, without supporting capability development in management, and extensive building of a supporting network of collaborators and partners, the process seems to linger.

Keywords: Capability development; case study; commercialization capability; commercialization process; entrepreneurship; innovative products; learning; marketing; qualitative study.

1 Introduction

Only successful commercialization realizes the profit potential of new innovative products (Jolly 1997) but the uncertainties related to timing, technologies, markets, and the organization and its resources create challenges for commercializing new innovative products (O'Connor & Rice 2013). Firms often have to develop new resources, knowledge, skills and competences in order to succeed with commercialization of an innovation (Leifer et al. 2000; McDermott & O'Connor 2002). In such cases there might not be a general pattern of commercialization activities but circles of probing and learning (Lynn et al. 1996). Many innovations come from technology-based, born global start-ups (e.g. Baumol 2004), but they face the risk of running out of resources before they learn what to do.

How start-ups with limited resources and skills could develop their commercialization capability effectively. More specifically, considering the progress and outcome of the commercialization

process, does it matter what and in which order firms learn? For example, firms stumble when they push sales aggressively, in hope of profits, before they have learned the value of the product for the customer (Aarikka-Stenroos & Lehtimäki 2014). On the other hand, it is important to start experimenting with the market early enough because that facilitates learning (e.g. Lynn et al. 1996). Understanding better the link between the learning patterns and commercialization capability development could help to avoid some of the turns of the commercialization process. Commercialization capability and especially its development is an under-researched area. Some general models for the life-cycle, evolution or development of capability development have been presented (Helfat & Peteraf 2003; Montealegre 2002), but studies have not pinpointed commercialization capability - what it is - or its development.

This study aims to understand commercialization capability build-up especially in start-ups with innovative products. The research questions are 1) what kind of learning patterns start-ups experience when commercializing their innovative products? and 2) how does commercialization capability accumulate via those patterns? The study is carried out as a longitudinal multiple case study. This paper presents an initial analysis of ongoing commercialization efforts of two firms, established in 2011, that have reached initial international sales but have very different situations.

The paper proceeds as follows. First, the loose theoretical frame for examining commercialization capability development is presented, which is followed by a methodological chapter. After that, brief case descriptions and initial findings are presented and discussed with limitations and further research ideas.

2 Theoretical background

2.1 Commercialization of innovative new products

In innovation and new product development literature, commercialization is often described as a third phase of NPD or innovation process, following discovery/ideation and development/R&D (e.g. Brettel et al. 2011; Datta et al. 2015). However, many authors see commercialization to start early on along the technical development and to happen through a cross-functional process that includes activities from ideation to the scaled sales (Aarikka-Stenroos & Lehtimäki 2014; Datta et al. 2015; Dutta et al. 1999; Mitchell & Singh 1996; Nevens 1990; Prebble et al. 2008; Prenkert 2012). Relying on the latter view, commercialization refers here to the commercial and marketing aspect of the innovation process that develops along the technical side of the innovation process (Prebble et al. 2008). It includes the needed activities and decisions that develop the market, link and diffuse the proposed innovation with the market, gaining some of the mainstream market (Datta et al. 2015), and profit (Jolly 1997).

Commercialization processes include similar activities for more and less innovative products but in case of innovative products activities form cycles of probing and learning with varying focus (Lynn et al. 1996), revolving around marketing strategy development, market development and sales development (Aarikka-Stenroos & Lehtimäki 2014; Costa et al. 2004). In this study these three domains are used to map the emerging commercialization learnings and capabilities (see e.g. Aarikka-Stenroos & Lehtimäki 2013). Strategic commercialization includes, besides developing marketing strategy, identification of relevant stakeholders, identification of the benefits of the users' perspective, and development of knowledge about the market. Market creation and preparation refers to credibility building for the firm and the in novation, involvement and activation of stakeholders, demonstrating and communicating the benefits of the innovation, building awareness, and educating the market. Creating and developing sales includes stakeholder mobilization to initiate and promote sales, and acquirement and involvement of reference customers. The process of commercialization does not proceed in a straightforward manner but may go back and forth while the different domains are refined and worked on. (Aarikka-Stenroos & Lehtimäki 2014.) The same is assumed to apply to learning and capability development patterns.

2.2. Commercialization capability

Capabilities are about "what a firm can do" (Zahra et al. 2006), and they require coordinated behaviour (Nelson & Winter 1982). Capabilities differ from resources in that they reflect a firm's abilities to integrate, build and reconfigure resources so that they can perform distinctive activities (Teece, Pisano & Sheun 1997); here, commercialization. For a complex activity such as commercialization it might not be enough to consider only the operating routines or repeatable processes as an analytical focus (see O'Connor 2008). Capability is understood as a collective construct, emerge from interactions between individuals, social processes, and structure (Felin et al. 2012). Especially young and small firms commercializing their innovative new products face pressure for establishing new organizational units and functions and changing how different units and processes work together (Marx & Hsu 2015).

Commercialization capability is here considered as a summative capability that includes both ordinary sub-capabilities, that are more routine-like, but also dynamic sub-capabilities that make it possible to change and develop the ordinary capabilities, and adaptive capabilities that are explorative and outside-in-orientated (see Day 2011), or that can shape business ecosystems through interaction with other actors (Teece 2007). As a result, a firm with a strong commercialization capability can adjust and develop its processes and activities to fit the market, and even develop and create markets. Summarizing existing commercialization capability definitions, commercialization capability is defined here as a firm's ability to bring a technological innovation to market and reach some of the mainstream, beyond the initial adopters (Datta et al. 2015), and to generate profits (Jolly 1997; Chang et al. 1999), including the necessary technical, operational and marketing aspects and their interaction and integration (Aarikka-Stenroos & Sandberg 2012; Lee 2009; Prebble et al. 2008; Story et al. 2011). In this study commercialization capability is studied firstly as a firm's ability to do something. The ability needs to be linked to the mentioned three domains of commercialization. Also supporting managerial, technical or operational capabilities are examined as they are necessary for commercialization.

2.3 Capability development in a start-up

Creation of capabilities necessitates learning (Eisenhardt & Martin 2000; Helfat 2000). However, not all learning is deliberate but happens when operating the business (Prashantham & Floyd 2012). Improvement of existing capabilities or development of new capabilities can happen via variation in routines and the reflectiveness of decision makers and other actors about action-outcome relationships (Zollo & Winter 2002), for example. Learning can be based on repeated practice, past mistakes and the pace of experience (Eisenhardt & Martin 2000).

International new ventures improvise when they have no prior experience on the matter, which leads to effective development of new capabilities, whereas when they have relevant experience, trial-and-error learning leads to existing capability development (Prashatham & Floyd 2012). This emphasizes the action-taking logic and relates to effectuation logic as entrepreneurs develop their business in an iterative and interactive way (Sarasvathy 2001). International new ventures often learn from operating their business instead of having specific learning tasks, due to their resource limitations (Prashantham & Floyd 2012). In conditions of uncertainty, experimentation increases (Chandler et al. 2011), and learning oriented activities and exploration are highlighted (O'Connor 2008; Coviello & Joseph 2012). However, in this study, learning processes and mechanisms are not that much of interest. Instead, focus is on what is learned and how that is reflected in what the firm is capable of doing.

Entrepreneur's prior knowledge base and intensity of effort (absorptive capacity) in learning affect greatly the whole organization (Kim 1998), and its capability development (Prashantham & Floyd 2012). To overcome the limitation of small personal and managerial resources of smaller firms, customers and suppliers are important sources of learning, but even then new knowledge is often

channelled via the entrepreneur (Jones & Macpherson 2006). Reflection is needed in improvisation as well as in trial-and-error learning (Prashantham & Floyd 2012). However, Feldman and Pentland (2003) remind that reflection is not enough – decision makers often reach wrong conclusions and may fail to learn from their experience. In addition, not all learning is useful (Prashantham & Floyd 2012).

2.4 Conceptual framework

To summarize, previous research has presented innovation commercialization as a zigzagging process with three main areas, some definitions for commercialization capability, and identified learning as a basis for capability development. This study draws from such research to build a loose conceptual framework to analyze commercialization capability build-up process in start-ups with innovative new products (Figure 1).

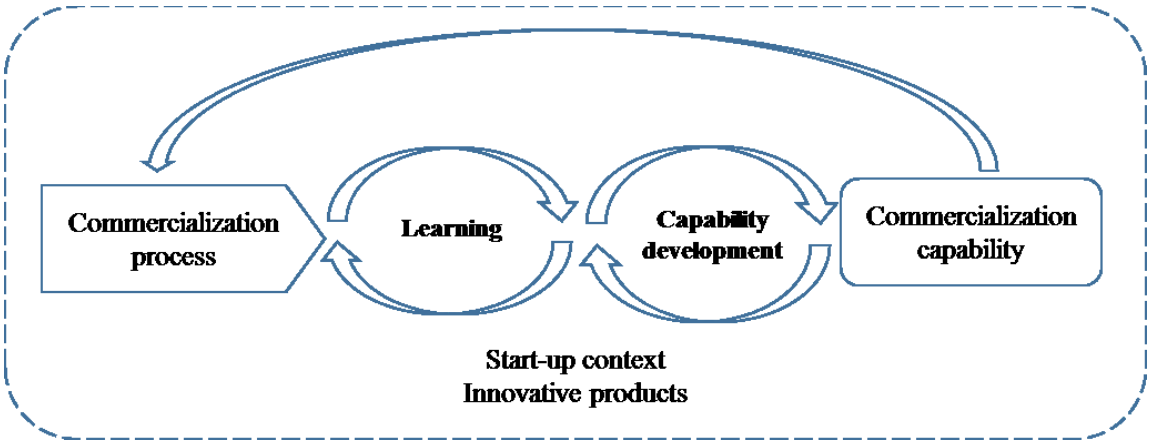

Figure 1 Conceptual framework.

The analysis focuses on identifying what is learned and how that builds the commercialization capability in start-ups with innovative products. That framework guides the empirical examination and it is expected to be refined and enriched during the research process.

3 Methodology

This qualitative longitudinal multiple case study (Yin 1989) relies on abductive approach where theoretical and empirical understanding develop in interaction (Dubois & Gadde 2002). The qualitative research methods are used in this study, as it is not purposeful here to examine the subject in terms of quantity, amount intensity, or frequency (Denzin & Lincoln 2000, 8). This study focuses on two technology-based start-ups that were established in 2011 and which have innovative products aimed at global markets.

Data has been gathered since 2014. There are 5 in-depth interviews with founding partners (altogether 30 000 words), firm documentation, news (37 pieces), and other public material and information, making data triangulation possible. The data gathering will stop when the data does not add to the reached understanding about the phenomenon the firm reaches some of the mainstream market (Datta et al. 2015).

Analysis is based on the overlapping phases of data reduction, data display and conclusion drawing (Miles & Huberman 1994). The analysis utilized the theoretical framework to categorize and reduce the data. First the commercialization processes were mapped out, together with the explicit and implicit learnings. Based on the events and learnings, the development of capabilities was analyzed.

These findings were merged in a table, where each row summarized one year's events, learnings and capabilities.

4 Initial findings

Table 1 summarizes commercialization events and capability development in the cases.

Table 1 Overview of the capability development

Year	Firm *Medical*, medical device	Firm *Air*, an indoor air solution
2010	The idea was born and they soon started to contact customers for testing the idea, and agreed on field tests with one potential customer. STRATEGIC: benefit identification, positioning, stakeholder identification *OPERATIONAL: applying funding* *TECHNICAL: ideation and product concept development*	The idea was born and soon a supporting team of experts from versatile fields was formed. STRATEGIC: benefit identification *TECHNICAL: prototype development and manufacturing, ideation* *MANAGERIAL: acquiring external know-how*
2011	They got a patent, made protos for field tests, started to develop the next version based on the feedback, and continued to collect versatile feedback. Lack of management in product development. STRATEGIC: benefit identification *TECHNICAL: concept development, manufacturing preparation* *MANAGERIAL: utilizing expert know-how and resources for product development*	New proto was developed based on the invention and tested with one potential customer. The test was successful and they acquired some lab test evidence for the benefits. They started to sell the product already and got some sales. STRATEGIC: benefit identification, stakeholder identification, sales orientation, vision, target market identification MARKET PREPARATION: credibility building, benefit communication SALES: initiated, removing sales obstacles *TECHNICAL: product development* *MANAGERIAL: purposeful recruitment, setting targets, persistence, confidence in the idea, utilizing varied external resources*
2012	Medical device approval received and manufacturing started. Funding from public sources. Tests with a customer. STRATEGIC: market segmentation, benefit identification *OPERATIONAL: gathering public funding*	Product development. 3 persons in the firm, turnover grows. SALES: grown *TECHNICAL: product development*
2013	Sales started. Active feedback collection continues. Products are sold with compensated price or given for free to trigger use. First two real customers and first important reference customer. Manufacturing capability was not ok. Financial difficulties continue. STRATEGIC: benefit identification, product adjustment MARKET PREPARATION: credibility building through a reference customer SALES: started, utilizing reference customers	Research activities to build evidence for the benefits. Strong growth of sales. 6 persons in the firm. MARKET PREPARATION: credibility building SALES CREATION
2014	Difficulties with subcontractors, manufacturing and product development, delays. Some international sales and distribution negotiations. Utilizing public organizations for product development. External help for contacting prospects. STRATEGIC: product adjustment, market	Research activities continue, sales grow a bit, and new product variants have been developed. Wants to partner with bigger firms to develop joint offerings. Clear plans (also partnering) for internationalization. About 20 persons in a firm. STRATEGIC: benefit identification, business model development, stakeholder identification, planning ahead,

	knowledge development, positioning, segmenting, business model, internationalization plan, identifying stakeholders MARKET PREPARATION: benefit communication, market education (started), awareness (started) SALES: continued but limited and domestic (Difficulties to find committed distributors)	market knowledge development MARKET PREPARATION: credibility building (strong), benefit communication adaptation, market education, awareness SALES: continues, international sales, removing sales obstacles *TECHNICAL: continuous product development* *MANAGERIAL: active partnering for various activities, values put into practice, rapid trial and error approach, entrepreneurial attitude, management of growth* *OPERATIONAL: gathering private and public funding*
2015	New private funding, new customers, new feature development. Temporary dismissal of personnel. MARKET PREPARATION: awareness, credibility building SALES: continued (small), domestic *TECHNICAL: continuous product development*	Brand is renewed, product development continues, operations are scaled up for internationalization, more evidence for benefits, partnering strategy continues, strong growth. STRATEGIC: product portfolio development, positioning, stakeholder identification MARKET PREPARATION: credibility building, benefit communication, awareness SALES: activating stakeholders for internationalization, removing sales obstacles *TECHNICAL: product development* *MANAGERIAL: continuous development, growth management, partnering, acquiring external expertise* *OPERATIONAL: acquiring public and private funding, scaling-up operations*
2016	New CEO, replaced by another new CEO (not a founding member) by the end of the year. Some small international sales. Negotiating new strategic partnership for marketing, sales and distribution. Previous distributors/retailers have sold nothing. New feature ready. Change of the primary target customer group, and product development to fulfil their needs better. Clearer evaluations of market potential. Confidence in firm's possibilities grows. Different visions for growth paths. STRATEGIC: vision, target market refinement, market knowledge development, plans for growth, identifying benefits, identifying potential partners MARKET PREPARATION: benefit communication adjustment *TECHNICAL: 3 ready products, continuous development* *OPERATIONAL: acquiring private funding* *MANAGERIAL: changing strategy, reacting to challenges, reflection, building strategic partnerships, utilizing external know-how*	Several new reference customers used in marketing communication. New product sales started, new countries entered and plans for expansion. Awareness has grown in Asia. The partnering strategy continues. Brand renewed again and launched internationally. Cooperative product development with various stakeholders. New supporting research evidence for the benefits. Process and organization development to manage growth. STRATEGIC: market knowledge development (international), positioning, vision, product strategy, business model development MARKET PREPARATION: involving stakeholders for different purposes, benefit communication adjustment, awareness, market education, credibility building (strong) SALES: removing sales obstacles, continued, campaigns *TECHNICAL: product development (product very reliable)* *MANAGERIAL: partnering for growth and internationalization, focused resource use, continuous development, growth management, purposeful recruitment, values put into practice, clear mission, fast trial and error, setting targets, reflection* *OPERATIONAL: gathering private and public funding*
2017	Takes part in some exhibition. Has not publicly told about its changes or negotiations or sales. The new version of the product is about to remove some sales obstacles.	Announced a new partnership for entering the USA. Global brand launch planned before entering Asia. Collecting new funding. Some changes to personnel. *MANAGERIAL: strategic partnering for internationalization and growth* *OPERATIONAL: acquiring funding*
Notes	The net result has been negative, personnel has varied between zero and three.	Turnover and the personnel have grown rapidly. Has received funding well from private and public sources. Net result currently negative.

The market potential for both products is still remarkable and global. However, the commercialization capability development has been slower and more limited in Medical than in Air.

Medical started with no full-time manager and with very limited resources. Its commercialization capability development has not been that much focused on market creation and preparation, and sales creation and development, as it has been in Air, especially during the first three years. Medical has missed throughout its process resources, a clear marketing strategy, growth strategy, and targets. It has used some external know-how and resources for its product development, but not on market preparation or sales. It has used a lot of effort to collect feedback from potential customers and developed product variants, and its recent new marketing strategy requires again a new product variant. It has applied for medical device approval several times. The firm has struggled in many managerial areas, leading to difficulties in product development schedules, gaining funding, and building up a partner base. That has slowed down its progress and perhaps hampered its credibility. It has reached only marginal international sales. Currently it is reconsidering its strategy and partners for marketing, sales and distribution.

Air has been interacting with various types of external stakeholders from the beginning, has passion and prior entrepreneurial experience, and has had visions, targets, and plans from the start. The founding members had different but matching know-how and entrepreneurship experience, which the entrepreneurs in Medical not have, even though they had experience from the industry. The firm has utilized a versatile network of collaborators for product and market development and sales creation, and attracted investors. Partnership building is central for its internationalization and growth. It has invested in product development but in market creation and development as well. The firm has systematically developed its business model to remove buying obstacles. It has succeeded to create awareness even internationally, but sales are still developing. They recently announced a new strategic partner for internationalization. Air has been able to gain a versatile base for its commercialization capability and already during the first years it worked on market and sales creation. Managerial capability build-up has been extensive throughout the process compared to Medical. Credibility building and stakeholder involvement capabilities ere stronger than in Medical.

Based on initial results, firms experience some similar learnings but in different order and with different domains of commercialization emphasized, and the scope of capability development patterns varies. As noted by Aarikka-Stenroos and Lehtimäki (2014), neglecting market creation and preparation causes often problems for commercialization. From the capability development perspective, and especially in start-ups, it seems to be stressed that firms need to cover all areas of commercialization rather quickly to test their idea, gain credibility, and to prepare the market to initiate sales so that they do not consume their resources, and can gain further funding. Too much focus on product development in the beginning might take attention from market preparation and sales initiation. Starting test-sales quickly has to be done to develop the strategic approach and to serve market preparation.

Besides the three domains of commercialization, capability development must happen from the beginning in all supporting domains: technical, managerial, and operational. Especially managerial capabilities are important for taking the firm forward and giving direction (importance of the entrepreneur(s)), as well as varied utilization of various external resources.

Further analysis will focus on refining and visualizing the actual learning and capability development patterns, and analyzing the link between them. It seems that many obstacles exist that hinder learnings from turning into capabilities, and these will be investigated.

5 Discussion

The study adds to understanding of commercialization capability development process in start-ups with innovative new products. The study will eventually present a commercialization capability

development roadmap for such firms. The main contribution of the study will add to understanding of the commercialization capability development process. For managers, the results will likely present diverse patterns for commercialization capability build-up and other start-ups can perhaps avoid some of the drawbacks.

There are some limitations for the current study, such as limited database, ongoing analysis and data gathering, and the still evolving theoretical framework. The difficulties of operationalizing learnings and capability development are also acknowledged. Also periodical data collection emphasizes learnings at some points so it is difficult to know exactly when some learning has occurred or a capability emerged. However, commercialization processes are long, and the overall picture is still encompassing.

These initial findings already show that it matters on which areas you start to experiment and when. That encourages further research on agile learning through "fast failure" when bringing innovations to market.

6 Areas for feedback & development

What alternative theoretical discussions or innovation management viewpoints there could be? How to overcome problems with operationalizing learning and capability development? The data is rich and gives many possibilities. What else could be interesting here?

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