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# Organisational capabilities and the long-term survival of new technology-based firms

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## Abstract

**Purpose** – This study aims to analyse organisational capabilities among new technology-based firms (NTBFs) and examine how these capabilities are linked to the firms' long-term survival.

**Design/methodology/approach** – The study leverages a data set of 131 NTBFs located at 16 incubators in Sweden. The first part of the analysis seeks suitable organisational capabilities as determinants of firm survival. The second part is a statistical analysis. The organisational capabilities comprise six variables concerning business experience, financing and international markets.

**Findings** – The study comprises two data collections, with the first data collection being conducted in 2005, and the second in 2014. The survival rate for these firms was 55 per cent according to their respective annual reports in 2013. First, this study showed that the logistic regression model that included the three organisational capabilities is significant. Second, one variable is significant at the variable level: business experience. In addition, the control variable firm size is also significant.

**Originality/value** – Further empirical research in this area is required as the current research on organisational capabilities is quite limited and mainly conceptual in nature. Very few related studies focus on NTBFs and their survival. This study demonstrates a significant logistic regression model to determine links between organisational capabilities and firm survival.

**Keywords** Business performance, Resources, Survival, Technology management, Organisational capabilities, New technology-based firms

**Paper type** Research paper

## Introduction

Because new firms have high mortality rates, very few survive their early years (Dunne *et al.*, 1988; Audretsch, 1995). Thus, during times of economic difficulties, policy makers and researchers focus on new venture creation. The five-year survival rate of European enterprises founded in 2005 is 46.4 per cent (Eurostat, 2013). However, the economic impact includes both survival and growth rates, as some industry sectors experience higher growth rates among their survivors, creating a greater overall economic impact, even if a specific sector is losing more firms than other sectors, for instance, employment growth was stronger in the information sector than in education, despite the fact that the former experienced a lower survival rate (Knaup and Piazza, 2007).

Therefore, based on start-up failure rates, it could be considered that something is amiss in the method of new start-up firm creation, and the organisation's capabilities during the firm's first years. However, firm death rates could also reflect the process of creative destruction (Schumpeter, 1942). It is generally recognised that in technologically intensive industries, competitive new firms need resources and

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capabilities aside from the actual technology and innovation is not equivalent to commercialisation, which implies the long-term ability to deliver new knowledge, concepts and products to the market. The feedback loop from innovation performance to business performance is hence important according to Löfsten (2014). While we acknowledge the start-up activities that lead to successful firm formation (Newbert and Tornikoski, 2012, 2013), or the configurations that must be in place for a firm to grow (Wiklund and Shepherd, 2005), we know relatively little about how organisational capabilities at the time of inception create a foundation for future survival.

Existing literature on organisational capability is based on the resource-based view of firms (Penrose, 1959; Wernerfelt, 1984; Barney, 1991; Grant, 1996) and describes how firms allocate their resources to develop a competitive advantage (Nonaka and Kenney, 1991). Moreover, according to the dynamic capabilities perspective, the resource base must be reconfigured and developed to adapt to changes in the environment (Teece *et al.*, 1997; Eisenhardt and Martin, 2000; Zollo and Winter, 2002; Helfat and Peteraf, 2003; Teece, 2007; Richtnér and Löfsten, 2014). Prior research has mainly focused on firms' innovation capabilities (Francis and Bessant, 2005; Assink, 2006; Colarelli O'Connor, 2008; Colarelli O'Connor *et al.*, 2008; Danneels, 2011; Börjesson and Löfsten, 2012).

However, research in this area is quite limited and mainly conceptual; therefore, there is a need for more empirical studies (Zollo and Winter, 2002; Helfat *et al.*, 2007). Furthermore, only few organisational capability studies focus on new technology-based firms (NTBFs) and their survival. NTBFs are not different from any other small business: they often have an inexperienced management team with a limited track record and may well be seeking to address new markets with new products. Therefore, this study focuses on the relationship between core organisational capabilities for firm survival.

This study aims to analyse the organisational capabilities among NTBFs and examine how these are linked to the firms' long-term survival. The empirical setting comprises 131 NTBFs based out of university-affiliated incubators in Sweden in 2005. The remainder of this paper is organised as follows. Section 2 provides a brief discussion of the important organisational capabilities related to firm performance, and Section 3 describes the study's empirical setting. Section 4 presents the empirical evidence and discusses the empirical results, and, finally, Section 5 concludes the study. Furthermore, this study extends the existing literature by exploring how NTBFs can link organisational capabilities in an entrepreneurial environment (incubators) to firm survival.

## Literature and research propositions

### *Organisational capabilities and the resource-based view*

According to Daft (1983), company resources include all assets, capabilities, organisational processes, information, knowledge, attributes and so on controlled by a firm. These firm-specific heterogeneous resources can be classified into three categories of capital resources: physical (plant and equipment), human (skills and knowledge) and organisational (capabilities associated with formal and informal planning, controlling and coordinating) (Barney, 1991). Distinctions may also be drawn between static and dynamic resources based on recent advancements in the resource-based theory (see for example Acedo *et al.*, 2006; Barney and Clark, 2007; Barney *et al.*, 2001).

Firm or capital resources are often referred to as *capabilities*, and Tyler (2001) notes that in some cases, physical, human or organisational assets may surpass similar assets of most competing firms, where the technological capabilities are the technical assets of the firm. *Organisational capabilities* refer to a firm's ability to deploy its available resources as its main assets (Prahalad and Hamel, 1990). Helfat and Peteraf (2003, p. 999) define organisational capabilities as "the ability of an organisation to perform a coordinated set of tasks, utilising organisational resources for the purpose of achieving a particular end result". Organisational research then suggests that firms in dynamic environments with high levels of information processing, communication and knowledge transfer are more likely to develop competencies resulting in a technology innovation compared to firms in the same type of environment with lower levels of cooperative resources (Henderson and Cockburn, 1994; Coff, 1997).

Christensen (1997) determines an organisation's capabilities as comprising resources, processes and values. Leonard-Barton (1992) describes this as the set of knowledge that provides competitive advantage. Thus, a firm's capabilities have four dimensions:

(1) employee knowledge and skills;

(2) technical systems;

(3) managerial systems that guide knowledge creation and control processes; and

(4) the values and norms associated with these processes.

*Research propositions*

Gimeno *et al.* (1997) studied 1,547 entrepreneurs in the USA and found that prior managerial and entrepreneurial experience positively affected new firms' economic performance, but did not influence their survival. Chrisman and McMullan (2004) surveyed 159 USA-based small business development centres and found that previous entrepreneurship experience had no effect on new firm growth. However, Colombo and Grilli (2005) examined 506 NTBFs in Italy and found that prior entrepreneurship experience influences growth, which is consistent with the competence-based theories, and the results indicate that the nature of the founders' education and prior work experience are key factors contributing to firm growth. They state that founders' years of university education in economic and managerial fields, and to a lesser extent in scientific and technical fields, positively affect growth, while that in other fields does not. Similarly, prior work experience in the same industry is positively associated with growth, while that of working in other industries is not. Colombo and Grilli (2005) also provide evidence of synergistic gains from the combination of the founders' complementary capabilities relating to economic-managerial and scientific-technical education and technical and commercial industry-specific work experiences.

West and Noel (2009) analysed 83 new firms in the USA and observed that founders' previous start-up experience had no impact on new venture performance. LeBrasseur and Zinger (2005) report the results of a longitudinal study into management capability and its relationship with new firm survival/failure, wherein the researchers tracked 115 surviving very small firms that were launched during 1997-1999, and compared them to 69 firms that had failed during these years. Their findings indicate that management capability enhances new firms' survival. Thus, our first research proposition is:

*RP1*. New technology-based firms with higher levels of business experience will have a higher survival rate.

Furthermore, this study assumes that both a firm's financing situation and its connection to international markets are important organisational capabilities. Obtaining funding is one of the major difficulties that NTBFs face. Mason (2009) claims that small firms' ability to access finance is hindered by persistent market failures, which, in turn, create funding gaps for new businesses, particularly in technology sectors, seeking small amounts of funding. Further, Mason states that in the past decade (longer in the UK), both the EU and Member States have increasingly focused on the informal venture capital market to increase the supply of early-stage venture capital, and recommends that governments should invest in methods to accurately measure investment trends in the early-stage venture capital market, specifically angel investment activity.

Aaboen *et al.* (2006) surveyed 183 general Swedish NTBFs and found that private sector organisations (banks) and families are most frequently consulted for financing. In these circumstances, founders must personally provide the initial finance to get started, and personal savings were the most important source of finance for 56 per cent of new independent firms (Storey, 1982). Thus, it is challenging for NTBFs to obtain funding, and self-financing is the dominant source for small firms (Lindelöf and Löfsten, 2002). Thus, our second research proposition is:

*RP2*. New technology-based firms with higher levels of financing will have a higher survival rate.

Aaboen and Löfsten (2015) confirm the literature describing how export activities may be a way to develop new international ventures, and this applies to firms working from incubators. However, they were only able to partly confirm that firms are more likely to focus on international markets if they perceive that their markets are competitive and developing quickly. Small, independent firms have problems developing their innovative capabilities due to the costs of market and technological development and integrating knowledge within the organisation. Innovation capability relates to technology and market development, where small firms' limited resources create difficulties in overcoming internal and external restrictions to develop the innovation (Aaboen and Löfsten, 2015). There are some reviews on international new ventures/entrepreneurship and how NTBFs enter and expand into foreign markets, for example, Oviatt and McDougall (1994) and Knight and Cavusgil (2004), in addition to important empirical research on new/small technology-based firms such as by Preece *et al.*, (1999), Autio *et al.* (2000), Coeurderoy and Murray (2008) and Jones *et al.* (2011).

Information about customers' location shows whether firms are linked to local, national or international markets, and, accordingly, indicates their potential for growth and survival. Thus, geographic markets (global market) are a significant variable. Independent technology firms have a much wider market distribution throughout the UK and abroad than what is typical of other small firms (Monck *et al.*, 1988). Market research and market planning are important (Löfsten and Lindelöf, 2002). This is not surprising, as the high-technology market is international, and the opportunities for high-technology-based products are not geographically constrained. Thus, given the short product life cycle of many technology-based products and services, it is imperative

to quickly reach a large international market to exploit the product's profit potential (Löfsten and Lindelöf, 2002). Thus, our third research proposition is:

*RP3.* New technology-based firms with a higher proportion of international markets will have a higher survival rate.

## Research methods and sample

### *Variables and statistical methods*

The empirical data were collected through an initial questionnaire in 2005, and a second in 2014 to analyse firm survival and performance. It comprises 14 variables composed of the dimensions listed in Table I.

*Dependent variable.* The dependent variable is firm survival (1/0), which is a relevant measure of firm performance when firms are young (Geroski, 1995). The data also include a number of firms wherein the ownership changed through a merger or acquisition (3.1 per cent of the observations), and this can confound estimates of organisational exit (Cefis and Marsili, 2011).

*Independent variables.* The variables in this study account for several NTBFs' organisational capabilities, such as business experience, financing and international markets (six variables). Business experience in small high-tech firms, generally, refers to the work experience and education of the few employees and the extent to which these are or not broad and multidisciplinary (Comparable measures: Colombo and Grilli, 2005; West and Noel, 2009; Börjesson and Löfsten, 2012). Obtaining funding is one of the major difficulties that NTBFs face (Comparable measures: Storey, 1982; Lindelöf and Löfsten, 2002; Aaboen *et al.*, 2006, 2011). Information on the location of customers shows whether firms are linked to local, national or international markets, and thereby indicates their potential for growth and survival (Comparable measures: Monck *et al.*, 1988; Löfsten and Lindelöf, 2002; Aaboen and Löfsten, 2015).

| Variables | | Mean | SD | Scale |
|---|---|---|---|---|
| *Independent variables* | | | | |
| 1. | Business experience – CEO | 0.745 | 0.440 | 1/0 |
| 2. | Business administration courses – CEO | 0.546 | 0.500 | 1/0 |
| 3. | Financing last three years (since firm start) | 2.421 | 1.076 | 1-5 |
| 4. | Capital structure – own capital – CEO | 74.469 | 36.855 | % |
| 5. | Markets – the rest of Europe | 9.299 | 20.996 | % |
| 6. | Markets – the rest of the world | 11.103 | 24.974 | % |
| *Control variables* | | | | |
| 7. | Firm start – importance of R&D from university | 2.702 | 1.753 | 1-5 |
| 8. | Firm start – importance of R&D from industry | 2.706 | 1.434 | 1-5 |
| 9. | Business administration courses – incubator support | 1.931 | 1.453 | 1-5 |
| 10. | Financing – incubator support | 3.102 | 1.379 | 1-5 |
| 11. | Ability to export – incubator support | 1.207 | 0.885 | 1-5 |
| 12. | Firm size – sales | 1,679 226 | 7,533 985 | SEK |
| 13. | Firm size – employment | 2.069 | 4.101 | Number |
| *Dependent variable* | | | | |
| 14. | Firm survival | 0.550 | 0.499 | 1/0 |

**Table I.** Variables in the study

*Control variables.* These variables account for the importance of R&D at firm launch – university or industry, incubator business support and firm size. Small high-tech firms are new firms established with the purpose of exploiting a technological innovation associated with a high-technological risk. Lindelöf and Löfsten (2002) argue that it is obvious that small high-tech firms located in incubators and science parks have higher R&D intensity than off-park firms have in terms of importance of R&D for starting a firm (Comparable measures: Löfsten and Lindelöf, 2002; Lindelöf and Löfsten, 2006; Börjesson and Löfsten, 2012). Innovative start-ups are, according to Baumol (2002), an important driver of economic growth in capitalist economies, but there is still no consensus on what effect innovation has on start-up performance. Some studies reveal a positive effect on the growth of new (Deeds, 2001) and small firms (Storey, 1994; Roper, 1997). However, others have found no evidence (Freel, 2000; Winters and Stam, 2007) or even a negative effect (Freel and Robson, 2004).

Links to higher education institutes are assumed to encourage innovation and production (Westhead and Storey, 1994). Tesfaye (1993) has identified several variables that differentiate small high-tech firms originating from an academic environment and those from the private sector. The results indicate that university spin-offs are more likely to base their operations more on high technology and less on business experience. The opposite is assumed for corporate spin-offs. Tesfaye does not draw any conclusion from these results regarding firm performance. However, Cooper (1984) and Smilor *et al.* (1990) argue that corporate spin-offs tend to have a higher growth rate than university spin-offs.

The three control variables regarding incubator support are intended to separate firm-related performance (survival) and the incubator's impact. The control variables and their associated questions are subjective measures of satisfaction with what the incubator environment had contributed to the firm's ability to perform, obtain resources and the ability to monitor the environment. "Normal" incubating activity involves offering a set of basic services to NTBFs, including space, infrastructure, markets, financing and information regarding communication channels, among others. The control variables are measured on a 1-5 scale, ranging from "not important" to "very important". There were also two control variables with reference to firm size (sales and employment).

University business incubators are generally located on university premises, owned by a university, or have university faculty involvement in their operations (Mian, 1996; Lalkaka, 2001). Business incubator performance is also rarely studied, with researchers stating that it is difficult to measure the effect of business incubators (Bearse, 1998; Voisey *et al.*, 2006), and according to Hackett and Dilts (2008), academic researchers have struggled to define and develop a theory to explain incubator performance. However, this study is only interested in the firms' performance; therefore, the control variables were created to separate the performance due to the firms' capability from the impact of the incubator.

The statistical analysis was conducted in two steps:

(1) A correlation analysis (Pearson correlation: correlation significant at at least the 0.05 level) presents the simple relationships between the 14 variables; and

(2) A logistic regression analysis identifies the statistically significant measures. A logistic regression tests the links between the business dimensions and firm survival.

*Data collected in 2005*

There were about 38 science parks and incubators in Sweden (SISP: Swedish Incubators and Science Parks) in 2005. The 18 incubators were selected by the Swedish Agency for Innovation Systems. Furthermore, 18 of the most promising incubators in Sweden were selected for inclusion in the programme in 2003. These incubators receive public funding, and various other types of support, rendering their conditions for development somewhat different from those of other incubators. Further, the incubators in this study are all affiliated with a university. The survey in 2005 was forwarded to the managers of the NTBFs to understand these firms current situation. The Swedish National Incubator Programme is a national government policy initiated by the Swedish Agency for Innovation Systems in Sweden, aimed at promoting innovation. The programme operations were transferred to the Technology Bridge foundations.

Although the selected incubators have more resources than other incubators in Sweden, they must demonstrate that they have developed according to the programme's intentions during the next round of applications. Of all incubators, two of the incubators in the programme are different from the others in terms of size and services provided, and were therefore not included in this study. The remaining 16 incubators included were: Inova, Science Park Jönköping, ProNova Science Park, Ideon Innovation, Gothia Business Incubator, Företagsinkubator Teknikdalen, Uppsala Innovation Centre, GU Holding, Karolinska Science Park, Mjärdevi, Uminova Innovation, Stockholm Innovation and Growth, Blekinge Business Incubator, SSE Business Lab, Chalmers Innovation and MINC (Malmö Incubator).

All 16 incubators were used in the sample for the survey, which was distributed to 189 NTBFs through the incubator's manager. Each incubator programme has an average of less than 12 firms, which were all independent, and emphasised high-technology industries. The growth rate for the responding 131 firms during their initial three years was 54.5 per cent (sales) and 60.0 per cent (employment). The study does not include branch operations and dependent subsidiaries of large businesses and one-person and limited partnership firms. Thus, the first phase identified NTBFs active in one of the six sectors (Table I, SNI-codes 62, 71, and 72). Moreover, in the second data collection phase, the firm's manager was identified as a suitable respondent. In addition, two written reminders were later sent to increase the response rate, followed by a telephone call to the incubator managers to urge the firms to respond.

Patents are often used as an indicator of technological development, although the propensity to patent varies between sectors, firms and countries (Taylor and Silberston, 1973). In this study, 41 per cent of the firms had either developed patents during the firm's first three years or already held one at the time of the firm's creation, 24 per cent had developed copyrights and 11 per cent had licenses (Table II). Nearly 70 per cent of the small high-tech firms had at least one employee with a PhD, and the firms were very young. The main difference among the firms in this study's sample concerned stated technology structure and R&D intensity. Several firms were leading edge firms undertaking R&D, while others were less sophisticated, undertaking relatively little R&D, essentially involved in downstream commercial activities, such as consulting.

*Data collected in 2014*

Secondary business data on the firms' latest business performance (annual reports, 2013) were gathered from the Retriever Business database of secondary data. All 131

| *Response rate* | |
|---|---|
| N (population) | 189 |
| n (response) | 133 |
| No valid firms | 2 |
| Response rate (%) | 69.3 |

| | Total population | | | Response | | |
|---|---|---|---|---|---|---|
| | Mean | SD | Median | Mean | SD | Median |
| Age[a] | 3.59 | 2.40 | 3.0 | 2.76 | 1.93 | 2.0 |

| | Mean | SD |
|---|---|---|
| *Business and innovation performance* | | |
| Sales 2004[b] | 1,679 226 | 7,533 985 |
| Employment 2004[c] | 2.07 | 4.10 |
| Patents[d] | 0.405 | 0.493 |
| Copyright[d] | 0.221 | 0.417 |
| Licenses[d] | 0.107 | 0.310 |
| Established in incubator[e] | 2,003.756 | 1.473 |

| | Total population | Response |
|---|---|---|
| *Branch – frequencies (%)* | | |
| Software/information technology | 35.10 | 41.90 |
| Technology consultants | 18.30 | 14.00 |
| Electronics/electrical | 6.90 | 5.60 |
| Pharmacology and pharmaceutical preparation | 16.80 | 17.70 |
| Mechanics | 9.90 | 10.50 |
| Other | 13.00 | 10.30 |
| Sum | 100.00 | 100.00 |

**Notes:** [a]Years; [b]1000 SEK; [c]number of employees; [d]Yes/No (1/0); [e]year

**Table II.** Means and frequencies of surveyed NTBFs located in 16 incubators, year 2005

firms from the 2005 survey were checked in the database. Table III presents the broad characteristics of the firms involved.

Of the 131 firms involved in the data collection in 2005, 54.96 per cent survived the eight-year period. The rest of the firms either could not be found, were liquidated, inactive or de-registered. Table AI and Figure A1 in the Appendix show the number of employees in 2013 and a histogram of liquidation frequencies. Table III shows the remaining firms' business performance for 2013, including the year of failure for both sub-groups. Table III illustrates that the surviving firms surveyed in 2013 were quite small and had problems with profit margins.

According to Cook *et al.* (2012), one of the first issues in the research related to small business failure is the relative lack of reliable data (Watson and Everett, 1996; Wu and Young, 2002). Watson and Everett (1996) note in their literature review that failure rates can vary depending on the definition of failure. A bankruptcy with a loss to creditors is the narrowest definition and results in the lowest failure rate (and therefore the highest

| | Mean | SD |
|---|---|---|
| *Overall survival rate*[a] (2005-2013): 72/131 = 54.96% | | |
| *Firm performance, year 2013 – survived firms*[b] | | |
| Employment[c] | 6.059 | 8.567 |
| Sales[d] | 8050.367 | 16011.181 |
| Profit margin[e] | −24.231 | 154.454 |
| Failure[f] | 2010.280 | 2.052 |
| *Type of failure*[g] | | |
| Liquidated | 17 | |
| Cannot be found | 36 | |
| Inactive | 1 | |
| De-registered | 5 | |
| Sum | 59 | |

**Table III.** Means and frequencies of surveyed NTBFs, year 2013

**Notes:** [a]Including mergers: 4 firms; [b]68 firms (excluding 4 mergers); [c]number of employees; [d]1,000 SEK; [e]percent; [f]liquidated (Year); [g]number of firms

survival rate), whereas a much broader definition is the end of business activities, which results in a much higher failure rate. Additionally, data on small firm failures are often scarce as these are typically private firms with no reporting requirements (Wu and Young, 2002).

*Validity and reliability*

As some incubators were less likely to be included than others, the sample is biased because all incubators are not objectively represented through random sampling. This is normally defined as a statistical sample of a population in which all participants are not equally objectively represented and is typically classified as a subtype of selection bias (sample selection bias). Sampling bias undermines the external validity of a test, i.e. to generalise the result to the rest of the population of incubators during 2005, while selection bias mainly addresses the internal validity for differences and similarities found in the sample. Selection bias is sometimes used to describe a systematic difference in the characteristics between those selected for the study and those that are not.

Because managers' perceptions are difficult to capture in terms of dichotomies such as "agree/disagree", "support/oppose", "like/dislike" or on Likert scales (1-5), the measures are only approximate indicators. Therefore, this field study uses a Likert scale (1-5) for the 14 variables. Furthermore, to address the potential common method bias, a questionnaire could be sent to several respondents in each NTBF, and then the average extracted. Unfortunately, this was not a valid strategy as only one person at an NTBF typically conforms to the respondent criteria (the manager of the firm).

## Analysis

*Statistical analysis*

The first step in the analysis considers the correlations between the variables. Table AII in the Appendix presents the Pearson correlations between the variables, in addition to

the correlations within the variables and between the firm survival variable. Figure A1 indicates strong correlations between business experience, financing in the last three years, capital structure – own capital, firm size – employment (control variable) and survival. The important dimensions for firm survival are business experience and financing issues.

The next step tests the relationship between the six independent variables, the control variable (firm size – employment) and long-term firm survival. The correlation matrix indicates that the firm size (employment) is the only control variable suitable for further analysis. A logistic regression with survival as the dependent variable, the six independent variables and the significant control variable as exploratory variables are included in the following regression model:

$$\ln[Y/(1-Y)] = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7$$

The slopes ($b_1$, $b_2$, …) and intercept ($a$) of the best-fitting equation in the multiple logistic regression, where:

$X_1$ = is business experience – CEO;
$X_2$ = is business administration courses – CEO;
$X_3$ = is financing in the last three years (since firm start);
$X_4$ = is capital structure – own capital – CEO;
$X_5$ = is markets – rest of Europe;
$X_6$ = is markets – rest of the world; and
$X_7$ = is control variable – firm size – employment.

Table IV reports the regression analysis results.

The logistic regression model is significant at the 0.005 level, and two of the variables are significant (at the 0.05 level): business experience (positive relationship) and the control variable firm size – employment (positive relationship). Only one variable (capital structure – own capital – CEO) has a negative impact on survival and is not significant at the variable level.

## Discussion

The regression model in this study analyses variables affecting long-term firm survival, and this model is significant at the 0.005 level. The regression model includes three

| Model[a,b,c] | B | S.E | Wald | Significance |
|---|---|---|---|---|
| $X_1$ | 1.202 | 0.576 | 4.344 | 0.037* |
| $X_2$ | 0.008 | 0.488 | 0.000 | 0.988 |
| $X_3$ | 0.250 | 0.234 | 1.142 | 0.285 |
| $X_4$ | −0.002 | 0.008 | 0.0078 | 0.780 |
| $X_5$ | 0.014 | 0.015 | 0.851 | 0.356 |
| $X_6$ | 0.017 | 0.012 | 2.143 | 0.143 |
| $X_7$ | 0.392 | 0.163 | 5.797 | 0.016* |
| (Constant) | −1.879 | 1.283 | 2.144 | 0.143 |

**Notes:** [a]Dependent variable: firm survival (1/0); [b]Model summary: Cox & Snell $R^2 = 0.242$; Nagelkerke $R^2 = 0.324$, Model Chi-square: 26.347; [c]the model: significance = 0.000***; *$p < 0.05$

**Table IV.** Logistic regression analysis.

organisational capabilities: business experience, financing and international markets. Business experience (*RP1*) has a significant effect (at the 0.05 level) on firm survival, thus, supporting *RP1*. The correlation matrix shows significant relationships between the financing variables and firm survival. However, the logistic regression analysis did not show any relationship between the two financing variables and the dependent variable; thus, *RP2* is not supported. There was also no support for *RP3* regarding international markets and firm survival.

The survival rate for the firms in this study is approximately 55 per cent for the NTBFs between 2005 and 2013. According to Cook *et al.* (2012), the likelihood that new firms continue operating varies. After allowing for different definitions of failure, van Praag (2003) notes that new firms have only a 50 per cent survival rate over the first three years, and Monk (2010) paints a similar picture, indicating that most new, small firms will not survive past their fifth year. However, other studies are more optimistic and have only analysed longer survival rates, which is after four or five years. Dunne *et al.* (1988) found a five-year exit rate of 52 per cent. Furthermore, survival rates have also been studied by the industry sector, and scholars have reported similar rates across different types of businesses (Knaup, 2005; Knaup and Piazza, 2007).

One variable, business experience, and the firm size (employment) control variable were significant at the 0.05 level. Moreover, 74.5 per cent of the CEOs in this study had business experience. However, the results for organisational capability in terms of business experience somewhat contradict the existing literature. Some authors claim that business experience is important for small firm survival. Gimeno *et al.* (1997) found that prior managerial and entrepreneurial experience positively affects the economic performance of new firms, but did not influence survival. Chrisman and McMullan (2004) and West and Noel (2009) found that previous entrepreneurial experience had no effect on new firm performance. However, Colombo and Grilli (2005) found that it influences growth, and LeBrasseur and Zinger (2005) found that management capability enhanced new firms' survivability.

There were no significant relationships between markets – rest of Europe – markets – rest of the world – and firm survival. Approximately, 9 per cent of the firms exported to the rest of Europe, and, approximately, 11 per cent to the rest of world. This result is a bit surprising because NTBFs have a much wider market distribution throughout Sweden and abroad than is typical for small firms (Löfsten and Lindelöf, 2002). Rialp *et al.* (2005) present a resource-based model for firms that globalise early, which comprises the firm's intangible resource base, specific international capability and the external conditions. However, Keupp and Gassmann (2009) found conflicting views on what enables a firm to internationalise early and rapidly. Furthermore, while some papers argue that a firm requires a certain minimum amount of resources to internationalise, others contend that resource scarcity could instead be a driver of early internationalisation. According to Sapienza *et al.* (2006), early internationalisation provides the advantage of deeply embedding the dynamic capability to exploit opportunities in foreign markets due to the early exposure to this stimulus. Zahra (2005) emphasises that it is important to focus on firm age, because internationalisation has implications for both performance and survival. The emphasis is on the age at which the firms became international, and not their size. However, firm size during the first three years has implications for firm survival (control variable: employment).

There were also no significant relationships in the regression model between the two financing variables [financing last three years (since firm start) and capital structure – own capital – CEO], initial importance of R&D for firm start and firm survival. However, the correlation analysis showed links between the two financing variables and firm survival, but the relationship between the latter and the CEO's own capital is negative. This means that if the firm's founder/CEO invests more of his or her private capital in the firm, the survival rate will be lower. It also impacts potential contacts with key customers, additional investors and generally higher credibility and legitimacy for the newly started firm (Markman *et al.*, 2001). According to Aaboen *et al.* (2011), the incubator has many different roles in the funding process, and when seeking public financing, it requires a network that includes governmental actors at both the regional and national levels.

Compared to the literature on the effects of technology-related industry factors on firm survival (Audretsch, 1995), there has been relatively little empirical research showing firm-level evidence on the relationship between firm survival and the innovative activities carried out within the NTBFs. Although many researchers believed that innovation plays a key role for firm survival, few studies have empirically examined the role of firm-level R&D investments in survival. However, Hall (1987) and Fontana and Nesta (2009) found support for the positive influence of R&D intensity on firm survival. Cefis and Marsili (2006) suggested that the positive effect of innovation on survival depends on firm age and size. Although the control variables in this study, that is the subjective measures of satisfaction with what the incubator environment had contributed to the firm's ability to perform, have no effect on firm survival, the control variable firm size has significant implications for it.

*Research and managerial implications*

This study extends the literature by exploring how NTBFs can link organisational capabilities in an entrepreneurial environment (incubators) to firm survival. These implications are important for policymakers and especially incubator managers who select and support NTBFs based on their R&D and business dimensions and support their development through the incubator. However, our research design offers possibilities to expand our findings. We encourage future researchers to investigate the relationship between the innovation dimension, especially the relationship between different innovation levels (radical and incremental innovation) and firm survival, with a focus on very small NTBFs. In a broad sense, innovation can play a key role in organisational learning for firm survival.

According to the correlation matrix, there are correlations between business experience, financing dimensions, the control variable firm size (employment) and firm survival. Moreover, it is a challenge for especially academic founders with little prior market knowledge and no previous professional investment experience to select which business dimensions can support successful firm creation, development and survival. An NTBF's need for an experienced management increases when technology and environments change and the intensity of competition exerts pressure on the firm. The key dimensions for incubators include strategic objectives, incubator financing/incubator sponsorship, and hence its impact on firm strategy. Firm strategy is an important outcome of firm processes and has been shown to be critical for small firm performance (Lindelöf and Löfsten, 2006). Accessing external financing for a new

technology-based firm is difficult due to liabilities of newness that are increased by the innovativeness of the initial business idea, and financing has been seen as the resource important for all the other aspects of innovation, and of newly started firms (Wright *et al.*, 2006, Clarysse *et al.*, 2007). Lack of seed funding was also seen as the largest impediment towards the creation of new technology-based firms (Wright and Lockett, 2004).

Audretsch and Mahmood (1993) state that the most consistent and reliable measure of the size of an establishment when it was founded is the number of employees, and a larger start-up size is expected to reduce the hazard rate. According to the logistic regression model in our study, the relationship between employment and firm survival is positive and significant, and this result is also important for incubator managers in the selection process of new firms. A new technology-based firm normally starts with a limited output of products and services, and the NTBFs must grow to survive in the long run. It is the responsibility of the incubator managers and the management to select the NTBFs that are able to grow and ultimately survive.

Many problems are common to new businesses, such as shortages of financing and business experience. These complementarities, business experience and financing, offer an opportunity that highlights the firm's overall business performance. However, despite the interest in NTBFs, relatively little research has examined the spectrum of NTBFs' organisation capabilities from the initial years to the long-term development, and hence, more empirical research in this area is required. Few organisational capability studies concentrate on NTBFs and their survival. This study demonstrates a significant model to determine links between three organisational capabilities and firm survival. This is especially an important finding for incubator managers when selecting and supporting NTBFs.

## Conclusion

This study presented a significant logistic regression model that included three key organisational capabilities important for firm survival. However, only two of the variables were significant in the model: business experience and firm size (employment). After eight years, the NTBF survival rate in this study is approximately 55 per cent between 2005 and 2013, which is consistent with other studies on firm survival. One of the most important findings in this study was that business experience significantly affects long-term firm survival. However, the results regarding business experience and firm performance are somewhat contradictory in the existing literature. This study contributes to an extension of the existing literature concerning how organisational capabilities in very small NTBFs' initial years can lay the foundation for future survival.

This study is subject to several limitations that open further possibilities for future research on the topic of organisational capabilities and firm survival. The set of business variables in this study were incomplete, including several data-related limitations regarding the sample of incubators and firms, because the incubators selected have more resources than others in Sweden. Furthermore, to address the potential common method bias, a forthcoming questionnaire could be sent to several respondents in each NTBF.

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## Appendix

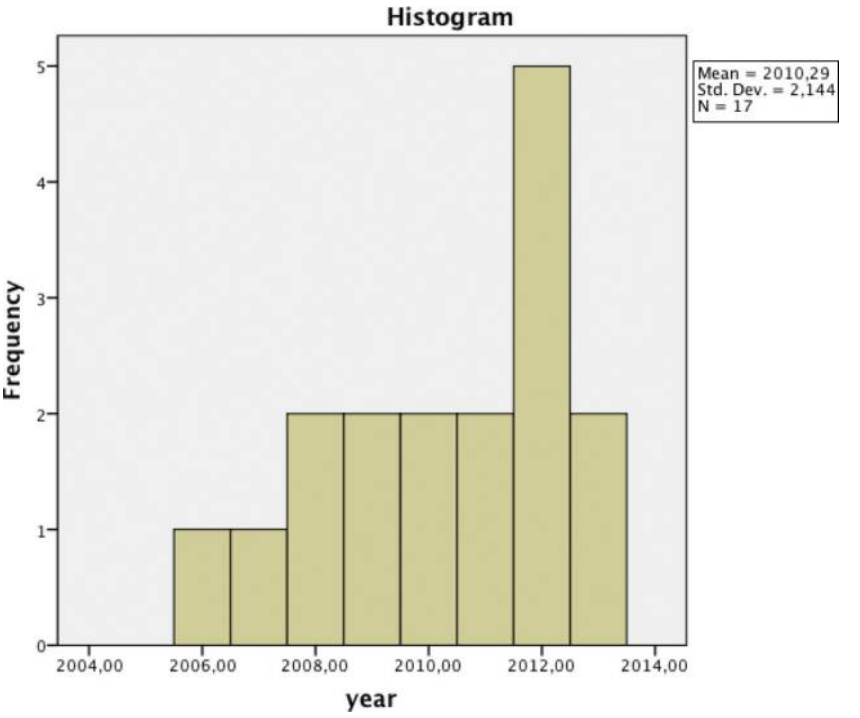


**Figure A1.**
Frequencies table regarding liquidations (year)

| No. of employees | Frequency | (%) | Valid (%) | Cumulative (%) |
|---|---|---|---|---|
| 0.00 | 17 | 13.0 | 25.0 | 25.0 |
| 1.00 | 6 | 4.6 | 8.8 | 33.8 |
| 2.00 | 6 | 4.6 | 8.8 | 42.6 |
| 3.00 | 4 | 3.1 | 5.9 | 48.5 |
| 4.00 | 7 | 5.3 | 10.3 | 58.8 |
| 5.00 | 4 | 3.1 | 5.9 | 64.7 |
| 6.00 | 6 | 4.6 | 8.8 | 73.6 |
| 7.00 | 2 | 1.5 | 2.9 | 76.5 |
| 8.00 | 2 | 1.5 | 2.9 | 79.4 |
| 9.00 | 2 | 1.5 | 2.9 | 82.4 |
| 10.00 | 1 | 0.8 | 1.5 | 83.8 |
| 11.00 | 1 | 0.8 | 1.5 | 85.3 |
| 13.00 | 2 | 1.5 | 2.9 | 88.2 |
| 16.00 | 1 | 0.8 | 1.5 | 89.7 |
| 19.00 | 2 | 1.5 | 2.9 | 92.6 |
| 20.00 | 1 | 0.8 | 1.5 | 94.1 |
| 23.00 | 1 | 0.8 | 1.5 | 95.6 |
| 24.00 | 1 | 0.8 | 1.5 | 97.1 |
| 33.00 | 1 | 0.8 | 1.5 | 98.5 |
| 49.00 | 1 | 0.8 | 1.5 | 100.0 |
| Total | 68 | 51.9 | 100.0 | |

**Note:** [a] Excluding mergers: 4 firms

**Table AI.** Number of employees, year 2013 – frequency table[a]

**Table AII.**
Correlation matrix[a] between organisation capabilities, control variables and firm survival

| Variables | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Organisation capabilities* | | | | | | | | | | | | | |
| Business experience – CEO | | | | | | | | | | | | | |
| Business administration courses – CEO | 0.020 | | | | | | | | | | | | |
| Financing last three years (since firm start) | 0.052 | 0.072 | | | | | | | | | | | |
| Capital structure – own capital – CEO | −0.202* | 0.044 | −0.183* | | | | | | | | | | |
| Markets – the rest of Europe | 0.059 | 0.068 | 0.051 | −0.235* | | | | | | | | | |
| Markets – the rest of the world | −0.086 | −0.060 | −0.014 | −0.079 | 0.248** | | | | | | | | |
| *Control variables* | | | | | | | | | | | | | |
| Firm start – importance of R&D from university | 0.079 | 0.190* | 0.076 | −0.240** | 0.100 | 0.185* | | | | | | | |
| Firm start – importance of R&D from industry | 0.056 | 0.135 | 0.101 | −0.063 | 0.085 | 0.116 | 0.040. | | | | | | |
| Business administration courses – incubator support | −0.222* | 0.586** | 0.044 | 0.144 | 0.096 | 0.027 | 0.315** | 0.021 | | | | | |
| Financing – incubator support | 0.070 | 0.090 | 0.184* | −0.160 | 0.008 | 0.105 | 0.186* | −0.010 | 0.062 | | | | |
| Ability to export – incubator support | 0.014 | 0.071 | −0.063 | −0.298** | 0.324** | 0.153 | 0.112 | 0.005 | 0.094 | 0.207* | | | |
| Firm size – sales | 0.106 | 0.057 | 0.216* | −0.126 | 0.134 | 0.110 | 0.033 | 0.071 | −0.094 | −0.907* | −0.016 | | |
| Firm size – employment | 0.117 | 0.042 | 0.205* | −0.281** | 0.191 | 0.125 | 0.152 | 0.060 | −0.034 | −0.030 | 0.252* | 0.781** | |
| *Firm survival* | | | | | | | | | | | | | |
| Survival | 0.199* | 0.021 | 0.258** | −0.204* | 0.136 | 0.148 | 0.144 | 0.005 | 0.021 | 0.011 | −0.038 | 0.088 | 0.257** |

**Notes:** [a] =; * $p < 0.05$; ** $p < 0.01$