Little Big Team:
Acquiring Human Capital in Software Startups

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Abstract. *Background* – Resource-based-view and human capital theories have been used for decades when studying firms, their strategies, organizations, businesses, and successes. The value of the theories as general frameworks has commonly been recognized, especially because of their flexibility in adopting new perspectives, such as the dynamic character of the resources and human capital. Startup companies represent an interesting area on a map of firms because of their specific characteristics and tendency not to strictly follow the processes common in more established companies. Despite the differences, it is reasonable to assume that startups face similar phenomena as established companies do when building up their firms and operations. *Aim* – In this research, we studied software startups from the perspective of resource-based-view and human capital theories. We examined what human capital resources, capabilities, knowledge, and skills, were needed in the early stages of software startups and how the startups acquired such human capital. *Method* – We conducted a multiple-case study on a group of software startups in Norway and Finland. *Results* – We identified six high-level capability areas, nine means to acquire those capabilities, and nine drivers affecting the utilization of different means. We concluded that the capabilities in software startups are dynamic, evolving by growth and learning from the basis of the founders' prior capabilities, and the utilization of different acquiring means is a case-dependent thing with a varying set of drivers. We also found the uniqueness of the resources, as proposed by the resource-based-view theory, was not reached in our case startups, but replaced with a combination of commonly-available resources, innovation, and application-specific capabilities.

Keywords: Software startup · Initial team · Product development · Product development process · Capability needs · Resource-based-view theory · Human capital theory

1 Introduction

A software startup's ability to transform an innovation to a product and a business case is largely affected by the challenges it faces during its early stages, such as time pressure, a small and inexperienced team, dependency on a single product, and general

lack of resources [1]. It is crucial that a startup should be able to gather the knowledge, skills, and capabilities needed to create a product based on the innovation.

Recent studies [1–3] revealed the software startups' characteristics that partly contradicted one another and these startups' contributions to the latest technical and economic developments. On one hand, typical software startups are immature [2, 3], characterized by small and inexperienced teams, limited resources, and third-party dependency [1]. On the other hand, they are innovative, rapidly evolving [1], and have created some of the most successful products of the past years.

We explored the software startups from the perspective of two interrelated business and economic theories defining the competitive potentials of firms—the resource-based-view (RBV) theory [4, 5] and the human capital (HC) theory [6, 7]. Research based on the RBV theory studies a firm's sustainable competitive advantage as a function of its resources, covering different categories. The HC theory focuses on knowledge-oriented human attributes as a basis of creating economic value. The focus of HC research varies from individuals to firms and further to nations, addressing a broad palette of human capabilities, knowledge, and skills, as well as ways to obtain them. The linkage of both theories by defining HC as one resource category of the RBV theory was already proposed by Barney [4], and a broader study on their convergence had been conducted [8].

In this research, we studied software startups' HC resources—capabilities, skills, and knowledge. We have chosen this research focus because several characteristics of software startups are tied to the availability of resources [1].

For our study, we asked the following research questions:

RQ1: What are the engineering-related capabilities in a software startup?

RQ2: What are the means to acquire those capabilities?

RQ3: What are the reasons for deploying different capability-acquiring means?

The research was conducted on two Norwegian and nine Finnish software companies. Nine companies were developing products of their own, while two were offering experienced resources to software startups on a subcontracting basis.

Comparing our empirical findings with the results of prior research on the theories, we identified both commonalities and differences. The importance of the availability of HC was recognized. Acquiring HC through experience and learning was also in line with the findings of prior literature. The uniqueness of the resources, as proposed by the RBV, was not identified in our study. Based on our results, we suggest that the software startups' business advantage does not depend on the uniqueness of their resources in general but on their ability to make a small team large by combining commonly available resources with unique innovation and application domain knowledge.

The rest of this paper is structured as follows. Section 2 focuses on the background of and the motivation for the study, reviewing prior research on software startups and the RBV and the HC theories. Section 3 presents the research design, including the case selection and research data analysis. Section 4 deals with the results, and Section 5 discusses the study's findings and relevance. Section 6 concludes the paper and offers suggestions for future research.

2 Prior Research

In this section, we review prior research on RBV and HC theories in the context of startups and entrepreneurship. We summarize the software startups' characteristics that were identified in previous studies.

2.1 Prior Research on Resource-Based View

The RBV is a business theory claiming that sustainable competitive advantage is gained when a company has access to valuable resources that the competitors lack and are rare, difficult to imitate, or difficult to substitute. The theory's development has led to various definitions and classifications of a company's resources.

Barney [4] divided the resources into three categories—physical capital, HC, and organizational capital. He further classified HC into such areas as training, experience, and personal characteristics of an individual. Several authors further developed the RBV by refining details and proposing various additional resources, such as strategic resources [9], managerial resources [10], or a division of resources into tangible and intangible ones [11].

In further developments of the RBV, a capability approach was defined, separating the so-called capabilities from the generic definition of resources. Research on the capability approach addressed companies very broadly, covering a multitude of definitions of capabilities [12–14]. Amit and Shoemaker [12] defined capabilities as firm specific and unavailable outside the company. A similar definition was presented by Makadok [15], claiming that the key characteristic of capabilities was that they must be built within the company and could not be bought.

To address the challenges caused by continuous changes in business and technology, the capability approach was further developed to address so-called dynamic capabilities [16–18]. Teece et al. defined in [16] the dynamic capabilities as "the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments". Dynamic capabilities had further been defined by different authors in the contexts of processes and routines [17, 18] and of product development-related competencies [19].

From our study's perspective, some definitions are of special interest, including capabilities as self-created [15], as company-internal processes and routines improving the usage of resources [14, 20, 21], as core competencies deployed in product development and gained through learning [11], and as dynamic phenomena [16–18, 21].

2.2 Prior Research on Human Capital Theory

The HC theory [6] is old and established in economics, focusing on human capacity, such as knowledge, intelligence, and talents, as a source of economic value creation. In the context of businesses and companies, the HC theory states that such human attributes as the personnel's education, experiences, and skills affect a firm's business performance [22].

In a broad study on Dutch startups, Bosma et al. reported that the founders' investments in human and social capital significantly affected the startups' performance, measured in three dimensions – survival, profits, and generated employment [23]. Thus, it is reasonable to assume that HC is a valuable resource for a startup, and investments in it further increase its value.

Based on the findings of an empirical study, Lazear [24] concluded that entrepreneurs were generalists with a broad variety of skills without necessarily being experts in any. Martin et al. in [25] found evidence that entrepreneurship-specific education positively contributed to entrepreneurship-specific HC, meaning that education was a valid source of such HC.

The effects of the technology entrepreneur's HC on innovation radicalness were studied by Marvel and Lumpkin [26], based on the understanding that breakthrough innovations were among the key competitive factors of a new enterprise. As general HC was proposed to build on the two main concepts of experience and education [6], Marvel and Lumpkin further divided experience into two different views on its depth and breadth. The study's results indicated that experience depth and education positively correlated to innovation radicalness, while experience breadth did not, differing from the results of Lazear [24].

Unger et al. [27] presented the results of a broad meta-analysis on HC research in entrepreneurship over the last three decades. The authors identified a significant relationship between HC and success. Interestingly, *a priori*-gained HC (existing capabilities, knowledge, and skills) showed a larger contribution to success than investments in HC in the form of education or learning. The HC that was specific for an actual task made the greatest positive contribution, and the positive contribution was stronger in the case of new businesses than in old established ones.

Shrader and Siegel in [28] found that a key determinant of the enterprises' long-term performance was the fit between the strategy and the team experience, and the most important determinant of a differentiation strategy's success was the team's technical experience. However, prior studies on software startups concluded that the initial team was often inexperienced [1, 29]. On the other hand, Hatch et al. [30] identified that utilizing external HC with prior industrial experience significantly reduced learning, while indicating that such compensation would not necessarily provide a startup with sustainable solutions to issues related to its team's missing experience.

2.3 Prior Research on Characteristics of Software Startups

Table 1 lists the characteristics of software startups that were identified in a broad literature review [1].

Table 1. Identified characteristics of software startups [1].

ID	Characteristic	Explanation
C1	Lack of resources	Limited economic, physical, and human resources
C2	Highly reactive	Ability to quickly react to changes in market, technology, and products
C3	Innovation	Given a competitive ecosystem, startups need to focus on highly innovative segments of the market.

C4	Uncertainty	Dealing with highly uncertain ecosystem from many perspectives: market, product, competition, people, and finance
C5	Rapidly evolving	Successful startups aim to grow and scale rapidly.
C6	Time pressure	External pressure to release fast and to work under constant pressure
C7	Third-party dependency	Due to lack of resources, startups heavily rely on external solutions, such as open-source software and outsourcing
C8	Small team	Small number of members of the initial team
C9	One product	Activities gravitate toward one product or service only.
C10	Low-experienced team	Many of the team members have less than 5 years of experience and are often recent graduates.
C11	New company	The company has been recently created.
C12	Flat organization	The company is usually founder centric, and all team members have major responsibilities with no need for high management.
C13	Highly risky	The failure rate of startups is extremely high.
C14	Not self-sustaining	Especially in the early stage, startups need external funding.
C15	Little work history	The basis of an organizational culture is not present initially.

When reviewing the above-mentioned results from the HC and the RBV theories' perspectives, potential conflicts can be observed. The RBV theory points out valuable, rare, and inimitable resources as key determinants of sustainable business advantage [4]. Later studies proposed that a category of such inimitable resources was based on unique company developments, routines, and processes that tied together the capabilities of individuals [14, 20, 21]. Compared with the findings of other studies [1, 29], it may be concluded that software startups are missing several resource categories identified as building blocks of sustainable business advantage [4, 11, 17, 18].

Similarly, some characteristics identified in a study [1], such as a small and low-experienced team, third-party dependency, and little work history, seem to be in conflict with the established HC theory.

3 Research Design

To answer the research questions, we carried out a multiple-case study on a group of software startups, following the guidelines set out in an article [31].

3.1 Case and Subject Selection

Our research data was collected in three European locations, including two companies in Trondheim, Norway; two in Helsinki, Finland; and seven in Oulu, Finland. Nine companies were startups with their own products, while two were service providers offering highly experienced human resources. The startups were chosen to represent different products, business cases, evolution phases, and business statuses, using local startup incubators as the starting point of the selection. The service providers brought another viewpoint on the capability development in software startups, deepening our study. Out of the startup group, four case companies had embedded products, while five were developing pure software products. Table 2 summarizes the case companies and their application areas, customer cases, and current statuses.

Table 2. Descriptions of the case startups.

Case	Location	Product	Customers	Interviewee(s)	Status
A	Norway	Pure software	B2C, B2B	Founder, expert	Product on market
B	Norway	Pure software	B2C, B2B	Founder, expert	Product on market
C	Finland	Embedded	B2C	Founder	Dissolved
D	Finland	Embedded	B2C	Co-founder	Prototype series
E	Finland	Pure software	B2B	Founder	Established business
F	Finland	Pure software	B2B	Founder	Prototype series
G	Finland	Embedded	B2B	Co-founder	Established business
H	Finland	Pure software	B2C, B2B	Founder	Established business
I	Finland	Embedded	B2C	CEO	Prototype series
J	Finland	Service	B2B	Founder	Selling services
K	Finland	Service	B2B	Founder	Selling services

Legend: B2C business to customer, B2B business to business, CEO chief executive officer

The sizes of the startups in terms of the staff ranged from four to twelve employees. The operational age was between one and five years. One service provider was an established company with over ten years of operational history, while the other was a startup.

3.2 Data Collection

We collected the research data by conducting interviews and applying the key informant technique as defined by Marshall [32]. Most of the interviewees were founders or co-founders. One was a hired chief executive officer (CEO), who had a founder-level understanding of his company. We conducted semi-structured face-to-face interviews, using thematic interview guides [33]. All interviews were held in English, recorded, and transcribed.

3.3 Data Analysis

We analyzed the interview data by combining thematic synthesis and narrative synthesis [34]. Starting with thematic synthesis, the transcribed interview data were analyzed with the NVivo11 tool. The data that were related to the research questions were identified and coded. We continued the synthesis by combining the identified codes under themes in a hierarchical manner as described by Cruzes and Dybå [35]. The interview data and the qualitative codes are available as open data in [36].

To study the case companies' characteristics, we opted to use the narrative synthesis method [34]. A previous broad study [1] had identified fifteen characteristics typical of software startups (Table 1). In the narrative analysis, we figured out how those characteristics fitted each of our case startups. The results are presented in the next section.

4 Results

In this section, we discuss the findings identified from the research data in the context of the case companies.

4.1 Thematic Synthesis Results

In the thematic synthesis we found twenty four themes that we categorized into three categories according to the research questions: *identified capabilities*, *capability-acquiring means*, and *acquiring drivers* (Tables 3a, 3b, and 3c, respectively).

Table 3a. Found codes of top-level theme identified capabilities.

Capability	**Knowledge about …**
Application domain	the product's desired functionality and its value to the customers
Software development	how to conduct software development fitting the product
Hardware development	how to conduct hardware development fitting the product
Mechanics development	how to conduct mechanics development fitting the product
Systematic development work	how to conduct development according to systematic practices
Difficult technology domain	especially difficult or rare technology needed in the product

In the research data, we identified two capability domains where special knowledge was required – capabilities needed to solve difficult technical issues and capabilities needed to implement systematic routines and processes.

Table 3b. Found codes of top-level theme capability-acquiring means.

Theme	**Description**
Founders' experience	Prior experience and knowledge of the founding team members
Other products	Learning from existing similar products
Prototyping and testing	Learning from developing prototypes and testing them
Customer cooperation	Learning from cooperating with the customer
Research	Learning from conducting empirical or literature research
Team growth: inexperienced	Acquiring new human capital by hiring inexperienced persons
Team growth: experienced	Acquiring new human capital by hiring experienced persons
Team growth: unconventional	Acquiring new human capital by offering unconventional remuneration or benefits instead of a conventional salary
Team growth: subcontracted	Acquiring new human capital by subcontracting

For the discussion section, we group the capability-acquiring means into three categories, as follows: a) the original HC (founders' experience), b) increasing the HC by growth (in-house hiring and subcontracting), and c) increasing the HC by learning.

Table 3c. Found codes of top-level theme acquiring drivers.

Theme	**Description**
Founders' experience	The knowledge that founders bring to the startup
Customer cooperation	Customer cooperation possible
Skills	Knowledge and skills needed in the startup
Known persons	Seeking already known persons
Special interests	Seeking persons with special interests
Stable economy	Company has necessary economic resources
Challenging economy	Company has challenges in economic resources
Avoiding economic risks	Company wants to avoid additional economic risks
Ensuring innovativeness	Allocation of the key persons' work on innovation instead of routines

We identified nine drivers for utilizing different means of acquiring the needed capabilities. As shown in Table 3c, the drivers varied from the level of the individual up to the level of the whole company. At the individual level, personal attributes were dominating, while at the company level, the economic situation was a key factor.

4.2 Company Characteristics

The case companies A to I were software-intensive startups, each with a single product that had either just entered the markets or was in the prototype phase. Other characteristics listed in Table 1 were also common, such as highly reactive, rapidly evolving, time pressure, small team, new company, flat organization, and little work history. The resource situations varied, but only one case company, E, had a good situation in economic, physical, and human resources. All the other cases lacked resources in some areas. Uncertainty was another common characteristic. Companies E and G, having established businesses, were the only ones not facing greater uncertainty in the market, product, competition, people, or finance areas.

The team experience varied a lot among the companies and individual team members. Some of the founders were experienced professionals, while others were recent graduates with no prior industrial experience. A mixed team with both experienced and inexperienced members was a common setup. All case companies were somehow dependent on third parties. Most of the companies were subcontracting, and case company G utilized lots of open-source software.

Three companies, E, G, and H, having established businesses, were self-sustaining. Other companies depended on external funding. However, the actual financial situation varied in all companies and affected their setup and operations.

The companies' innovativeness also varied. Most case companies were modifying existing product innovations to fit a new market, another price segment, or a new application domain. Three companies, C, E, and I, developed more innovative, totally new products. All companies utilized the latest technology, and companies C and G created new, technically challenging, multidisciplinary solutions.

Case companies J and K differed from the others; their business was to offer human resources to customer companies. Case company J was a software house that provided excellent software development knowledge, with over ten years of accumulated experience in different application domains. Case company K offered services to build up company structures and systematic work approaches. The company employed few but very experienced personnel. Company K had created the position of hired chief information officer (CIO) to support the customers in building up solid administration structures.

4.3 Prevalence of Capability-Related Themes

We combined the results of the thematic synthesis with the company narratives to find out the distribution of the themes among the case companies and to highlight the potential dependencies between the themes and the company characteristics. Table 4 shows the results. Note that the acquiring driver 'skills' is not listed in the table because

it was common for all case companies and self-evident in any selection of a new hire or a subcontractor. All case companies performed prototyping and testing though this theme is mentioned only in company G, where it played an especially significant role in learning.

Table 4. Themes' distribution among the case companies.

Case	Capability domains	Founders' experience	Acquiring means	Drivers
A	Application, software, systematic development	Just graduated	Other products, team growth – experienced and inexperienced	Stable economy
B	Application, software, systematic development	Just graduated	Other products, customer cooperation, team growth – experienced, inexperienced, unconventional and subcontracting	Customer cooperation, challenging economy
C	Application, software, hardware, mechanics, systematic development, difficult technology	Software, hardware, mechanics, systematic development	Founders' experience, team growth – experienced and subcontracting, research	Founders' experience, avoiding economic risks
D	Application, software, hardware, mechanics, difficult technology, systematic development	Application	Founders' experience, customer cooperation, team growth – experienced and subcontracting	Founders' experience, customer cooperation, avoiding economic risks
E	Application, software, systematic development, difficult technology	Application, software, systematic development, difficult technology	Founders' experience, team growth – experienced and inexperienced	Founders' experience, stable economy, special interest, ensuring innovativeness
F	Application, software, systematic development	Application, software, systematic development	Founders' experience, team growth – experienced and inexperienced	Founders' experience, known persons, avoiding economic risks
G	Application, software, hardware, mechanics, systematic development, difficult technology	Application, software, hardware, systematic development, difficult technology	Founders' experience, other products, team growth – experienced, inexperienced, unconventional and subcontracting, prototyping and testing, customer cooperation, research	Founders' experience, customer relationship, avoiding economic risks, ensuring innovativeness
H	Application, software, systematic development	Only managerial experience in software development	Customer cooperation, team growth – experienced, unconventional	Customer relationship, avoiding economic risks
I	Application, software, hardware, mechanics, systematic development, difficult technology	Application, difficult technology	Founders' experience, growth – experienced, subcontracting	Founders' experience, stable economy, known persons, ensuring innovativeness

5 Discussion

In this section, the answers to the research questions are discussed. The findings are then explained in the context of the HC and the RBV theories. The discussion on the validity of the results and their relevance to the academia and to practitioners completes the section.

5.1 Answering the Research Questions

RQ1: What are the engineering-related capabilities in a software startup?

We identified six high-level capability domains (Table 3a). Application knowledge and software development domains were common in almost all the case companies; the service provider K focused on the systematic work domain. The research data further revealed that the application domain and software development capabilities must be available from the very beginning. Companies A and B failed in building their first software development teams, causing difficulties with the first versions of their respective products.

Hardware and mechanics development were present in all cases with embedded products. The companies differed the most in two capability areas—systematic development and difficult technology domains.

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RQ2: What are the means to acquire those capabilities?

We identified nine means used in startups to acquire the capabilities (Table 3b). The most common one was the original HC—the prior knowledge and experience brought by the founder to the company. In three companies, A, B, and H, the founders' missing capabilities in software development were compensated by hiring experts.

Increasing the capabilities by learning was common. The sources included learning from existing similar products, customer cooperation, and prototype-oriented development. In the case of difficult technology domains, research in the form of searching results from the scientific literature and conducting empirical studies was used.

Additional capabilities were typically also acquired through growth, by hiring new employees or subcontracting. In companies B, G, and H, new employees were offered other benefits but normal salaries. For in-house growth, both experienced and inexperienced individuals were hired, while the subcontractors were selected based on their prior experiences and skills.

RQ3: What are the reasons for deploying different capability-acquiring means?

We identified nine drivers affecting the means deployed to acquire the needed capabilities (Table 3c). While the basis of the startups' HC was their founders' prior experience and knowledge, other means identified in our study could be perceived as compensation for the founders' missing capabilities.

Three companies, E, G, and I, had a special arrangement for administrative tasks, ensuring their respective founders' continuous focus on innovation and product development. In companies E and I, a CEO was hired at an early phase from outside of the company. Company K's special service, hired CIO, confirmed the value of ensuring continuous innovativeness instead of concentrating on administration.

The major division line between in-house hiring and subcontracting seemed to be the financial situation. In cases of a solid funding situation, new persons were hired, while in the opposite circumstances, subcontracting was preferred. Subcontracting was also common in cases of hardware and mechanics development and in some situations when difficult technology was deployed. Avoiding economic risks affected the

selection of the hired persons; experts with well-known careers or former workmates were recruited for key positions, while the implementation work was many times performed by students.

In companies B, G, and H, the missing economic resources led to offering shared ownership instead of normal salaries when hiring new team members. The founder of company H pointed out that this option was used simply because the firm needed an experienced software developer but had no possibility to pay the costs of normal employment or subcontracting.

The individuals' skills had an effect on when a company sought new employees or subcontracting partners. The service provider companies, J and K, pointed out their specific capabilities as the key sales arguments presented to startup companies.

Table 4 summarizes that both the utilization of the means and the reasons were strongly depending on the context. Several means were used to acquire a specific capability, and several capabilities acquired by the same means. Similarly, the same reason led to utilization of different capability acquiring means, and the utilization of a means was driven by several reasons. Thus, in this study we were not able to create any proposal of a generic theory linking the capabilities, acquiring means, and reasons.

5.2 Findings in the Context of Prior Research

We discuss our study's results in the context of the prior knowledge presented in section 2, covering the previous research on software startups, the HC theory, and the RBV theory.

Our study's findings are in line with those of the prior research on software startups [1, 29], though the companies, their products, and targeted customer segments varied. Eight out of the fifteen characteristics listed in Table 1 could be identified in all product-developing case companies. The rest of the characteristics were also identified in one or more cases. The research data from the service-providing companies, J and K, confirmed the findings; their business with startups was based on the customers' lack of specific HC and need to avoid financial risks.

From a larger perspective, our findings are consistent with those of the earlier research on the HC theory [6, 22–28, 30]. Becker's [6] definition of HC as composed of experience and education should preferably be broadened in the context of startups to cover learning, as proposed by Hatch and Dyer [30]. In all case companies, the initial capabilities were both broadened and deepened by learning from different sources, as shown in Table 4. The need for additional learning was also recognized in the case companies with founders possessing broader and deeper experiences because they tended to opt for more challenging technology.

A potential conflict exists between the results of Lazear's study [24], pointing out that the entrepreneurs are generalists, and those of Shrader and Siegel's work [28], noting the importance of technical experience for a startup. Our results are more in line with the latter. Five out of nine founders had strong technical experience, and even the rest (four) hired technical experts to compensate for their missing capabilities.

Companies C, E, G, and I confirmed the linkage between the depth of experience (especially in technology) and the radicalness of the innovation. The findings of Unger

et al. [27], claiming that *a priori* experience had a more positive effect than education, were partly confirmed by the significant role of the founders.

Hatch and Dyer's [30] results, indicating that utilizing external HC with prior industrial experience significantly reduced learning, were not found in our study. External HC in the form of subcontracting was broadly used in the case companies in parallel with learning. In the resource-limited and risk-avoiding reality of a software startup, it can be regarded as a rational decision to reach the immediate product-related targets.

Generally, the resources to which the competitors lacked access, as defined in the RBV [4], were also unavailable in our case companies. The definition of capabilities as firm specific and unavailable outside the company, as proposed by Amit and Schoemaker [12], was not supported. All companies were building capabilities through learning as proposed in prior research [11], but those capabilities could not be classified as rare and difficult to imitate [4]. In most cases, potential competitors would have been able to develop the same competencies or pay for them from outside. Companies C, E, G, and I owned technology-related capabilities that could be considered rare but not inimitable.

All but one capability acquiring means were related to growth or learning, creating dynamic capabilities and supporting the findings of prior research [1, 16]. Dynamic capabilities, defined as company-internal processes and routines improving the usage of resources [14, 20, 21], were identified especially in companies A, B, and F.

In summary, we conclude that our case companies' situations aligned well with the findings of the prior research on software startups. The HC theory and the RBV theory were partly applicable in the case companies. The partial applicability could be perceived as an expected result due to the theories' broad coverage of different types of companies. The important role of the availability of HC in the form of knowledge and capabilities was particularly identified in our study. Creating HC through education, experience, and learning, as proposed in the prior literature, was also consistent with our study's results.

The largest deviation from the HC and the RBV theories involved the uniqueness of the HC resources. Working with small and inexperienced teams under time pressure did not allow the startups to pursue uniqueness but forced them to acquire external knowledge and capabilities, which could not be considered exceptional.

Based on our study's results, we conclude that in the context of software startups, a company's ability to rapidly create difficult technology and complex products with a small team is the key component of its HC, especially in the form of its organizational capital as defined by Barney [4]. We also suggest that this ability represents uniqueness and sustainable advantage in the context of the RBV though a startup needs to deploy various external, publicly available resources to make use of its distinctive ability.

5.3 Validity Discussion

Our study focused on exploring phenomena related to the HC and the RBV theories in software startups. We conducted the study by interviewing a group of startups, analyzing the research data, and drawing conclusions from the analyzed research data.

From the validity perspective, we now discuss construct validity, external validity, and reliability, as described by Runeson and Höst [31]. Our findings highlighted the context-dependent nature of the capabilities, acquiring means and reasons, and did not allow us to draw generic conclusions on the causal relationships them. Thus, we omit the internal validity discussion [31].

We addressed the construct validity by building our study out of well-established components, using a pre-prepared semi-structured interview as the means for collecting the research data, applying the key informant technique by interviewing persons in senior positions [32], and analyzing the data systematically with thematic and narrative analysis methods [34].

We collected the research data from nine Finnish and two Norwegian software companies, using interviews as the data gathering method. The sample's limited size, its geographical extent, and the single data gathering method restrict the external validity of our results though the case companies represent fairly large variations of business cases, technologies, and evolution phases. Further studies that will broaden the base of the research data are needed to improve the generalizability of the findings.

To address the reliability issues, we utilized peer work in the steps of our study. Our research team created the interview schema to enable a broad coverage of the phenomena in software startups. The research data were transcribed by an external professional. The results of the qualitative data analysis performed by the first author were reviewed by the co-authors.

5.4 Relevance to Academia and Practitioners

Our study focused on software startups from the perspective of two established theories about firms – HC and RBV. The results indicate that software startups represent a specific case under those theories. Because some key aspects of the theories, such as uniqueness of resources [4], seem unattainable in startups, it would be interesting to more closely examine what characteristics of a successful startup would compensate for those shortages on the resource side.

The theories referred to in this research can be perceived as focusing on a firm's success from the *how and by whom* perspective. Innovativeness, a characteristic of startups, addresses the *what* question. Because innovativeness is generally regarded as a key success factor of a startup, it would be important to conduct studies that compare the value of *what* with that of *how and by whom*.

From the practitioner's viewpoint, our study identifies the means utilized for acquiring HC-related resources in different software startups. It highlights the importance of knowledge and capabilities as key resources. Table 3b shows that all identified HC-acquiring means, besides the founders' own prior experiences and increasing the team size, are related to learning. This fact points out that a startup's early stages to a great extent constitute a learning story, and the founder has to utilize all relevant means for nurturing the necessary learning.

6 Conclusions and Future Research

We empirically explored what the elements of the HC in software startups were and how they were acquired. We identified six high-level capability areas, nine means to gather the required capabilities, and nine contextual drivers affecting the utilization of those means. We found that increasing the capabilities could be divided into three categories—the capabilities brought to the startup by the founders, the capabilities of the hired or subcontracted team members, and the capabilities developed by learning.

Our results indicate that the contextual features of a software startup drive the utilization of different capability-acquiring means, including both in-house and external types. The most important drivers are the founder's prior experience and the startup's economic situation.

Referring to the theories and prior research on a company's resources, we found that from an overall perspective, the startups follow the RBV and HC theories. The deviations in the uniqueness of the resources are due to specific characteristics of software startups, that is, small and inexperienced teams and limited economic resources.

In our study, learning was identified as a key means to increase the HC in a startup. Keeping in mind that software startups have managed to tackle the obstacles related to small and inexperienced teams, it would be interesting to investigate learning more closely. Is learning more effective in the small, flat, and new organization of a startup than in a larger and more established company?

Our study was based on a fairly small group of software startups located in two North European countries. Further studies that will increase the sample size and the geographical coverage would be needed to validate and generalize our results.

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