



Management priorities of digital health service start-ups in California

Matti Muhos¹ · Martti Saarela¹ · Delbert Foit Jr² · Lada Rasochova²

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Abstract

Digitalisation has revolutionised health service delivery, which has provided global business opportunities for start-ups that specialise in digital innovations. Such start-ups challenge the traditional healthcare service industry by introducing radical and sustainable innovations in the agile product development cycle and the creative acquisition of resources within their networks. Starting up is the most critical period in establishing a new digital health service company. However, little is known about the critical early growth processes of newly established digital healthcare service businesses. The aim of this study is to clarify the experience-based priorities of managers of digital health service businesses in California during the critical start-up stage. Based on this multiple case study, the qualitative and contextual characteristics of growth in California-based digital health service start-ups were clarified, and a framework of management priorities was formed. Network management is a high priority in digital service start-ups that are focused on bringing radical innovations to the complex and hard-to-access market where fundraising is an integral part of success.

Keywords Digital health service start-up · Growth management · Growth strategies · Network management

✉ Matti Muhos
matti.muho@oulu.fi

Martti Saarela
martti.saarela@oulu.fi

Delbert Foit, Jr
dfoit@ucsd.edu

Lada Rasochova
lrasochova@ucsd.edu

¹ Kerttu Saalasti Institute, Micro-Entrepreneurship Research Group, University of Oulu, Pajatie 5, FI-85500 Nivala, Finland

² Rady School of Management, University of California, San Diego, CA, USA

Introduction

Starting up is the most critical period in establishing a new digital health service company, and the decisions that are made during the early stages of growth have a definitive influence on a company's success (Bennett 2016; Furlan and Grandinetti 2014). Despite massive empirical research into business growth, theoretical development has been slow (e.g., McKelvie and Wiklund 2010; Shepherd and Wiklund 2009). The early stages of business growth are mostly described using generic models. However, the latest developments are moving research towards more context-specific presentations of growth processes (Levie and Lichtenstein 2010; Muhos et al. 2010; Phelps et al. 2007). The majority of growth research has not acknowledged the qualitative and contextual differences in the growth processes of companies (see McKelvie and Wiklund 2010; Shepherd and Wiklund 2009). This paradigm shift provided a starting point for this study. The aim of this study is to clarify the management priorities as experienced by managers of the digital health service businesses in California in the critical start-up stage.

In the United States, healthcare spending is 17.2% of the gross domestic product (GDP), and an average of USD10,000 is spent annually on health care per person (OECD 2017). Because of demographic changes, increased longevity, the rising prevalence of chronic conditions and the re-emergence of infectious diseases, developed economies are challenged to ensure the sustainability and quality of healthcare service provision (European Commission 2017a). From the economic perspective, health care has never been more important than it is today. As economies shift from an industrial to a service-orientated approach (Pinto and Baracsi 2012), healthcare contributes to the rising percentages of GDPs. However, there is robust evidence for inefficiencies in healthcare (OECD 2017), and the healthcare industry lags other industries in the deployment of emerging technologies (PwC Health Research Institute 2016). These increased challenges emphasise the need for effective, scalable, sustainable, and innovative healthcare services (Rocha et al. 2013; Barnett et al. 2011; Pinto and Baracsi 2012).

Digitalisation and information and communication technologies (ICT) have been viewed as effective tools to meet the increased requirements of cost-effectiveness, accelerate efficiencies and quality improvement in healthcare systems and services (European Commission 2012; Agarwal et al. 2010; Pinto and Baracsi 2012). Moreover, digital technologies can provide tools to support the transition from hospital-based healthcare models to patient-centred models as well as improve the access to healthcare, and contribute to the sustainability of healthcare systems (European Commission 2017b). Borrelli and Ritterband (2015) pointed to an unprecedented opportunity to utilise digital technologies to prevent, assess, inform, promote, and treat health behaviours across large segments of the population. Digital technologies facilitate the development of innovations, products, and services, thus providing possibilities to restructure the business model of health care delivery (European Commission 2017a; Meier et al. 2013) and offer opportunities to build new businesses that, in a long run, improve health care sustainability (Chowdhury 2012).

According to Samuelsson and Davidsson (2009), start-ups are major factors in economic development because of their innovations and competitive pressure they produce. Start-ups are new (Sutton 2000), active, independent (Luger and Koo 2005),

and pioneers in innovation (Rosenbusch et al. 2011). They typically have organisational agility, promising ideas, the willingness to take risks, and the tendency toward growth (Weiblen and Chesbrough 2015). Radical and disruptive innovations require the orientation toward experimentation and the willingness to fail (Nanda and Rhodes-Kropf 2013). However, start-ups have shortcomings regarding resources (Sutton 2000), routines, products, and the environment because they try to do something that nobody have done before (Hite and Hesterly 2001). Thus, the success rate of new start-up companies is low (Griffith 2014), and failure is an integral part of the search process (Blank and Dorf 2012). Most of the new healthcare service businesses never reach the market (Kijl et al. 2010).

Nevertheless, little is known about the critical early growth processes of newly established digital healthcare service businesses. There is a need for research on the different stages of a healthcare service development (Van Meeuwen et al. 2015). The above mentioned provides a solid starting point for the in-depth analyses of the management priorities of digital healthcare service start-up. To clarify the critical management processes of the start-ups in the context of healthcare in California, this study focuses on the management priorities of five digital health service start-ups.

Theoretical framework

Business growth has been researched from numerous viewpoints, including stochastic theory (Gibrat 1931), static equilibrium theory (Coase 1937), resource-based theory (Penrose 1959), economics of growth theory (Penrose 1959), transaction cost theory (Williamson 1975), organisational ecology theory (Hannan and Freeman 1977), evolutionary theory (Nelson and Winter 1982), strategic adaptation theory (Sandberg and Hofer 1982), motivational theory (McClelland 1961), and configuration theory (Churchill and Lewis 1983; Greiner 1972). The vast majority of research has focused on the factors that lead to growth (i.e. growth as an outcome), without acknowledging possibly considerable qualitative and contextual differences among the growth processes of firms (i.e. growth as a process) (see McKelvie and Wiklund 2010; Shepherd and Wiklund 2009). A deeper understanding of business growth processes is needed.

The current study bridges this literature gap by selecting as its starting point the perspective of growth as a process. This study represents the *configuration* perspective of business growth, often called the *stages of growth* or *lifecycle* perspective. Among the first researchers to use the term ‘configuration’ in this sense were Miller and Friesen (1984), who agree with Hanks and Chandler (1994) that lifecycle stages are best characterised as configurations. In these studies, the term ‘stage’ corresponds to a unique configuration of variables (e.g. priorities, problems, and strategies) that growing firms are likely to face (Miller and Friesen 1984).

Configuration studies seek to clarify managerial priorities in the early stage of business growth. The configuration perspective focuses, for example, on how managerial problems occur and how they can be addressed during the firm’s presumed growth in typical stages of development (Davidsson and Wiklund 2006). The configuration school of thought explores, describes, and explains how growth affects a company and how a growing company can be best managed (Davidsson and Wiklund 2006; Wiklund 1998).

Based on reviews of recent developments in this field (see Phelps et al. 2007; Levie and Lichtenstein 2010; Muhos et al. 2010), there is an oversupply of generic–universal models and frameworks that seek to describe the stages of firm growth. These models tend to feature a vague (or altogether absent) contextual understanding. However, focused empirical configuration models have produced consistent findings. The results of the empirical tests of Hanks et al. (1993) and Kazanjian and Drazin (1990), among those of others, provide support for the applicability of these models. It is important to understand the phenomenon of business growth within its context (e.g. business environment, industry, etc.).

Moreover, the latest developments from the configuration perspective are migrating from the deterministic ‘stages of growth’ view towards a probabilistic ‘states of growth’ view (see Levie and Lichtenstein 2010; Muhos et al. 2010; Phelps et al. 2007). According to this latter view, developmental stages exhibit no inevitable linear sequence. From the probabilistic viewpoint, a company may proceed/return from one state to another through quantum leaps, and each state has a more or less stable set of challenges and opportunities. During each quantum leap (up or down, skipping states), the set of challenges and opportunities changes.

Empirically based configuration studies have traditionally focused on technology-oriented firms. However, interest in service business growth has increased in recent years; moreover, the number of empirically based stage models that focus on service business has increased. A recent meta-analysis by Muhos et al. (2017) provides a synthesis of nine recent empirically based service-business-focused stages-of-growth models (see Auzair 2010; Empson 2012; Ferreira et al. 2011; Greiner and Malernee 2005; Masurel and Van Montfort 2006; Shim et al. 2000; Teeter and Whelan-Berry 2008; Van Tonder and McMullan 2010; Witmeur and Fayolle 2011). This meta-analysis integrates the results of these models into a four-stage framework with reference to the early stages of service-based companies. It provides a starting point for exploring context-specific perspectives. The first stage of the framework, which is the focus of this study, is *Start-up – growth through market exploration and commercialisation of services*.

As digital health service start-ups constitute the main focus of this study, the start-up stage of the framework serves herein as a frame of reference. According to the results of the aforementioned meta-analysis, service-based businesses typically have the following management priority areas.

1. Focus
2. Power
3. Structure
4. Decision-making systems
5. Strategic management
6. Service development and delivery
7. Marketing
8. Human resources
9. Growth management

These findings provide a useful frame for in-depth and context-specific studies on service businesses. The previously described framework functions as the reference

framework for the current study, and we use it to analyse and reflect on the experiences of managers in the context of digital health service businesses.

Aim and methodology

A welcome trend in the academic community is the growing interest in developing a context-specific understanding rather than seeking universal solutions. Therefore, understanding phenomena in-context is becoming increasingly salient. The aim of this study is to clarify the growth management priorities as experienced by managers of healthcare service businesses in California at the critical start-up stage. Our data analysis approach devised nine central management priority areas of a service business (Muhos et al. 2017) for in-depth analysis and clarification of the early growth process of digital health service start-ups in California. There is an urgent need for an empirical understanding of the processes underlying the growth of digital healthcare start-ups. This study bridges this gap by answering the research question: What are the critical management priorities in digital health service start-ups in Southern California?

This research is a multiple case study based on a holistic research strategy (Saunders et al. 2007; Yin 1989). Compared to single cases, theory building from the findings of multiple case studies typically yields more reliable (Baxter and Jack 2008), robust, generalisable, and testable theories than single-case research does (Eisenhardt and Graebner 2007). Moreover, multiple case studies provide a stronger basis for theory building (Yin 1989), and the propositions are more deeply grounded in varied empirical evidence (Eisenhardt and Graebner 2007).

Five digital healthcare case start-ups in Southern California were analysed using the critical incident technique (CIT) and semi-structured interviews that were completed in 2015. In total, we conducted 10 interviews. For the purpose of triangulation, our data collection protocol covered three managerial viewpoints: one in company management, one in operations management, and one in marketing management. The CIT facilitates the investigation of significant occurrences (e.g., events, incidents, processes, and issues) identified by the interviewee as well as the way they are managed and the perceived outcomes (Chell and Pittaway 1998). The CIT is a flexible method, and it may be used to identify the factors that lead to successful or unsuccessful performances in divergent phases of business growth. Although the cases may be unique, types of incidents, contexts, strategies, and outcomes may be applicable to other businesses (Chell and Karatas-Ozkan 2014).

In this study, the cases are based on companies that have a digital service focus, the company's age (less than 5 years), and its geographic location. They are typical cases (Seawright and Gerring 2008), and accessible by the time of data collection. The main characteristics of the case companies analysed are summarised in Table 1:

The interview frame consisted of two sections: managers' open-ended stories of the business's growth and detailed descriptions of the positive and negative incidents experienced during the start-up stage. The interview frame was constructed to encourage the managers first to give a broad recounting of the business growth story and then detailed their experiences on both general and specific levels.

Table 1 The main characteristics of the case companies

Case	Founded (year)	No. of staff	Sales (\$)	Assets (\$)	Duration of interviews	Description of services
α	2014	10	0	25000	137 min.	On-line real-time service for disabled people
β	2014	2	4000	22000	138 min.	On-demand service for life-science infrastructure
γ	2013	3	0	600000	130 min.	Digital product-service platform for guided self-care of a chronic skin condition
δ	2012	5	6000	0	90 min.	Mobile telemedicine application and digital service platform
ϵ	2011	4	0	0	84 min.	On-line solution for matching patients and doctors with medical trial opportunities

All interviews were audio-recorded and transcribed. To improve the coding reliability and to confirm the findings, two researchers coded each transcript. The transcriptions were analysed qualitatively using an inductive approach (Crabtree and Miller 1999). All critical incidents, both negative and positive, were identified case by case.

Innovative digital healthcare start-ups occur under certain conditions, such as in the United States where the rapid growth of the digital health sector has brought together numerous incubators and investors to specialise in the healthcare sector (Pinto and Baracsi 2012). Southern California was selected as the location of the study because of its flourishing healthcare and life sciences ecosystem. In the ecosystems, companies are part of 'loose networks of suppliers, distributors, and outsourcers; makers of related products or services; providers of relevant technology; and other organizations that affect, and are affected by, the creation and delivery of a company's own offering' (Iansiti and Levien 2004). The Southern California region has a significant presence of start-ups, close ties to research institutes, high funding levels of venture capital, and economies focused on the life sciences industries (JLL 2014). The United States is the global leader in research and development funding and the life sciences sector in terms of the number of patent applications. Southern California can be considered a leader in the life science industry (JLL 2014), and its dynamic ecosystem is considered conducive to start-ups (Majava et al. 2016).

Data analysis and results

In this section, case-by-case analyses of the selected start-ups are provided. In analysing the critical managerial incidents, this study seeks to clarify the management priorities in the process of starting up digital businesses in the healthcare and life-science ecosystem in Southern California. The results were drawn from interview data on the critical incidents recalled by the management teams of the selected start-ups. In the following sections, the management priorities of the selected start-ups are presented using the critical incidents as the selective lens.

Cases α through ϵ are presented first as inductive single case analyses. Then, a deductive cross-case analysis is provided by using the nine central management priorities as a selective lens.

Case α

Case α is aimed at building more sustainable health service. The business idea was to develop a new service that could help disabled people use pre-existing technologies. Currently, the corresponding personal services, such as hiring a personal assistant, are very costly. The aim of the company was to gather a community of disabled persons and their caregivers around new products and services. This start-up's service platform enabled remote services via the internet that promoted resource utilisation and effective consumption, which were not tied to a specific time or place.

[T]his is like we're helping people to become independent or helping people to really enjoy the world individually.

The critical incidents are presented in Table 2 and Table 3:

Table 2 The positive managerial incidents of Case α

Positive incidents

- + The founder envisioned a new service that would change the lives of disabled people, which empowered the team: *Making money is one thing. But helping the world—that's great.*
- + An active local subgroup of a national foundation of disabled people shared this vision and began promoting the initiative: *...so we built the product, designed the experiment and said, 'Look, this is what we will do.' ...[Name removed] was helping me with that, and he introduced us to a good number of people.*
- + Bringing the first investor on board was a significant positive event: *That's the biggest thing. [Investor name] came on because he wanted to support the product. ...And that was the founder of [company name removed], which was huge. That's a multi-billion-dollar company.*
- + Having a clear vision enabled the team to exhibit creativity with regard to the acquisition of human resources. Such creative methods included the introduction of equity-based reward systems and the involvement of student trainees, volunteers, local and overseas freelancers, etc. Everyone's networks were used to build the team: *...Equity is a small part of the deal, but a bigger part of the deal is all the people around me, believing in the [service].*
- + The company experimented with real customers from Day One: *The team was as one, because we were always like 'go shoot in the dark', because we didn't know the customers. ...We had more customers to talk to and more experiments to do and more development work to complete.*
- + The company was able to utilise scalable and affordable (or free-of-charge) software that facilitated communication and decision-making: *...This stage was great, man. Pretty much anything was available, and you went and signed up for the thing that you wanted, and you paid.*
- + It was realised that the platform could be used to enable other services as well. This opened up new opportunities for scaling outside of the original context: *...We are constantly reinforcing and upgrading our platform, and hopefully it will be able to support multiple other products.*
- + Beneficial external networks were actively searched and found. A non-profit organisation promoted the issue of target customers and brought in pilot customers. Founders that had different backgrounds and that were committed by equity brought in variable personal networks. Inter-organisational partnerships were established to gain a mutual exchange of benefits, for example, to expand the marketing strategy through social media and websites with no finances.
- + Case α succeeded in reaching its primary target: it created networks with investors.

Table 3 The negative managerial incidents of Case α *Negative incidents*

- A core member, who had equity, was found to be unfit with respect to the values of the firm: *We realised that he was misrepresenting us, and in a way that benefitted himself. ...So that was one big lesson learned.*
- As Case α did not involve sales, everyone had time commitments outside the company: *How could they balance their time—that was one of the biggest challenges. Everyone had their own schedule, and we could not always line them up.*
- The founders and team members had a shared vision of the core service, but the investor had a different vision. Case α thus included the development of two services: *We were very, very passionate about [Service 1]. Then we had [Service 2] launch in October, and then we got an investor for it. ...But [Service 1] was 'the money'.*
- The Case α team produced a minimum viable product that was released prematurely; it failed at various critical marketing events due to the existence of serious bugs and security issues.
- The revenue model was not yet defined: *For the user, payment is interesting and has not been at all defined; it is dependent on how are we going to charge them.*
- The company searched for a scalable decision-making system from the outset. The first two management systems caused miscommunications and unnecessary delays.

Case β

In Case β , the business idea was to develop the efficient use of existing healthcare resources. Typically, large amounts of funding are needed when health science companies need funding to buy the infrastructure required to conduct experiments. At the same time, resources may not be used in another organisation. Case β provided a market platform that enabled the efficient use of physical healthcare resources as infrastructure and equipment. Case β was an intermediary service actor that matched the demand side and the supply side. From the perspective of demand side companies, service could lower the barrier to utilise available infrastructure in the right time without a large amount of invested capital.

The critical incidents are presented in Table 4 and Table 5:

Case γ

Case γ provided a digital product-service platform for the guided self-care of a chronic condition. The advanced technology-based service solution allowed patients to take care of themselves at home. Telehealth treatment provides improved and alternative ways to accomplish the provision of an effective health service to patients with a chronic skin disease. The critical incidents are presented in Table 6 and Table 7:

Case δ

As the mobile telemedicine application and digital service platform developed by Case δ worked through network, the platform was particularly beneficial over long distances. The start-up implemented the idea of sustainable development and met the global challenges of health care provision. In the pilot projects, the

Table 4 The critical managerial incidents of Case β *Positive incidents*

- + The validation of the riskiest hypothesis regarding the sharing economy-based business model and the availability of healthcare infrastructure was successful: *Here you had a quarter of a million-dollar piece of instrumentation. ...Now you're going to share it with somebody you don't know? We addressed it head-on. ...We learned on \$15,000, but we know other companies have learned on \$2 million.*
- + The Case β team was able to quickly build the service and verify customers (on both the supply and demand sides) with affordable losses: *...we had a landing page. We used cold calls. ...we said, 'Okay, we've built enough supply. Let's start focusing on demand.' ...In September, we made several hundred.*
- + The creative acquisition of human resources and the protection of human capital were also positive incidents. In particular, it was difficult to find webtech developers in California. Acquisition methods included equity based reward system, outsourcing, local and overseas freelancers (50 freelancers), virtual development teams, trainees, and external advisors. Human capital was protected by building an in-house core and generating a culture of involvement and ownership.
- + From the beginning, the company worked to build a strategy to facilitate scaling: *...We've always looked at our markets. We always knew what the potential markets were, and we always set up a matrix to kill that market.*
- + From the outset, the company built systems to enable scaling: *...Building systems, we had an eye towards scalability...so that our customer experience was consistent, so that processes were efficient.*
- + The reaction from the local business ecosystem was found to be positive. The company received support from a non-profit accelerator associated with the university and from a healthcare industry-focused incubator: *[The university accelerator] put us on a billboard. ...We had market fit, advocates and advisors. ...You get into an incubator, you win competitions at [pitch events], and you get big-name lawyers...then investors will warm up to you.*

service was used in rural clinics in developing countries in Africa and South America. This platform contributed to the efficient use of resources to avoid unnecessary primary care in emergency department or specialists' visits to villages in rural areas. Over long distances, the platform allows both the faster time to care and substantial savings. The critical incidents are presented in Table 8 and Table 9:

Table 5 The negative managerial incidents of Case β *Negative incidents*

- The single-most negative incident involved a failed software outsourcing project: *We were maybe in a bit of a rush to get out our MVP. ...We paid too much; basically, they kept the money, and they didn't complete the project.*
- In the beginning, the Case β team acquired too much healthcare infrastructure on the supply side and ended up over-supplying the demand: *...It snuck up on us that we had over-supplied the demand, and it wasn't until September that we started to say, 'We've got a problem. We're not making money.'*
- Finding customers on the demand side was more difficult than expected: *There was not a social network for [customers]. They were interested in publications patents. You had to go to 12 [events, one for each type of customer]. ...They were highly risk averse, even though they had a proposition to fund their research.*
- Fundraising presented a critical challenge: *At this stage, building relationships with investors was unfamiliar territory for them; they were used to marketing within high-tech companies. ... we were serving a market that they were not familiar with. It was very difficult for people to fund marketplaces.*
- The adjustment from having a solo-entrepreneur to having a co-founder required trust and was difficult for the original founder: *Going from being a solo founder to having, you know, a co-founder has been difficult, because you built a vision, and now you've got to share that vision.*

Table 6 The positive managerial incidents of Case γ *Positive incidents*

- + The development of a minimum viable product allowed the team to self-test its idea and gather interest at the university and within associations related to the target group. The founder pitched the product, which received various awards and a great deal of visibility: *...I went and started hustling people, and I ended up connecting with the head of the [name removed] Association. She loved the product. She had some great ideas.*
- + Transition to a service-based business model generated a win for patients (allowing for radically easier self-care at home, which provided greater independence), a win for doctors (easier reimbursement, more available time, simpler care control) and a win for the hospital (cost reductions, no need for clinics). The vision of a product-service platform was radically new: *...The best case is that everything will become streamlined through a digital automation system.*
- + After graduating from the university accelerator, the founder was introduced to his first investor: *...These guys drive innovation. They're super angels; they're throwing money around, and they have a whole bunch of people that they know.*
- + The founder was successful with regard to the creative acquisition of human resources. The Southern California business ecosystem offers both start-up mentality and corporate experience. The vision allowed the founder to convince top tier talent (Co-founder, CLO, CFO): *...They were willing to go down on salary if they knew that there was the potential to become a millionaire. ...Case γ outsourced its HR and engineering resources to the maximum level.*
- + The company found support in the ecosystem. The start-up joined a university accelerator program, was introduced to an investor, and ultimately became involved with a health and life sciences incubator. *... [The accelerator] really helped to solidify, what I was seeing online, and it gave us more experts to consult. I was introduced to an investor: ...That was the best thing to happen. ... [The health and life sciences] incubator got me in touch with affordable care organisations.*
- + The successful protection of IP was a vital part of the team's product-service business model: *Now we've got a really great intellectual property portfolio. It's fantastic.*

Table 7 The negative managerial incidents of Case γ *Negative incidents*

- The core team had conflicting ideas concerning the company's fundraising strategy: *That's got to be the biggest challenge. It takes a lot of money to develop these types of products. ...the other people on the team thought that we should raise small amounts and own a larger percent of the company.*
- The product-service platform required U.S. Food and Drug Administration (FDA) clearance before the product could be sold to actual customers: *There are a lot of hoops you have to jump through in order to make sure you're ready. It costs a lot more money, and it takes a lot more time. We don't have a product that's already on the market.*
- The company did not yet have established processes and scalable management systems: *...You know, purchase orders, processes and things like that...we didn't have the sort of infrastructure to be able to tap into the teams.*
- It was a significant challenge to convince key opinion leaders to support the service. These leaders were found to be conservative and did not understand the team's vision: *He's by far the most-referred one, and he had, like, no clue what we were talking about.*
- It was very difficult to recruit capable people to work on the development of a digital service platform: *... there were some areas that we didn't cover very well. One of the human resources problems involved trying to pull in really qualified software people.*

Table 8 The positive managerial incidents of Case δ *Positive incidents*

- + The most positive incident involved a business model shift from a product-based model to a service-based model with unlimited scalability: *We looked at it and said, 'Wait a minute. Why are we building yet another [device] that no one's going to use?' ...So we talked to an urgent care physician. What she wanted was a doctor-friendly [digital service].*
- + Service trials run in the USA and in overseas markets provided the team with invaluable information, which facilitated multiple pivots and gradually shifted the service platform towards a full-scale commercial roll-out: *I think one of our strengths was our ability to pivot. ...Now we're in the process of trying to get paid within several target markets in the USA and overseas.*
- + Case δ found cost-driven capitation-based markets both within the USA and overseas: *We had to find markets where the attributes that we could bring to bear were desired. We're gaining traction in Europe because they have National Health Systems where cost is a driver. We have to be in Europe, in Africa and in South America. In the United States, the capitated space is small.*
- + Case δ earned recognition through the publication of a widespread report: *So, Frost and Sullivan did a research report on telemedicine and leading vendors. ...They said, 'There's only one company in the world to look at.'*
- + The company was able to acquire capable and self-driven human resources. Within a small team, the full-scale contributions of each member are required: *We really had stars who grabbed the ores and start pulling. There are five of us involved, and everybody is committed to success.*
- + The Case δ team was invited to join an incubator program; this incubator was part of a global medical company, and there was an acceptance process: *[The chairman of the committee] has done a tremendous amount to promote us, and he has really worked on our behalf.*
- + The founders talked to more than 200 doctors and nurses about the service concept prior to establishing the business. Regarding partnerships, the managers highlighted inter-organisational networks with non-profit consortiums and charity organisations. Through these networks, service delivery improved in the developing countries that were included in the pilot projects. Pilot projects throughout the world were carried out with an extensive network of cooperation partners, which included nurses and several hospitals.

Table 9 The negative managerial incidents of Case δ *Negative incidents*

- Raising capital was described as a critical challenge: *That's where I spend all of my time. The venture capitalist will tell you that they want products that are 'must have' and 'need to have' versus ones that are 'nice to have'. Getting them over the hump to where they can see our service as 'need to have', that's probably been the biggest challenge.*
- The healthcare system in the USA was found to be a very difficult market to penetrate: *Knowing what I know now, I probably would never have started, because the healthcare system is so complex and so painful. In the United States, as long as there's no reimbursement code, it's a constrained market. You cannot see the widespread adoption of any kind of telemedicine or telehealth program unless you're in a capitated system.*
- Existing healthcare IT systems are difficult to access with new services: *You run into problems if you don't anticipate everything. It took us two years to solve that problem.*
- Product differentiation was difficult to accomplish in a risk-averse but highly-competitive market. The selected market niche, which had high quality requirements, was narrow and difficult to access.
- Human resources mistakes cost the team time and money: *...We've had people come through here that didn't work out. ...The number of people that can actually survive in the start-up world at various stages is very small. You have to have a very high threshold for ambiguity and risk.*

Case ϵ

As an intermediate actor, Case ϵ aimed to respond to the need for an effective recruiting of patients for medical trials. From the perspective of such patients, the start-up offered a digital solution in which the patient could find a trial and experimental treatments in aggregate form in one place. The digital solution provided information about opportunities that patients did not know existed, thus providing the freedom of choice for patients who were ready to participate in riskier than normal treatments. The critical incidents are presented in Table 10 and Table 11.

Table 10 The positive managerial incidents of Case ϵ

Positive incidents

- + The Case ϵ team developed a disruptive service-based business model; they aimed to shift the lead generation model in clinical trials from a market push to a market pull mode. This generated a win-win-win scenario for all three stakeholders associated with the business model: *You're getting the patient to push themselves and approach the doctor themselves.*
- + Following the completion of an initial pilot program, and after an intense process of building a minimum viable product, experimentation and pivots, the Case ϵ team was able to generate evidence about the scalability: *We hired a development firm to create our MVP. We had to get it into the clinic for testing, because the big question mark right off the bat was 'would patients actually use that solution?'*
- + From the outset, the Case ϵ team used creative methods to acquire the best-available human resources. These methods involved outsourcing, part-time staff, volunteers and interns as well as the use of equity-based rewards: *I am notorious for saying, 'You've got to do a trial period with me'. If they are a good fit, then they're in.*
- + The Case ϵ team developed digital management systems that were affordable and ready for scaling: *All of these tools that we're utilising right now should be able to sail with us for the foreseeable future. ...We try to keep it very simple, very straightforward; we try not to create any redundancy.*
- + Early on, the Case ϵ team developed a strategy and structure for scaling: *We spent a good deal of time talking about our strategy. ...We put infrastructure in place in order to make sure that we were documenting that we were doing these things. That way, we made sure that we didn't cross the line into something that would require regulatory oversight.*
- +At the time of this interview, the Case ϵ team was on the verge of acquiring investors: *We just opened our c-round in the last week and a half. ...we need additional resources in order to take it to the next step.*
- +Case ϵ received strong support from the local business ecosystem. While studying, the founder won a seed funding competition that was organised by a student-run organisation: *In order to collect the prize, the company actually had to be incorporated.* The founder was then connected to an incubator to validate the business model: *We graduated from [the incubator], and then we got into [the accelerator].*
- + The managers had positive experiences regarding networking at the beginning when the contractors helped develop the business, and some projects were used to validate the business idea. *I got started pitching out at different events and trying to get that industry validation from folks. ... [A]s you know, with the start-up, you have a lot of people [who] are contractors. We had some development developers that were contracts.*
- +Because of Case ϵ 's business model and their role as an intermediate actor, several networks needed to be created, such as patients, physicians, clinical research organisations, pharma companies, medical device companies, and biotech companies. Personal relationships were emphasised, and the founders' own networks were harnessed for the benefit of the company.

Table 11 The critical managerial incidents of Case ϵ *Negative incidents*

- Case ϵ faced challenges with regard to raising capital, as the team did not yet have a product or sales to out: *The greatest challenge in general for this company was that we had no product. It was a matter of, 'Okay, are you going to try to raise money without any product?' ...It always goes in terms of resources, time and money.*
- A shortage of human resources was another significant challenge: *We had limited time resources for fundraising, because it was me, primarily, doing the fundraising. I also had to run the company. ...trying to find an intern. I couldn't find anyone. That was in part because we weren't paying a lot.*
- The Case ϵ team pivoted its strategy to accommodate unexpected changes in the business environment: *We've had to have serious sit-down strategic discussions.*
- Communicating a new-to-the-market business idea to stakeholder groups presented another significant challenge: *Really, for folks to understand what we're doing, they have to be knowledgeable about two of the three things I talk about—software, healthcare, and the life sciences. There is nothing like [Case ϵ] out there.*
- It was a challenge to balance a neutral digital service provider between two heavily regulated contexts—healthcare and life sciences—without becoming one of the heavily regulated players themselves: *...We kind of operate outside the regulatory framework.*

Cross-case analysis

The inductive single case analyses that were previously described yielded critical management-related incidents as recalled by the managers of the digital health service start-ups. The cross-case analysis of these incidents was conducted with deductive logic to synthesise the managers' experiences by using central management priority areas that were derived from the configuration literature. The distribution of the context-specific critical incidents as recalled by the managers was condensed as shown in Table 12 (see Muhos et al. 2017).

Table 12 Managerial priorities in the cases analysed (positive incidents = +, negative incidents = -)

Category	Case alpha	Case beta	Case gamma	Case delta	Case epsilon
Focus	++	+	++	++	+
Power	--	-	-		-
Structure					+
Decision-making systems	+-	+	-		+
Strategic management		+			+
Service development and delivery	+-	+-	+-	+--	+
Marketing	+	--	-	+	
Human resources	+-	+	+-	+-	+
Growth management	+-	-	+	--	+
Network management	++	+	+	++	+++

The majority of the incidents fell into the predefined management priorities. The incidents that did not fall into the predefined categories were further analysed. These incidents were found to form a relatively consistent new category that is focused on external networks to the company itself. This category is labelled as *network management*.

Discussion

This study opened the qualitative and contextual characteristics in the growth process of digital health service start-ups in California by clarifying the managerial priorities based on experience. This study was based on the research question: What are the critical management priorities in digital health service start-ups in Southern California? The question was answered by analysing the positive and negative incidents that the managers of the case companies experienced.

The five single case analyses yielded critical management-related incidents as recalled by the managers of digital health service start-ups. The analyses were reported in detail in the Results section. The cross-case analysis of these incidents was carried out with deductive logic, devising the nine management priority categories. The nine predefined management priorities of the reference framework apply to the classification of the majority of the critical incidents. The incidents that did not fit into the predefined categories were further analysed. These incidents form a new category focused on *network management*. The condensed findings related to the management priorities of digital health service start-ups in California are presented in Table 13:

As a contribution to theory, the modified framework functions as a platform (a set of propositions) for further clarification of the qualitative and contextual characteristics in the start-up processes of the digital health service market in California. Cross-case analysis of these management priority areas revealed several context-specific characteristics as explained in the following paragraphs.

First, the start-up companies in each case focused on bringing radical, disruptive innovations (see Nanda and Rhodes-Kropf 2013) to the US health service market. The risk-reward ratio was considered high. The rising percentage of health in GDPs (OECD 2017), the mega trend of digitalised health (Agarwal et al. 2010; Pinto and Baracsi 2012), and the economic shift to services (Pinto and Baracsi 2012) were experienced as promising opportunities for disruptive digital service businesses. However, with radical service innovations, the risks of failure are high due to inefficiencies (OECD 2017) of the complex, slow-to-change, highly protected and regulated health market. As these digital service start-ups aimed at creating something that nobody had done before, they faced shortcomings regarding resources, service offerings, routines, and the environment (e.g., Sutton 2000; Hite and Hesterly 2001). For example, the slow speed of deploying emerging technologies within the US health market (PwC Health Research Institute 2016) increases the risk of failure. Alternatively, radical digital service start-ups seem to have the advantage of a prolonged time of operation under conditions of limited competition (see Rosenbusch et al. 2011).

Second, fundraising was an integral part of the strategy of these digital health service start-ups. The complex digital health service market requires long service development and, in some cases, approval cycles with nothing to sell yet. The key opinion leaders were the early target group of the marketing activities for customer verification.

Table 13 Management priorities of digital health service start-ups in California

Category	Management priorities of digital health service start-ups
1. Focus*	The central aim of a digital service start-up is to bring radically new digital services to the healthcare market with a scalable business model. Translating the business model to diverse stakeholders requires attention.
2. Power	In an owner-centric start-up, the founders might face conflicting interests related to vision, core values, and strategy. These conflicting interests can cause a loss of focus but can be seen as a necessity for the birth of radical innovations.
3. Structure	Transition from a simple owner-centric structure to a scalable structure starts early because the aim is at scaling the business in the large digital healthcare market of the US and beyond.
4. Decision-making systems	Affordable, easy-to-access, and scalable decision-making systems are devised. These digital tools include digital systems, for example, for communication, resource management, project management, cloud computing, and data management.
5. Strategic management	The strategic aim is to attract investors and scale. However, strategies must be flexible to cope with the unexpected changes of the target market.
6. Service development and delivery	Through a process of early piloting, minimal viable products, experimentation, pivots, and customer verification, evidence about scalability is generated. Premature service releases and hard-to-access IT systems can cause challenges.
7. Marketing	Convincing opinion leaders to support the service provides invaluable recognition for new-to-market start-ups. However, finding key opinion leaders and verifying the target customer segment are often challenging.
8. Human resources	Start-ups need to compete of capable people. Companies acquire human resources by equity-based rewards, part-time staff, volunteers, interns, trainees, freelancers, outsourcing (domestic or overseas), advisers, and virtual methods. The core is protected by involvement and ownership.
9. Growth management	Creative methods are used to raise capital, including self-funding, seed capital competitions, family and friends, business angels, super angels, foundations, patient groups, large companies, and so on. The complex market requires long development times with nothing to sell yet.
10. Network management**	In a complex, multi-faceted, and highly protected market with many stakeholders (for example, patients, caregivers, physicians, hospitals, insurance companies, associations, and charity organisations), network management is important. The ecosystem supports start-ups by providing access to university accelerator programs, start-up competitions, incubators, health sector-specialised accelerators, business angel networks, private investors, advisers, and mentors.

*= the categories deduced from the empirical literature (1–9)

**= the new inductive category (10)

Organic cash flow was zero or limited. These digital service start-ups (active at start-up and seed and series A–C funding phases) raised capital from a broad range of sources, including self-funding, seed capital competitions, and family and friends. Capital also came from business angels that included “super angels” (high risk-tolerance and a proven record in the health space), foundations, patient groups, large companies, and so on. These findings are similar to the findings of Ford and Nelsen (2014). The

fundraising landscape for early-stage companies has changed. These start-ups need to look toward new, emerging categories of investors to provide funding that venture capital historically provided. Corporate venture funds, angels, angel networks, government agencies, foundations, patient advocacy non-profits, family offices, and hybrid funds are all investing to start-ups (Ford and Nelsen 2014).

Third, development and delivery in the complex and hard-to-access digital health service market required early specialisation in skills, time, and the systematic development approach from early experimentation to a large scale. The market required contextual understanding from the founding team and effective acquisition of capable human resources who fit the context. Specialised skill sets were acquired by freelancers, part-time staff, volunteers, outsourcing (domestic or overseas), interns, and so on. However, the core was protected building it in-house, generating a culture of involvement and ownership.

Fourth, in a complex, multifaceted, and highly protected digital health service market, network management was experienced as an integral part of success (Elfring and Hulsink 2003) and growth (Hansen 1995). Because of the lack of necessary capital and legitimacy, news needed access to external resources and expertise (Hite and Hesterly 2001). Through networking, these start-ups aimed at enhancing their early performance (Baum et al. 2000), achieving positive effects on innovation (Pittaway et al. 2004), discovering opportunities, testing ideas, and building legitimacy (Parida et al. 2010). The start-ups that were interviewed perceived that they belonged to the health and life science ecosystem in Southern California. This ecosystem supported start-ups by providing rapid access to useful networks, including university accelerator programs, start-up competitions, incubators, health sector-specialised accelerators, business angel networks, private investors, advisers, and mentors. Incubators and/or accelerators were seen as an entrance into the ecosystem of the health business. These communities provided, for example, subsidised rent, business advice, marketing assistance, and networking advice (Davidsson and Honig 2003). In terms of the success of start-ups, networking with funding actors was highlighted in all cases. These results align with Lee et al. (2001), who found that start-ups preferred networks with external actors, such as venture capitalists and venture associations.

In addition to the context-specific features, the interviews also revealed typical characteristics of start-ups (Gartner 1985). These digital service start-ups created a new digital health service under conditions of extreme uncertainty (Knight 1921; Milliken 1987; McMullen and Shepherd 2006). They had promising ideas and accepted the high risk of failure in experimenting with an idea and reaching towards a scalable business model (Weiblen and Chesbrough 2015) within their specific digital service market. Everything, including the strategies, structures, and systems of the studied digital health start-ups, were prepared for scaling. Moreover, small failures were an integral part of the search process (Griffith 2014; Blank and Dorf 2012). The context-specific characteristics of digital health service start-ups in California are presented in the Figure 1.

For the managers who start up a digital health service business or target this market, this study provides a useful benchmark for the typical management priorities. The empirical-based stage framework forms an effective tool for reflecting on and predicting the challenges faced during the start-up stage. Compared to other available frameworks, this study provides an in-depth, empirical-based and context-specific view of the early growth processes of the digital health service start-ups.

To conclude, this study defined the qualitative and contextual characteristics of the growth process in digital health service start-ups in California by clarifying

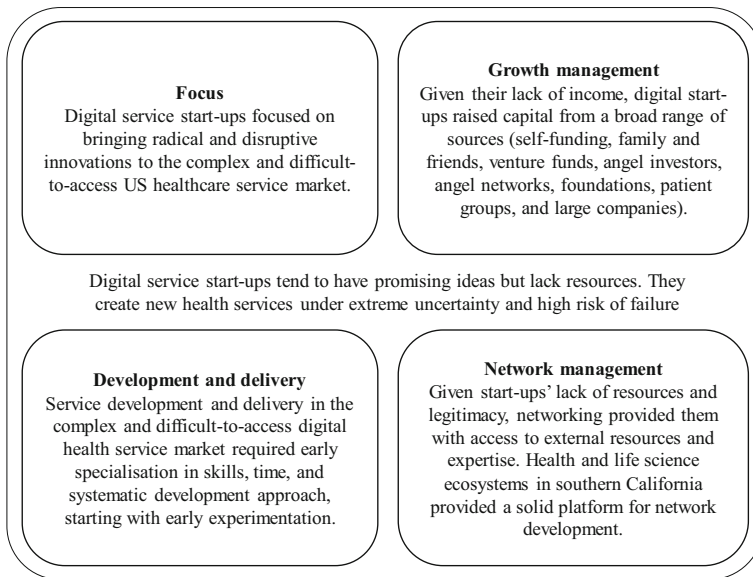


Fig. 1 Context-specific characteristics of digital health service start-ups in California

experienced managerial priorities. The devised empirical-based stage framework seems to be a useful starting point for reflecting on and predicting the challenges faced during early development of a digital health service start-up, taking into account the context-specific features of digital health service businesses. This study revealed some context-specific viewpoints partly comparable to the findings of Saarela et al. (2018). These viewpoints suggest that companies in different contexts face culture- and context-specific issues in their early growth. The healthcare context and the essential role of radical innovation of digital health start-ups were clearly visible characteristics of the case companies. Growth is a heterogeneous process with a high variable of patterns, growth factors, and knowledge sources (Brenner and Schimke 2015). Every service-based start-up is unique.

The context of this study partly limits the research. For example, the findings of the study cannot be generalised to other countries or business contexts and depend on the time of the data collection. With replication logic, analytic generalisation (generalisation based on a theory) is possible when building context-specific frameworks that are applicable to the digital health service start-ups in California.

The qualitative and contextual differences of growth management priorities in the start-up process provide promising paths for future research. It would be interesting to compare the results of similar analyses in other countries. Moreover, the support provided by the business ecosystems to start-ups requires further examination. Finally, understanding the context-specific management priority area—network management—requires more in-depth analysis and provides an interesting topic for future research. To support digital service start-ups and remove structural and context-specific barriers to their growth, in-depth knowledge of the processes involved is required.

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