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An exploration of the applicability of Lean Startup in small non-digital firms: an effectuation perspective

Sam Solaimani, Tijl van Eck, Henk Kievit and Kitty Koelemeijer
Center for Marketing and Supply Chain Management, Nyenrode Business Universiteit, Breukelen, The Netherlands

Abstract

Purpose – Lean Startup (LS) has gained considerable traction in the startup scene, especially within digital firms where the concept finds the concept's genesis. However, there are more and more calls in the entrepreneurship literature to study LS's application beyond the digital context. The purpose of this study is to explore the applicability of LS within the largely under-researched context of non-digital entrepreneurs. To structure the authors' understanding of the participating entrepreneurs' cognitive and behavioural logic, effectuation theory is applied.

Design/methodology/approach – To explore how LS is applied in non-digital settings, this study analyses the LS approach of 15 Dutch brick-and-mortar and click-and-mortar Small to Medium-sized Enterprises (SMEs) and startups.

Findings – This study provides empirical evidence that non-digital entrepreneurs pursue an effectual logic in their LS approach. However, the entrepreneurs' LS approach appeared to be contextualised to the non-digital contexts' inherent constraints and trade-offs. Such contextualisation calls for a particular set of skills and competencies, including applying mixed-methods cross-validation, affinity and passion for craftsmanship and aesthetics, inferring from limited, qualitative, and often skewed data, establishing an empathetic collaborative relationship with customers and suppliers, and leveraging prior market knowledge and experience.

Originality/value – This study advances the current understanding of the LS applicability and gives a more nuanced account of how LS is practised in the context of non-digital firms, the challenges entrepreneurs involved in non-digital firms need to overcome, and the skills and competencies they need to possess. In practical terms, the findings help non-digital entrepreneurs and coaches to be more heedful of the contextual peculiarities when employing LS.

Keywords Lean startup, Effectuation theory, Entrepreneurship, Non-digital, SME, Startup

Paper type Research paper

1. Introduction

Since the 1970s scholars and practitioners (e.g. venture capital firms, governmental support agencies, and universities) have urged entrepreneurs to write a business plan [1] when embarking on new ventures (Honig and Karlsson, 2004; Lange *et al.*, 2007; Furr and Ahlstrom, 2011). However, the relatively stable marketplace in the later part of the 20th century has been superseded by the unprecedented dynamic and uncertain business market of the 21st century, marked by globalisation, fast-moving technological advancements, increasingly demanding customers, and shortening product life cycles (Earl and Wakeley, 2010; Neary, 2003). Within the contemporary VUCA (i.e. volatile, uncertain, complex, and ambiguous) context, recent research shows that the link between business planning and business performance is less straightforward (Brinckmann *et al.*, 2010; Honig and Samuelsson, 2021; Kraus *et al.*, 2018). Especially in the small firms' context, business planning's impact on

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performance is more significant for established firms with existing routines and information from prior operations than new ventures where structures and procedures are missing, and decision making is carried out under high degrees of uncertainty with a scarcity of (if not ambiguous) information (Brinckmann *et al.*, 2010).

The relation between business planning, performance, and uncertainty is best understood through the theory of effectuation and its contrast to causation (Brinckmann *et al.*, 2010; Sarasvathy, 2001). Sarasvathy (2001) argues that in our increasingly entrepreneurial, dynamic, and nonlinear world, entrepreneurs tend to focus on controllable aspects of an unpredictable future (i.e. effectuation) instead of focussing on the prediction of an uncertain future (i.e. causation). In other words, effectuation, associated with ex-post emergent strategies, is better equipped against uncertainty than causation, which relies on *ex ante* rational planning that is more suitable in static and linear environments (Harms and Schiele, 2012).

In the face of growing business uncertainty, the tradition of business planning and the underpinning linear approach (often based on the so-called waterfall mindset) have taken a back seat, and the Agile principles [2] and methods in general (Hohl *et al.*, 2018), and the "Lean Startup" (LS) approach in specific have gained immense popularity in the Small to Medium-sized Enterprise (SME) and startup scene (Blank, 2013; Eisenmann *et al.*, 2012; Ries, 2011; Shepherd and Gruber, 2020). LS is inspired by the well-known Lean philosophy and provides structure and guidance for entrepreneurs to accelerate their product development and launch whilst maximising efficient use of the available resources (Blank, 2013; Ries, 2011). To do so, several learning approaches and experimentation methods are proposed to help entrepreneurs validate their assumptions about customers and their expressed needs and tacit desires (Ries, 2011). It is argued that the LS practitioners are predominantly focussed on effectuation as they rarely start with a perfect idea or plan but develop it over time with frequent experimentation and interactions with environments (Silberzahn, 2013).

However, the empirical studies on the applicability and effectiveness of the LS approach are scarce (Leatherbee and Katila, 2020; Silva *et al.*, 2020), and the limited existing body of knowledge has mainly focussed on digital or web-based firms (e.g. Ghezzi, 2019; Ghezzi and Cavallo, 2020; Harm and Schwery, 2020). Non-digital entrepreneurs [3], who are often dealing with a different "reality" – a reality where hypothesis testing is far more complicated, research and development costs are significantly higher, and law and regulation has a more restrictive impact when compared to digital settings – are largely overlooked in the literature (Bortolini *et al.*, 2018; Galli, 2019; Nirwan and Dhewanto, 2015; Nobel, 2011; Silva *et al.*, 2020). A contextualised perspective on entrepreneurship is a powerful way to identify and analyse varieties of entrepreneurship and their behaviour that often remain invisible to us (Baker and Ted, 2020). In particular, exploring the application of LS within various contexts is necessary, knowing that even Steve Blank, one of the inventors of LS, acknowledges the context-specificity of his model, which stems from his experiences as a serial technology entrepreneur and investor in Silicon Valley (Brännback and Carsrud, 2016). To the best of our knowledge, this study is the first attempt to empirically explore the applicability of LS practices within the setting of non-digital entrepreneurs and use effectual reasoning as a theoretical lens to explain the entrepreneurs' cognitive and behavioural logic. In doing so, fifteen Dutch SMEs and startups from various sectors, including consumer goods, food, retail, and construction, are studied.

The remainder of this article is structured as follows. First, the theory of effectual reasoning and its relationship with the LS approach is elaborated. Next, the research method, including data sampling, collection, and analysis, are explained. The findings are provided in the third section, where the entrepreneurs' effectual reasoning and actions are detailed. The

research concludes with theoretical and practical lessons drawn from the analysis and discusses the methodological limitations and potential areas for future research.

2. The effectuation theory and its relationship with the Lean Startup approach

Ries (2011, p. 8) defines LS as "a set of practices for helping entrepreneurs increase their odds of building a successful startup". The LS approach seeks to provide tools to decrease product development cycles by creating hypotheses and experiments through an iterative process in which collected information is validated (Eisenmann *et al.*, 2012). In line with the Lean's focus on customer value (Gülyaz *et al.*, 2019), the LS entrepreneurs build Minimum Viable Products (MVPs) to test their hypotheses with the potential users, terminate the initiative if the hypothesised demand appears to be non-existing, "preserve" if they fulfil an actual customer need, or "pivot" if with minor adjustments of the MVP customer satisfaction is probable (Buhl, 2018). LS is embedded in a cyclic model called Build-Measure-Learn (BML), where (1) the first set of requirements of the product is detailed, "hypotheses" are formulated, and a Minimum Viable Product [4] (MVP) is crafted, (2) with the MVP and based standardised metrics, the customers' appeal and product performance is gauged, and (3) the gained insight is compared with the hypotheses and the underlying presumptions, where discrepancies and deviations give rise to new experiments, and in this way the cycle of "validated" learning iterates (Ries, 2011).

The LS approach provides several intuitive and straightforward practices within each phase of BML [5] to help startups utilise their scarce resources efficiently and effectively in their often volatile business environment. However, the LS approach is associated with several shortcomings and challenges (see Table 1 for a short overview), one of which is its applicability beyond digital firms' context. The examples used in the Ries' (2011) seminal book and a significant portion of the subsequent studies on LS are based on digital firms with virtual or web-based services by scholars, practitioners, and entrepreneurs from software development and Information Technology (IT) oriented communities (Bosch *et al.*, 2013; Harms *et al.*, 2015; May, 2012; Miski, 2014) [6]. Therefore, it can be argued that the LS practices are mainly tuned to the peculiar setting of digital ventures and pay no heed to different

Table 1.
A highlight of Lean Startup challenges discussed in the literature

Lean Startup challenges	References
The traditional strategic planning methods perform more effectively in small businesses and new companies that inherently deal with information scarcity	Bortolini *et al.* (2018)
Informal hypothesis testing in the LS can be prone to certain biases (i.e. selection, representativeness, acquiescence, confirmation, overconfidence, and optimism bias), impairing its accuracy	York and Danes (2014)
There is a lack of qualitative methods for data collection and feedback evaluation around the customers' needs	Müller and Thoring (2012)
There is a heavy emphasis on market uncertainty, and technology uncertainty is overlooked	Harms *et al.* (2015)
The emphasis on Lean tools from manufacturing leads inherently to incremental innovation, which is of less value to startups trying to create radically new products and markets. Also, there is a heavy dependency on readily observable customer feedback whilst the customer does not necessarily have better knowledge than the startup founder, and as a result, potential ideas can incorrectly be rejected based on customer 'incorrect' feedback	Felin *et al.* (2019), Ladd (2016), Mollick (2019), Yordanova (2018)
LS alone will not suffice to create a robust product/market fit when applied to hard tech or science-based startups. The hard science context differs in several fundamental ways, such as a long gestation period, intense intellectual property considerations, less available seed, and investment capital for the startups	Werwath (2019)

realities, for instance, the non-digital context (Galli, 2019; Nirwan and Dhewanto, 2015; Nobel, 2011; Silva *et al.*, 2020). Silva *et al.* (2021) argue that contextual constraints impose limitations on LS applicability and hinder LS adoption.

A key difference between the two settings is the relatively fixed production structure with physical and logistical constraints in the non-digital context as opposed to the digital firms' highly flexible working and "production" environment (Jesemann *et al.*, 2020). More to the point, the effort and budget needed for physical product development and launch and product re-evaluation and revision are considerably higher than in digital settings (Nobel, 2011). Additionally, in the heavily regulated, risk-averse, and flaw-intolerant sectors such as healthcare, pharmaceutical, or aerospace, LS's effectiveness is questionable (Nirwan and Dhewanto, 2015). In sum, products, marketing activities and the workplace are major differences between digital and non-digital entrepreneurs (Kraus *et al.*, 2018). Hence, it is reasonable to argue that different sets of entrepreneurial behaviours and competencies are needed in digital and non-digital settings to apply the LS practices effectively.

As discussed in the introduction, the effectuation theory aims to explain the startups' behaviour and decision-making in the face of uncertainty. Sarasvathy (2001, p. 245) defines effectuation as "processes that take a set of means as given and focus on selecting between various possible effects that can be created with that set of means" and contrast that with causation, which is "processes that take a particular effect as given and focus on selecting the correct means to create that effect". The contrast is further detailed by five effectual behavioural principles, namely, (1) beginning with a set of given means, the so-called "bird-in-the-hand" (as opposed to beginning with goals in causation logic); (2) focussing on acceptable cost, i.e. "affordable loss" (as opposed to expected returns in causation logic); (3) emphasising strategic alliances and pre-commitments, i.e. "crazy quilt" (as opposed to focussing on competitive analysis in causation logic); (4) leveraging environmental contingencies, i.e. "lemonade" (as opposed to exploiting pre-existing knowledge in causation logic); and (5) seeking to control an unpredictable future, i.e. "pilot-in-the-plane" (as opposed to trying to predict a risky future in causation logic) (Sarasvathy and Kotha, 2001). In later works, the five principles are reduced to four, and the pilot-in-the-plane principle is considered the underpinning of effectuation logic (Read *et al.*, 2016). Effectuation is thus not about the identification of the optimal means to pursue a predetermined objective, but "given an uncertain world, what could I do with the means, resources, and capabilities I have or could readily mobilise?" (Grégoire and Cherchem, 2020, p. 623).

In later studies on the effectuation theory, it is argued that effectuation and causation are not on the opposite end of a continuum, and hence, it should be viewed as orthogonal and measured separately (Perry *et al.*, 2012). In fact, entrepreneurial decision-making seems to follow "a hybrid logic that uses both effectuation and causation simultaneously, while the dominant logic dynamically shifts over time" (Reymen *et al.*, 2015, p. 33). That is to say, flexible effectual decision-making in the earlier stages of venture creation, with a transition to more causal planning-based decision-making over time as both the new venture and market mature (Alvarez and Barney, 2005).

In recent studies, the LS approach has been explored from an effectuation perspective. Yang *et al.* (2019), for instance, provide a nuanced view on the entrepreneurs' cognitions behind the LS and claim that entrepreneurial effectuation cognition is associated with search behaviours, and entrepreneurial causation cognition is associated with execution behaviours [7]. Ghezzi (2019), however, argues that the entrepreneurs' behaviour when applying LS mirrors effectuation, that is, to "make sense of the opportunities they create, rather than to discover and plan around them" (p. 13). For instance, LS's startup-customer interactions and experimentation provide the entrepreneurs with the flexibility to handle and even exploit unexpected events, which is consistent with effectuation logic (Ghezzi, 2019). More specifically, the LS approach enables entrepreneurs to use incremental, iterative, and

inductive processes to make decisions until the product-market fit is achieved. At this point, the decision-making context is converted from uncertain to risky, a setting in which causal logic based on planning is more suitable. Similarly, Mansoori and Lackeus (2019) proposed that effectuation and LS can be positioned as complementary across different phases of an entrepreneurial venture; i.e. whilst effectuation is useful in ideation and pre-startup phases when stakes are low, the LS approach is more valuable in the pre-startup and startup phase when the stakes are slightly higher.

In sum, it can be argued that the literature on the applicability of LS mainly focusses on digital firms, where behaviourally speaking, entrepreneurs tend to pursue (or manifest) a contrasting cognitive logic when practising LS (Daniel *et al.*, 2015; Ghezzi, 2019; Harm and Schwery, 2020). Going back to the outset of this study, the aim is to explore (1) the applicability of the LS practices within the context of non-digital entrepreneurs and (2) the entrepreneurial cognitive and behavioural logic from an effectuation perspective. The following section details how this study empirically delves into the identified gap.

3. Research method

In this study, a phenomenological research approach is adopted to capture the entrepreneurs "lived experiences" (Berglund, 2015). Phenomenology is particularly relevant to studying entrepreneurship, which is "often defined by its demand for creativity and judgement in the face of unclear goals and radical uncertainty" (Berglund, 2015, p. 479). To collect data about the entrepreneurs' experiences with LS in a non-digital setting, a qualitative explorative case study analysis is conducted. Case study analysis helps gain a detailed account of the context in which a phenomenon occurs, including the underlying social arrangement, behavioural dynamics, explicit and implicit rules, intentions, and needs (Dul and Hak, 2008; Eisenhardt, 1989; Miles and Huberman, 1994). To select cases, a purposive sampling strategy is applied (Miles and Huberman, 1994), in which the cases' internal homogeneity (Seawright and Gerring, 2008) is ensured by (1) inviting only non-digital micro-sized [8] SMEs and startups; (2) the invited entrepreneurs confirmed to have read (at least) Ries (2011), and apply or have applied LS practices in their daily business; and (3) all invitees were located in the Netherlands to minimise potential geo-cultural influences. To ensure generalisability or transferability (Lincoln and Guba, 1985), a "diverse" case selection strategy is applied in which it is strived to look into a heterogeneous set of SMEs and startups in terms of industries and years of establishment (Seawright and Gerring, 2008).

In the end, fifteen startups that complied with the inclusion criteria have taken part in this study, all of which were located in Amsterdam (The Netherlands) with a revenue of 2 M or less on an annual basis (see Table 2 for an overview of the participating companies). All the interviewees' and companies' names are anonymised to protect privacy. The sample size is comparable to earlier studies on entrepreneurship process and entrepreneurial behaviour; for instance, the study by Stirzaker *et al.* (2021) based on 12 entrepreneurs, or Secundo *et al.* (2020) based on 12 case studies.

Given the explorative nature of this study, data collection is based on semi-structured interviews, mainly to be able to "probe" a response, i.e. asking the interviewees to explain, or build on, their previous answers, and in this way better understand the meanings that participants ascribe to various phenomena (Saunders *et al.*, 2019). To enhance credibility (i.e. establishing confidence in the truth of the findings), data triangulation is applied (Lincoln and Guba, 1985), in which interview data is enriched with data from firms' websites, product brochures, business reports, and financial reports statements. The interviews are structured according to the LS-based BML framework presented in the previous section. As such, the interviewee questions were mainly focussing on the interviewees' knowledge and experience in building, measuring, and learning, and what methods and approaches are used in each

Firms	Description	Industry	Role	Size (FTEs[†])	Firms' age (years[‡])
Label producer	Designing, producing, and delivering clothing labels and tags to exclusive brands in the USA, EU, and the Middle East	Textile	Founder/CEO	4	3
Ecological roofing	Designing and building ecological rooftops, rooftop gardens, water drainage, and suchlike, mainly for SME and consumer market with societal values (e.g. water buffering, gardening in urban areas)	Construction	Founder/CEO	8	6
Navigation device	Enabling tourists to navigate through hotspots in urban areas based on wind direction for an entertaining and unique experience	Consumer electronics	Co-founder/CEO	3	3
Food platform festivals	Bringing innovative/novice food concepts to festivals/corporate events, initially in music festivals, but now in many other settings such as corporate food courts	Food	Founder/CEO	9	5
Head-phones	Design and production of high-end headphones offered based on a unique lease model	Consumer electronics	Founder/CEO	4	3
Vegetarian pizza	Producing vegetarian pizza based on a unique cauliflower-based dough, starting to sell at a local restaurant but now selling in supermarkets	Food	Founder/CEO	9	2
Monitoring device	Developing sensors and algorithms to conduct and predict maintenance on large electrical motors	Hardware vendor	Co-founder/CEO	4	2
Special wines	Wine vendor specialised in German wines selling in "specially decorated" pop-up location	Retail	Co-Founder	2	2
Cardboard tents	Designing and producing cardboard tents supplying to a wide range of customers, e.g. festivals, conferences, kids	Leisure	Co-Founder	4	3
Beer brewer	Brewer and retailer of speciality beers in the Benelux region	Brewery	Co-Founder	2	3
Modular homes	Designing, building, and constructing modular homes	Construction	Co-Founder	9	2
Chocolate sprinkles	Producing exclusive chocolate sprinklers (often used as a marketing item)	Food	Co-Founder	2	4
Luxury raincoats	Producing "bike" raincoat	Fashion and design	Co-Founder	3	3
Craft beer brewer	Brewing special beer based on spirit herbs	Brewery	Co-Founder	5	3
Cookie producer	Producing organic cookies	Food	Co-Founder	6	5

Note(s): [†]Some of the participating firms have an additional (variable) layer of on-call employees with flexible contracts. For the sake of clarity, only the permanent workforce is indicated
[‡]Some of the participating firms have a more extended history of trial and error with an earlier version of their product. For the sake of clarity, the year of formal establishment is indicated

Table 2.
Overview of the participating firms

phase, such as "how is ideation stimulated and facilitated?", "how are ideas prototyped?", "how is knowledge captured and reused?", followed by questions on LS's potentials and limitations, and how the entrepreneurs acted or took measures to leverage the potentials and cope with the limitations (e.g. "what are the most useful/practical or useless/inappropriate LS practices? And why", "how do you apply or adjust the practices to your context?"). The semi-structured interview format helped the interviewers dig into the entrepreneurs' anecdotes, analogies, workarounds, and concerns.

In contributing to internal validity or dependability (i.e. replicability of findings if the inquiry were replicated with the same or similar subjects in the same or similar context) (Lincoln and Guba, 1985), all the interviews were recorded and transcribed, and the interviewees reviewed the transcriptions. The data analysis is based on coding guidelines by Miles and Huberman (1994). First, open coding is applied to identify recurring themes in transcriptions and collect secondary data (Bluhm *et al.*, 2011; Straus and Corbin, 2008). Some of the themes corresponded to the LS practices discussed in the key LS publications (e.g. Blank, 2013; Eisenmann *et al.*, 2012; Ries, 2011; Ries and Euchner, 2013); however, some themes put the LS practices in a new light or even challenged the relevance of some practices. Next, with axial coding (Miles and Huberman, 1994), the identified codes are compared and clustered into higher-level interrelated constructs that appear to correspond to an effectual instead of a causational logic (see Table 3 for an overview of confirmative, emerged and clustered themes). To establish higher extents of confirmability (i.e. transparency on how interpretations are derived from the transcripts) (Lincoln and Guba, 1985), a systematic coding process was carried out using qualitative data analysis software, Atlas.ti (version 6.2.28). The tool helped consolidate transcriptions and reports and systematically code and annotate findings in the primary data material.

4. Findings

The entrepreneurs' behaviour, actions, and decisions are structured according to the LS approach's three phases: Building, Measuring, and Learning. Furthermore, in the analysis process, attention is paid to LS's differences and commonalities in the digital and non-digital settings.

4.1 Building

In the ideation stage, the data corroborate the LS practice of hypothesis-testing given the fact that almost all interviewees seem to initiate their product development process with the query on customer value or the so-called leap-of-faith assumption where the firm's value proposition depends on, i.e. "what are the expected values and how should it be delivered to targeted customer group?". Similar to a digital environment, the studied non-digital SMEs and startups underline openness, interaction, and learning with customers:

> [. . .] It was not a very successful campaign [sales at a Dutch amusement park] for us, at least not in terms of sales. We wanted to know the exact reasons behind our poor sales, so we changed the strategy and used the same event to root cause our sales problem. (Food platform festivals).

A proactive curiosity towards customers is crucial:

> At various events, we get in touch with our customers to find their true opinions about the cardboard tent. It allowed us to pinpoint problems in the design and improve them. At succeeding events, we ask users again to see if we actually have improved our products (Cardboard tents).

However, sometimes entrepreneurs seem to reflect on hypotheses based on their vision of the future, not driven by customers' tacit needs *per se*, as emphasised in the LS literature. It

Table 3.
Overview of initial themes and codes

	Confirmative themes	Codes	Emerging themes	Codes	Clustered themes
Build	• Voice of customer • Just-in-Time • Small Batches • Kanban • Andon • Pull • MVP • Single-piece-flow • Innovation accounting • Rapid iteration • Cross functional team	• *b_voc* • *b_jit* • *b_sbatch* • *b_kanban* • *b_andon* • *b_pull* • *b_mvp* • *b_spf* • *b_innacc* • *b_rapiditer* • *b_crossfunc*	• Entrepreneurs' vision • Entrepreneurs' frustration • Entrepreneurs' domain knowledge • Finished products instead of MVP • Mass production requirements • Aesthetics • Benefits of large batches • Collaborative exploration • Continuous improvement • (Creative) craftmanship	• *b_vision* • *b_frust* • *b_domainknow* • *b_no_mvp* • *b_massproduct* • *b_aesthetic* • *b_lbatch* • *b_collexpl* • *b_kaizen* • *b_craftmanship*	Bird-in-the-hand: • *Entrepreneurs' vision and frustrations (B-emerge); domain knowledge (B-emerge); creative experiments (M-confirm)* Affordable loss: • *Continuous improvement with stakeholders (B-emerge); MVP (B-confirm)* Crazy quilt: • *Trust-based alliance (L-emerge); experiential learning with partners (L-emerge); supplier development (L-emerge); pre-purchase agreements (L-emerge)* Lemonade: • *Cross validation of data and assumptions (M-emerge); multistakeholder scenario testing (M-emerge); mixed methods (M-emerge); qualitative and quantitative data (M-confirm)* Pilot-in-the-plane: • *Mass production requirements (L-emerge); collaborative exploration (L-emerge); joint ideation and development (L-emerge); emphatic relationship with stakeholders (L-emerge); profit-sharing (L-emerge); stakeholder management (L-emerge)*
Measure	• Genchi Gembutsu • Customer archetype • Customer behaviour • Actionable metrics • Creative (hypothesis) testing • Qualitative measurement • Quantitative measurement • Innovation accounting • Experiments	• *m_gg* • *m_arch* • *m_behavior* • *m_metrics* • *m_test* • *m_quali* • *m_quanti* • *m_innaccount* • *m_exp*	• Experts' valuation • Emphatic relationship with customers and suppliers • Mixed-methods • Scenario testing • Cross validation • Data scarcity	• *m_expert* • *m_emphathy* • *m_mixedmethods* • *m_scenario* • *m-crossvalid* • *m_datascarce*	
Learn	• Observation • Validated learning • Five-why's • Pivoting • Customer interview	• *l_observe* • *l_learn* • *l_5w* • *l_pivot* • *l_interview*	• Experiential learning • Collective data • Collaborative exploration • Emphatic relationship • Data triangulation • Supplier development • Stakeholder management • Profit-sharing with suppliers • Pre-purchase agreements • Trust-based relationship	• *l_experiential* • *l_colldata* • *l_collexplore* • *l_emphatic* • *l_triang* • *l_supplydev* • *l_stakeholder* • *l_profitsharing* • *l_prepurchase* • *l_trust*	

sometimes spans beyond the problem identification (based on which a solution can be developed). There seems a higher-level purpose at stake:

> I have not become an entrepreneur to make clients happy per se but more because I believe in this company's mission which is fully focused on sustainability (Ecological roofings), or a report by the Cookie Producer on how the firm perceives the future of farming soil in terms of fertility, the firm's commitment to Direct Trade Verified Sustainable (DTVS), Global Reporting Initiative (GRI), Committee on Sustainability Assessment (COSA), among others, and the future action plan to reduce overall carbon footprint as part of the firm's sense of purpose.

Also, personal frustration and competencies (or prior market knowledge as it will be discussed in the next section) play a vital role:

> For work, my co-founder needed to ride his bike in Amsterdam wearing a suit to get from one appointment to the other. He wore a raincoat but still got wet pants and asked me to come up with a fashionable idea to stay dry without using rain pants (Luxury, raincoats), and,

> I worked in a distillery company where we used many botanicals to flavour gins and other spirits. And then I thought why not use those botanicals to brew beers, and that is how I came up with the idea. (Craft beer).

Once hypotheses are formulated, product prototyping is the critical next step virtually for all interviewees:

> We develop prototypes with clear target settings. For example, the beer needs to be 4% alcohol. It needs to be 32 EBU in terms of bitterness, 20 EBU in terms of colour, 12° Plato, or X amount of CO2 gas content. We then compare what we put into the brewing process and the value that comes out. If the values do not match the targets, we think about the adjustments that need to be made. When we do get the targeted values, we then ask consumers on festivals, for instance, what they think of our output (Craft beer). Or,

> [. . .] innovating a product was the challenging part for me. I started to "design" pizzas in my own kitchen. After that, I asked a lot of people to taste the pizza to see whether I had "nailed" the targeted requirements (Veggi pizza).

However, an MVP seems not always helpful in the consumer goods context. It may lead to partial customers' experience or a misleading customers' perception of the product, and as a result, misleading insights for the entrepreneurs:

> Our online customer experiments were disappointing; the MVP was rather a minimum customer experience; they [the customers] had a hard time imagining the comfort of our product, but after the physical experiment they were willing to buy our wearables they had tried out and felt physically comfortable with. (Luxury raincoats).

According to some of the interviewed entrepreneurs, consumers need to see a (relatively) finished product before "being able" to assess its perceived value:

> We made a 3D image of the first version of the tent, and we send this to festivals. Most of them did not respond, and the ones that did question whether we thought of all the requirements. This path was unsuccessful for us [. . .] we then went back to our manufacturer to produce an agreed minimum order quantity and went on to test the actual product at festivals (Cardboard tents). Or,

> We have used social media and our personal network to invite people to taste our early products. We need to probe our potential customers at the stores. At some point, we also collaborated with a local hotel so that their visitors could taste our products (Cookie producer).

Moreover, the path from MVP to large-scale production is considered too risky in the non-digital context; e.g. large production often requires a different design that cannot be captured by MVP:

> MVP is great, but you often need to think things through because you will be stuck with choices you made once the product is in the production phase . . . Small scale production would have been a solution, but it is not always possible with minimum order quantity imposed by suppliers. [. . .] everything you do wrong now, you will pay for it in future (Labels).

Besides, the non-digital entrepreneurs seem to work significantly longer on their prototype compared to the digital-based firm's "alpha version":

> It takes about a year for us to release a new design . . . we try to process all iterations at once. I believe this is a large difference between the Lean Startup method and our approach. LSU is a lot more difficult when you have a product. It is easier to use short iteration cycles for software or your website. (Headphones).

The reason seems to be mainly related to experiment setup costs: *"We need to batch our iterations because we need to achieve some volume; otherwise, the production cost would be too high" (Headphones)*. Also, the length of design iterations seems to be variable and sometimes unpredictable: "*[. . .] as part of testing, I placed this cardboard tent in my garden for a month or two . . . And the tent was still dry on the inside after two months" (Cardboard tents).*

In contrast to a digital setting, too many iterations with small batches are not always desired in physical firms' realm since it exponentially increases the average cost per unit. Instead, to facilitate learning, some firms tend to experiment with various materials and designs (e.g. texture and shapes): "*[. . .] using punch knives, which is a more flexible production technique, helped us to maintain the experimentation cost and have some iterations. It allowed us to learn and develop a mature product much quicker" (Cardboard tents).*

4.2 Measuring

In line with the LS school of thought, measurement appears to be a crucial part of the product development process in the non-digital context as well, often based on customer feedback:

> We tolerated a lot of trial and error in order to identify our segment as sharply as possible. We knew that our customer group is largely musicians, but that appeared to be only 25%. So, 75% of the profiles were quite unknown! To better understand our customers, we pursued A/B tests, hoping it will help us narrow down profile specifications. (Headphones). Or,

> we could not wait until our idea was completely flawless; we had to get exposed to the market with our imperfect product, learn from the feedback and improve our proposition. I like Hoffman's quote in this regard: "if you are not embarrassed by the first version of your product, you've launched too late". (Cookie producer).

However, customer feedback is not the only source. The non-digital entrepreneurs seem to seek out a broader range of sources to assess customers' needs; for instance, the expert's valuation is often employed:

> We have not tested the taste of our sprinkles with our target customer group. Instead, we have asked a Michelin star chef to taste our sprinkles and measure the amounts of our ingredients. (Chocolate Sprinkles).

> Or insights from supply chain partners: *"We are doing big data tests with Albert Heijn [a large Dutch supermarket]. They are testing which stores are doing well and which do not. We follow up on those insights by looking into why we do not perform in certain stores. Usually, social media exposure is low in these areas as well, and we try to see how we can change this" (Veggi pizza).*

The measurement itself does not seem to be quantitative *per se*; in fact, qualitative methods are more often used as the sample sizes are generally limited:

> We selected a top 20 from all clients that reward us with a "10"-score – and are not from our inner circle – and invited them to join a focus group and validate our assumptions together; through surveys, we study customer preference regarding wireless [. . .] (Headphones).

Similarly, the digital and non-digital SMEs and startups seem to differ when it comes to their access to data:

> LS emphasises quantitative testing while for us gathering sufficient data to perform any test is extremely difficult. Perhaps heavily funded startups can manage to have about 100k visitors a month in the beginning. Only then split testing is an option, but how the heck are we supposed to get that much traffic to validate our products? It costs a massive amount of marketing money. (Headphones).

Moreover, the processes around products, e.g. usage and value creation, do not lead to data generation:

> I always found innovation accounting difficult because of the amount of data this requires. We do a low number of sales transactions but with a high individual value. I believe that Ries puts such a strong emphasis on the quantitative side of things because he comes from the software industry. Ries sells zeroes and ones, and these are way easier and cheaper to keep track of. (Modular homes).

Notwithstanding the qualitative or quantitative nature of data, data collection requires creativity in both digital and non-digital environments (e.g. developing falsifiable hypotheses, operationalising the hypotheses into researchable questions, finding representative or potential customers, and probing the potential customers directly and indirectly). Examples of creative experiments to generate valuable data are abundant in the LS literature, and in the same way, non-digital entrepreneurs had many creative ways to engage with potential customers and gauge their interest. For example, one of the startups compared one of its experiments to the "Wizard of Oz testing" in which customers believe they are interacting with the actual product, but behind the scene, human beings are doing the work (Ries, 2011, p. 106): *"For one of our products, we A/B-tested a prototype using photoshopped images, and it really worked [. . .] the product is online for pre-sale, right now!" (Headphone)*.

Nevertheless, data that non-digital entrepreneurs are dealing with are also sometimes incomplete. For instance, data produced by prospects that drop out of the sales funnel is barely available, and this limits some of the interviewed firms to improve their proposition based on customer data: *". . . during the summer we go to festivals mainly because we normally do not get much data about customers. This way we have a chance to reach out to people that are not buying our product and ask them why" (Headphones).*

Strikingly, the non-digital entrepreneurs do not always need to seek data; some receive "voluntary"' customer feedback regularly due to their physical presence in the local community: *"In a small shop like ours, unsolicited feedback is easily available. Most people living in the neighbourhood feel very much involved and advise us. This worked nicely for us!" (Special wines).*

4.3 Learning

Finally, the learning stage, where insights are translated into actions, seems to be equally crucial for non-digital entrepreneurs. Similar to digital businesses, learning should be focussed on "prioritised" knowledge gaps:

> We got responses from our customers, indicating that the labels on our bottle were not clear enough. They thought it was chocolate milk, so we adjusted the line on the bottle into "chocolate for breakfast". We never tested this again to see if customers better understand it now; we just went with it. You cannot try everything over and over again; you just do not have the time (Chocolate Sprinkles).

Mainly, formulating (key) performance indicators or targets makes the learning process much more manageable: *"We have agreed on clear success criteria with our customers. If our quantitative tests do not meet the criteria, we need to look at why we did not meet them. The process is very straightforward" (Monitoring solution)*.

What differs in the non-digital context is the subjective data that is collected with qualitative methods. To address this problem, firms seem to triangulate data and data sources (as discussed earlier) and learn collaboratively with their suppliers, customers, or domain experts: "*we hired an industry expert to look at the problem and together list high priority issues and ways to solve them. A fresh view on the problems, while thinking together, help us to understand better our customers' actual needs" (Cardboard tents)*.

Such collective effort leads to more awareness of stakeholders about the proposition that the firm is pursuing and the hurdles in the way, and makes it easier for stakeholders to think about the feasibility and viability of the proposed ideas:

> In our suppliers' meetings on New Product Development, or any product experimentation for that matter, we need to negotiate the cost structure and the viability of our ideas; we need our suppliers for their view and opinion on manufacturability, for instance. (Cookie producer)

> Suppliers also need to co-invest sometime. Take, for example, the topic of sustainability. We are in discussions with our suppliers about the packaging and moving towards biodegradable material. The financial part of the discussion is, fortunately, very tough. Why "fortunately"? Because you need these discussions to arrive at an economically viable solution. The right balance between ecological footprint, social impact, and economic viability is critical if you are no charity organisation. (Cookie producer).

However, a long-term, trust-based relationship with suppliers is vital:

> You need to build "likeability factor" or "supplier goodwill" if your like, especially, in the early phases of venturing, by going the extra mile, building a personal relationship with them [supplier], being yourself, and showing your genuine belief in your product and the problem it solves, and being forgiving sometimes when production flaws occur. Only, then, you get the production problems at the supplier's end effectively and promptly solved. Remember that startups are generally an insignificant partner to their supplier. (Cookie producer).

4.4 The non-digital entrepreneurs' behaviours and actions

Drawing upon the studied entrepreneurs' behaviours and activities discussed in section 4.1–4.3, it becomes clear that several LS practices that are commonly applied in both digital and non-digital contexts (e.g. ideation with the potential customer, evolving a vision towards a "leap-of-faith", hypothesis testing with iterative experimentation and MVP, quantification of questions and actionable metrics, validated learning and pivoting). However, the findings shed new light on nuanced differences when compared to the LS in digital settings as described by Ries (2011). For instance, the entrepreneurs' vision and frustrations, rigorous prototyping and working with semi-finished products, validation based on small sample sizes augmented with stakeholders' validation (i.e. suppliers and partners) and reliance on qualitative insights and analysis.

From a behavioural perspective, effectuation seems to be the entrepreneurs' dominant decision-making logic; however, different effectuation principles appeared to be prominent across the LS stages, none of which has hitherto been – to the best of our knowledge – postulated as necessary entrepreneurial skills in the literature on LS practices. As such, the findings show an emphasis on (1) the entrepreneurs' focus on available means, their personal vision, frustrations and domain knowledge preceded the creative, creational process (i.e. the bird-in-the-hand principle), (2) the entrepreneurs' continuous search for new ways to enhance their products' manufacturability, usability, quality, and scalability together with the supply

chain actors and customers (i.e. the affordable loss principle), (3) entrepreneurs' strategic (trust-based) alliances with various supply chain stakeholders to resolve production- and logistics-related issues and be supported in manufacturing planning (often prioritised and paced by suppliers), and entrepreneurs' agreements and pre-commitments to control and build operational and financial security for an unpredictable future (i.e. the crazy quilt principle), (4) the environmental contingencies as part of the entrepreneurs' typical operation, perceived as an "expected" dynamism, in which, cross-validation of assumptions together with supply chain stakeholders creates opportunities for the entrepreneurs to improve or expand their offering (i.e. the lemonade principle), and (5) empathic relationship with supply chain actors and customers and pursuing collective action with suppliers (supported with co-exploration and co-creation, revenue sharing) to control potential economic and market (demand) fluctuations (i.e. the pilot-in-the-plane principle).

5. Discussion

The findings of this study on the entrepreneurs' behaviours and actions corroborate with the findings of Ghezzi (2019), in which entrepreneurs appear to adopt a creational and effectual approach. However, building upon the entrepreneurs' decision-making logic and their LS actions and practices discussed in the previous section, several noteworthy skills and competencies aligned to the non-digital context and its idiosyncrasies can be derived from the empirical findings (corresponding to the confirmative and emerging themes captured in Table 3).

Firstly, in addition to systematic, iterative, short-term experimental approach (e.g. commonly present in digital entrepreneurship such as usability testing with multiple users often within a controlled environment, Kohavi and Longbotham, 2017), non-digital entrepreneurs appear to need the ability to combine a diverse set of physical experiments, which inherently require more resources and patience to plan and execute whilst overcoming the physical and budgetary constraints. Seemingly, the non-digital entrepreneurs combine LS with vicarious (i.e. learning by observing others' behaviour such as customers, suppliers, partners) and experiential (i.e. learning by experience such as business development activities, marketing, experimentations) learning modes (Mansoori, 2017). Some examples are the "cardboard tents" entrepreneurs that used additive manufacturing to evaluate their product in then carefully selected festivals on multiple occasions or the founder of veggie pizza provided free pizzas to local restaurants to collect free customers' feedback in return. In this way, the entrepreneur could refine the recipe and evolve towards a more broadly admired taste.

Secondly, in line with the previous point, the non-digital entrepreneurs appear to possess a strong affinity, passion, and appreciation for craftsmanship and aesthetics, possibly more associated with "non-conformist art entrepreneurship" mentality (Aggestam, 2007), as an impactful way to "create" new demand (i.e. surprise and delight users) instead of being entirely reliant on hypothesis-testing to "reveal" an existing demand (i.e. follow and adhere to users). For instance, the fashion and design entrepreneur emphasised the importance of the entrepreneur's feeling about their crafted product and how it helps them become a trend-setter instead of a trend-follower.

Thirdly, the non-digital entrepreneurs appear to need the ability to infer insight from limited, possibly skewed data based on a personal relationship with customers and an intuitive understanding of their, often implicit, needs. Such intuition is often the result of entrepreneurs' in-depth knowledge of and experience with the production process, the material used, supply network, trends, and challenges. This finding can be explained by the notion of "empathetic accuracy" that is "facilitated by a good judgement which requires mental models that accurately assess, estimate, or infer others' preferences well enough to

form expectations of how various stakeholders will respond to the entrepreneur's new customer value proposition" (McMullen, 2015, p. 652). These models are informed by experiences with others, shared institutions, shared resources, social skill, empathic imagination, and other sources. For instance, the special winemaker developed a unique recipe by combining limited feedback from a few local testers with his extensive breweries experience. Similarly, the craft beer brewer had long experience brewing spirits before developing his unique product. And the food platform entrepreneurs were all food experts with extensive experience in the food industry, which helped them build their unique business model.

Fourthly, the non-digital entrepreneurs appear to need the ability and skills to collect and analyse qualitative data simply because access to (quantitative) data is extremely limited for the non-digital entrepreneurs (Hair *et al.*, 2012), and the population homogeneity is often untenable. Although from a conceptual viewpoint, Müller and Thoring (2012) advocate an extension of LS with more qualitative methods. An example is the "modular home" founder, who has used both qualitative and quantitative data collection methods in understanding the customers' needs but the quantitative survey appeared to be less accurate as the customers' various needs were either not captured or averaged out. Similarly, for the food platform firm, festivals are amongst the most important venues for meeting potential customers and suppliers and maintaining a relationship with their existing network.

Fifthly, the non-digital entrepreneurs appear to need collaborative skills to learn from suppliers, engage them in product development, negotiate favourable terms and conditions, volumes and prices, and suchlike, which seems to be another required competency. Whilst attention for supply chain collaboration within large enterprises is growing (Solaimani *et al.*, 2015; Solaimani and van der Veen, 2021), entrepreneurs' collective action and collaborative effort with supply chain partners is not explicitly discussed in the LS literature. From an effectuation perspective; however, means and affordable losses are dynamic concepts determined by the entrepreneurs' ability to co-create with (and coordinate) the alliance network (Murdock and Varnes, 2018). According to the founder of the headphones startup, their agreed price scheme with the supplier for yearly releases has been one of the most critical aspects of their new product development process.

Finally, the non-digital entrepreneurs' prior market knowledge and experience (i.e. subject matter expertise) appears to be a critical asset for several interviewed entrepreneurs (e.g. the ecological roofing, crafted beer, headphone, modular homes) in managing the ideation and experimentation phase efficiently and effectively (i.e. formulating novel propositions, accurate, viable and testable assumptions, and access to valuable industry network to whom a part of the production, logistics, technology could be outsourced). This corroborates with De Cock *et al.*'s (2020) case study on digital startups, where the role of prior market knowledge as an essential boundary condition for a successful application of the LS is underlined. It is noteworthy that any entrepreneur, regardless of the context, may possess the indicated skills and competencies in different degrees; however, drawing from the patterns identified in the cross-case comparison in this study, it can be argued that the discussed skills and competencies are more prominently and frequently required in the non-digital settings.

6. Conclusion

In response to increasing calls for more empirical research on the application of the LS (Shepherd and Gruber, 2020; Bocken and Yuliya, 2020), mainly, in non-digital domains (Bortolini *et al.*, 2018; Galli, 2019; Nirwan and Dhewanto, 2015; Nobel, 2011; Silva *et al.*, 2020), this study explores how entrepreneurs in non-digital context use the LS practices. Attention to the entrepreneurs' context is broadly posited as a way to understand and explain entrepreneurship and entrepreneurs' behaviour and actions (Baker and Welter, 2020; Welter

and Gartner, 2016; Zahra *et al.*, 2014), and amongst other forces, sectoral influences are considered in studying the impact of context on entrepreneurs (De Massis *et al.*, 2018). Accordingly, this study delves into fifteen SMEs and startups to explore how the founding entrepreneurs deal with peculiarities of non-digital context when practising LS. To understand the entrepreneurs' cognitive and behavioural logic, the effectuation theory proposed by Sarasvathy (2001) is used. Building on the commonalities and differences between digital and non-digital entrepreneurs (as suggested by König *et al.*, 2019 and Kraus *et al.*, 2018) and their context-specific LS approach, combined with a reflection from an effectuation perspective, this study put forward several challenges that non-digital entrepreneurs need to handle when applying the LS practices and proposes a novel set of entrepreneurial skills and competencies that non-digital entrepreneurs need to use the LS practices effectively.

From a theoretical standpoint, this study provides confirmatory empirical evidence regarding the generic applicability of some of the LS practices (Edison *et al.*, 2018; Furr and Dyer, 2014; Power, 2014); however, it sheds new light on the limitations of LS practices within non-digital context, and provide new insights into how non-digital entrepreneurs contextualise the LS practices. Furthermore, the findings not only confirm the effectual logic of non-digital entrepreneurs in applying the LS approach; it provides a refined view on how different effectuation principles are at play in various stages of LS within the non-digital context (i.e. the confirmative and emerging themes are captured in Table 3 and discussed in previous section). Practically speaking, the findings help LS practitioners in general, and non-digital entrepreneurs in specific, to be more heedful of the contextual peculiarities of non-digital settings when employing the LS practices, i.e. which practices are commonly valuable for non-digital environments and which practices should be reconsidered in light of physical constraints and possibilities, but also, what skills and competencies need to be developed to employ LS in the most effective was. Accordingly, the LS coaching and training programmes are suggested to pay attention to (and reflect on) contextual factors and challenges inherent in non-digital entrepreneurship.

Some limitations of this study should be taken into account for future research. First, to ensure internal validity, this study focusses on a (relatively) homogeneous pool of micro-sized SMEs and startups. Future research can improve the generalisability of this study by exploring the entrepreneurs' context more elaboratively, in terms of geographical locations and the inherent cultural influences and economic disparities between different regions (e.g. Rajagopalan and Solaimani, 2019), and firm size both in terms FTEs (e.g. the impact of organisational complexity) and revenue (e.g. as a proxy of resource scarcity) (e.g. Al-Hyari *et al.*, 2016). On another note, an attempt is made to ensure an acceptable sample size comparable with earlier studies in a similar context; however, for the sake of generalisability, future studies can involve larger sample sizes or employ quantitative analyses within or beyond a non-digital context to advance our understanding of effectuation and entrepreneurs' action and behaviour (e.g. regressing entrepreneurs' effectual-causal approach on firms' time-to-market, commercialisation rate or customer acquisition cost whilst controlling for the context). Second, to avoid speculative reasoning, this study is scoped to the LS' BML phases, leaving out the scaling stage because most of the cases were either not at or were just starting to scale their operations. Future studies can consider scaling or scaled SMEs and startups to explore non-digital entrepreneurs' behaviour and decision-making once the product-market-fit tipping point is achieved (Ghezzi, 2019) or the impact of effectuation in their internationalisation endeavours (Prashantham *et al.*, 2019). Also, the level of analysis from a company level to a department level, especially in the large enterprise context, can be another future research topic. For instance, the LS's applicability to firms' research and development division deserves

special attention, building on the existing literature on Lean's application to innovation management (Solaimani *et al.*, 2019a, b).

Notes

1. A business plan is defined as the written document that describes the current state as well as the presupposed future of an organisation (Honig and Karlsson, 2004).
2. For more information see: www.agilealliance.org
3. The entrepreneurs active in the so-called brick-and-mortar (B&M) and click-and-mortar (C&M) firms, i.e. businesses that serve their customers entirely or partly in a physical environment.
4. An MVP is an early version of the product that "enables a full turn of the Build-Measure-Learn loop with a minimum amount of effort and the least amount of development time" (Ries, 2011, p. 77).
5. Some examples of the LS practices are building "single-piece-flow" processes, performing innovation accounting (build phase), "Genchi Gembutsu" or "go and see for yourself", crafting customer archetypes, setting up actionable metrics, conducting various tests and analyses such as split-test and cohort-analysis (measure phase), considering various pivots and asking five-why's (learn phase); for a full list of practices, see Ries (2011).
6. Although there are a few exceptions, such as the application of LS in General Electric (Power, 2014) or healthcare (Silva *et al.*, 2013) where the LS applicability is discussed non-digital environments, none of which are resource-poor small firms that, for instance, deals with difficulties to afford the extent of experimentation the LS is proposing.
7. In the study by Yang *et al.* (2019), search behaviour refers to "the learning and discovery process through which new firms examine untested hypotheses of their products, look for the right customers, identify the market segment, cultivate suppliers and alliances, and develop a repeatable, scalable, and profitable business model" (Blank, 2013, p. 68); and, the execution behaviour refers to "to the process of carrying out or accomplishing a well-defined plan." (Yang *et al.*, 2019, p. 669).
8. Although there is no consensus on SME's definition (McAdam *et al.*, 2004), in this study the European Commission (2008) guideline regarding micro-sized SME is adopted which refers to enterprises with fewer than ten employees, and turnover of less than 2 million.

References

Aggestam, M. (2007), "Art-entrepreneurship in the Scandinavian music industry", in Henry, C. (Ed.), *Entrepreneurship in the Creative Industries: An International Perspective*, Edward Elgar, UK, pp. 30-53.

Al-Hyari, K., Abu Hammour, S., Abu Zaid, M.K.S. and Haffar, M. (2016), "The impact of Lean bundles on hospital performance: does size matter?", *International Journal of Health Care Quality Assurance*, Vol. 29 No. 8, pp. 877-894.

Alvarez, S.A. and Barney, J.B. (2005), "How do entrepreneurs organize firms under conditions of uncertainty?", *Journal of Management*, Vol. 31 No. 5, pp. 776-793.

Baker, T. and Welter, F. (2020), *Contextualizing Entrepreneurship Theory*, Routledge, New York.

Berglund, H. (2015), "Between cognition and discourse: phenomenology and the study of entrepreneurship", *International Journal of Entrepreneurial Behavior and Research*, Vol. 21 No. 3, pp. 472-488.

Blank, S. (2013), "Why the lean start-up changes everything", *Harvard Business Review*, Vol. 91 No. 5, pp. 63-72.

Bluhm, D.J., Harman, W., Lee, T.W. and Mitchell, T.R. (2011), "Qualitative research in management: a decade of progress", *Journal of Management Studies*, Vol. 48 No. 8, pp. 1866-1891.

Bocken, N. and Yuliya, S. (2020), "Lean startup and the business model: experimenting for novelty and impact", *Long Range Planning*, Vol. 53 No. 4, pp. 1-6.

Bortolini, R.F., Nogueira Cortimiglia, M., Danilevicz, A.D.M.F. and Ghezzi, A. (2018), "Lean startup: a comprehensive historical review", *Management Decision*, Vol. 59 No. 8, pp. 1765-1783, doi: 10.1108/MD-07-2017-0663 (accessed 8 May 2022).

Bosch, J., Olsson, H.H., Björk, J. and Ljungblad, J. (2013), "The early stage software startup development model: a framework for operationalizing lean principles in software startups", in Fitzgerald, B., Conboy, K., Power, K., Valerdi, R., Morgan, L. and Stol, J. (Eds), *Lean Enterprise Software and Systems*, Springer, Heidelberg, pp. 1-15.

Brännback, M. and Carsrud, A.L. (2016), "Understanding entrepreneurial cognitions through the lenses of context", in Welter, F. and Gartner, W.B. (Eds), *A Research Agenda for Entrepreneurship and Context*, Edward Elgar Publishing, pp. 16-27.

Brinckmann, J., Grichnik, G. and Kapsa, D. (2010), "Should entrepreneurs plan or just storm the castle? A meta-analysis on contextual factors impacting the business planning–performance relationship in small firms", *Journal of Business Venturing*, Vol. 25 No. 1, pp. 24-40.

Buhl, A. (2018), "Do it yourself - a lean startup toolbox for employee-driven green product innovation", *International Journal of Entrepreneurship and Innovation Management*, Vol. 22 Nos 4/5, pp. 526-544.

Daniel, E.M., Domenico, M.D. and Sharma, S. (2015), "Effectuation and home-based online business entrepreneurs", *International Small Business Journal*, Vol. 33 No. 8, pp. 799-823.

De Cock, R., Bruneel, J. and Bobelyn, A. (2020), "Making the lean start-up method work: the role of prior market knowledge", *Journal of Small Business Management*, Vol. 58 No. 5, pp. 1-28.

De Massis, A., Kotlar, J., Wright, M. and Kellermanns, F.W. (2018), "Sector-based entrepreneurial capabilities and the promise of sector studies in entrepreneurship", *Entrepreneurship Theory and Practice*, Vol. 42 No. 1, pp. 3-23.

Dul, J. and Hak, T. (2008), *Case Study Methodology in Business Research*, 1st ed., Butterworth-Heinemann Elsevier, Burlington.

Earl, P. and Wakeley, T. (2010), "Economic perspectives on the development of complex products for increasingly demanding customers", *Research Policy*, Vol. 39 No. 8, pp. 1122-1132.

Edison, H., Smørsgård, N.M., Wang, X. and Abrahamsson, P. (2018), "Lean internal startups for software product innovation in large companies: enablers and inhibitors", *Journal of Systems and Software*, Vol. 135, pp. 69-87.

Eisenhardt, K.M. (1989), "Building theories from case study research", *Academy of Management Review*, Vol. 14 No. 4, pp. 532-550.

Eisenmann, T.R., Ries, E. and Dillard, S. (2012), "Hypothesis-Driven Entrepreneurship: The Lean Startup", *Harvard Business School*, Background Note 812–095, December.

European Commission (2008), "Putting small businesses first: Europe is good for SMEs; SMEs are good for Europe", available at: https://ec.europa.eu/docsroom/documents/3445/attachments/1/translations/en/renditions/native/ (accessed 8 May 2022).

Felin, T., Gambardella, A., Stern, S. and Zenger, T. (2019), "Lean startup and the business model: experimentation revisited", *Long Range Planning*, Vol. 53 No. 4, pp. 1-14.

Furr, N. and Ahlstrom, P. (2011), *Nail it Then Scale it: The Entrepreneur's Guide to Creating and Managing Breakthrough Innovation*, 1st ed., NISI Publishing, Lehi, UT.

Furr, N.R. and Dyer, J. (2014), *The Innovator's Method: Bringing the Lean Startup into Your Organization*, Harvard Business Press, Boston, Massachusetts.

Galli, B.J. (2019), "Reflection of literature on using lean innovation models for start-up ventures", *Journal of Modern Project Management*, Vol. 7 No. 2, pp. 6-18.

Ghezzi, A. (2019), "Digital startups and the adoption and implementation of lean startup approaches: effectuation, bricolage and opportunity creation in practice", *Technological Forecasting and Social Change*, Vol. 146, pp. 945-960.

Ghezzi, A. and Cavallo, A. (2020), "Agile business model innovation in digital entrepreneurship: lean startup approaches", *Journal of Business Research*, Vol. 110, pp. 519-537.

Grégoire, D.A. and Cherchem, N. (2020), "A structured literature review and suggestions for future effectuation research", *Small Business Economics*, Vol. 54 No. 3, pp. 621-639.

Gülyaz, E., van der Veen, J.A., Venugopal, V. and Solaimani, S. (2019), "Towards a holistic view of customer value creation in Lean: a design science approach", *Cogent Business and Management*, Vol. 6 No. 1, pp. 1-30.

Hair, N., Wetsch, L.R., Hull, C.E., Perotti, V. and Hung, Y.T.C. (2012), "Market orientation in digital entrepreneurship: advantages and challenges in a Web 2.0 networked world", *International Journal of Innovation and Technology Management*, Vol. 9 No. 6, pp. 1-18.

Harms, R. and Schiele, H. (2012), "Antecedents and consequences of effectuation and causation in the international new venture creation process", *Journal of International Entrepreneurship*, Vol. 10 No. 2, pp. 95-116.

Harms, R. and Schwery, M. (2020), "Lean startup: operationalizing lean startup capability and testing its performance implications", *Journal of Small Business Management*, Vol. 58 No. 1, pp. 200-223.

Harms, R., Marinakis, Y. and Walsh, S.T. (2015), "Lean startup for materials ventures and other science-based ventures: under what conditions is it useful?", *Translational Materials Research*, Vol. 2 No. 3, pp. 1-8.

Hohl, P., Klünder, J., van Bennekum, A., Lockard, R., Gifford, J., Münch, J., Stupperisch, M. and Schneider, K. (2018), "Back to the future: origins and directions of the 'Agile Manifesto'– views of the originators", *Journal of Software Engineering Research and Development*, Vol. 6 No. 1, pp. 1-27.

Honig, B. and Karlsson, T. (2004), "Institutional forces and the written business plan", *Journal of Management*, Vol. 30 No. 1, pp. 29-48.

Honig, B. and Samuelsson, M. (2021), "Business planning by intrapreneurs and entrepreneurs under environmental uncertainty and institutional pressure", *Technovation*, Vol. 99, pp. 1-12.

Jesemann, I., Beichter, T., Herburger, K., Constantinescu, C. and Rüger, M. (2020), "Migration of the Lean-Startup approach from High-Tech startups towards product design in large manufacturing companies", *Procedia CIRP*, Vol. 91, pp. 594-599.

König, M., Ungerer, C., Baltes, G. and Terzidis, O. (2019), "Different patterns in the evolution of digital and non-digital ventures' business models", *Technological Forecasting and Social Change*, Vol. 146, pp. 844-852.

Kohavi, R. and Longbotham, R. (2017), "Online controlled experiments and A/B testing", *Encyclopedia of Machine Learning and Data Mining*, Vol. 7 No. 8, pp. 922-929.

Kraus, S., Palmer, C., Kailer, N., Kallinger, F.L. and Spitzer, J. (2018), "Digital entrepreneurship: a research agenda on new business models for the twenty-first century", *International Journal of Entrepreneurial Behavior and Research*, Vol. 25 No. 2, pp. 353-375.

Ladd, T. (2016), "The limits of the lean startup method", *Harvard Business Review*, available at: https://hbr.org/2016/03/the-limits-of-the-lean-startup-method (accessed 8 May 2022).

Lange, J.E., Mollov, A. and Pearlmutter, M. (2007), "Pre-startup formal business plans and post-startup performance: a study of 116 new ventures", *Venture Capital Journal*, Vol. 9 No. 4, pp. 1-20.

Leatherbee, M. and Katila, R. (2020), "The lean startup method: early-stage teams and hypothesis-based probing of business ideas", *Strategic Entrepreneurship Journal*, Vol. 4 No. 14, pp. 570-593.

Lincoln, Y. and Guba, E. (1985), *Naturalistic Inquiry*, Sage, Beverly Hills, CA.

Mansoori, Y. (2017), "Enacting the lean startup methodology: the role of vicarious and experiential learning processes", *International Journal of Entrepreneurial Behavior and Research*, Vol. 23 No. 5, pp. 812-838.

Mansoori, Y. and Lackeus, M. (2019), "Comparing effectuation to discovery-driven planning, prescriptive entrepreneurship, business planning, lean startup, and design thinking", *Small Business Economics*, Vol. 54, pp. 791-818.

May, B. (2012), "Applying Lean startup: an experience report – lean and Lean UX by a UX veteran: lessons learned in creating and launching a complex consumer App", *Agile Conference*, Dallas, USA, pp. 141-147, IEEE.

McAdam, R., Reid, R.S. and Gibson, D.A. (2004), "Innovation and organisational size in Irish SMEs: an empirical study", *International Journal of Innovation Management*, Vol. 8 No. 2, pp. 147-165.

McMullen, J.S. (2015), "Entrepreneurial judgment as empathic accuracy: a sequential decision-making approach to entrepreneurial action", *Journal of Institutional Economics*, Vol. 11 No. 3, pp. 651-681.

Miles, M. and Huberman, M. (1994), *Qualitative Data Analysis: An Expanded Sourcebook*, 2nd ed., Sage, Thousand Oaks, CA.

Miski, A. (2014), "Development of a mobile application using the Lean Startup methodology", *International Journal of Scientific and Engineering Research*, Vol. 5 No. 1, pp. 1743-1748.

Mollick, E. (2019), "What the Lean Startup method gets right and wrong", *Harvard Business Review*, Vol. 10, pp. 1-4.

Müller, R.M. and Thoring, K. (2012), "Design thinking vs. lean startup: a comparison of two user-driven innovation strategies", in Bohemia, E., Liedtka, J. and Rieple, A. (Eds), *Leading Innovation through Design: Proceedings of the DMI 2012 International Research Conference*, Boston, MA, USA, pp. 151-161.

Murdock, K. and Varnes, C.J. (2018), "Beyond effectuation: analysing the transformation of business ideas into ventures using actor-network theory", *International Journal of Entrepreneurial Behavior and Research*, Vol. 24 No. 1, pp. 256-272.

Neary, J. (2003), "Globalization and market structure", *Journal of the European Economic Association*, Vol. 1 Nos 2-3, pp. 245-271.

Nirwan, M.D. and Dhewanto, W. (2015), "Barriers in implementing the lean startup methodology in Indonesia–case study of B2B startup", *Procedia-Social and Behavioral Sciences*, Vol. 169, pp. 23-30.

Nobel, C. (2011), "Teaching a 'lean startup' strategy", *HBS Working Knowledge*, pp. 1-2, available at: https://hbswk.hbs.edu/item/teaching-a-leanstartup-strategy (accessed 8 May 2022).

Perry, J.T., Chandler, G.N. and Markova, G. (2012), "Entrepreneurial effectuation: a review and suggestions for future research", *Entrepreneurship Theory and Practice*, Vol. 36 No. 4, pp. 837-861.

Power, B. (2014), "How GE applies lean startup practices", *Harvard Business Review*, available at: https://hbr.org/2014/04/how-ge-applies-lean-startup-practices (accessed 8 May 2022).

Prashantham, S., Kumar, K., Bhagavatula, S. and Sarasvathy, S.D. (2019), "Effectuation, network-building and internationalisation speed", *International Small Business Journal*, Vol. 37 No. 1, pp. 3-21.

Rajagopalan, J. and Solaimani, S. (2019), "Lean management in Indian industry: an exploratory research study using a longitudinal survey", *International Journal of Lean Six Sigma*, Vol. 11 No. 3, pp. 515-542.

Read, S., Sarasvathy, S., Dew, N. and Wiltbank, R. (2016), *Effectual Entrepreneurship*, 2nd ed., Taylor & Francis, London.

Reymen, I.M., Andries, P., Berends, H., Mauer, R., Stephan, U. and Van Burg, E. (2015), "Understanding dynamics of strategic decision making in venture creation: a process study of effectuation and causation", *Strategic Entrepreneurship Journal*, Vol. 9 No. 4, pp. 351-379.

Ries, E. (2011), *The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses*, Crown Books, New York, NY.

Ries, E. and Euchner, J. (2013), "What large companies can learn from start-up", *Research-Technology Management*, Vol. 56 No. 4, pp. 12-16.

Sarasvathy, S.D. (2001), "Causation and effectuation: toward a theoretical shift from economic inevitability to entrepreneurial contingency", *Academy of Management Review*, Vol. 26 No. 2, pp. 243-263.

Sarasvathy, S.D. and Kotha, S. (2001), "Dealing with Knightian uncertainty in the new economy: the RealNetworks case", in Butler, J. (Ed.), *Research on Management and Entrepreneurship*, Greenwich, CT, pp. 31-62.

Saunders, M., Lewis, P. and Thornhill, A. (2019), *Research Methods for Business Students*, 8th ed., Prentice-Hall, Harlow.

Seawright, J. and Gerring, J. (2008), "Case selection techniques in case study research: a menu of qualitative and quantitative options", *Political Research Quarterly*, Vol. 61 No. 2, pp. 94-308.

Secundo, G., Rippa, P. and Meoli, M. (2020), "Digital transformation in entrepreneurship education centres: preliminary evidence from the Italian Contamination Labs network", *International Journal of Entrepreneurial Behavior and Research*, Vol. 26 No. 7, pp. 1589-1605.

Shepherd, D.A. and Gruber, M. (2020), "The Lean Startup framework: closing the academic-practitioner divide", *Entrepreneurship Theory and Practice*, Vol. 45 No. 5, pp. 967-998, doi: 10.1177/1042258719899415 (accessed 8 May 2022).

Silberzahn, P. (2013), "Lean startup: le compagnon idéal de l'effectuation?", *Entreprendre Innover*, Vol. 3, pp. 29-35.

Silva, S.E., Calado, R.D., Silva, M.B. and Nascimento, M.A. (2013), "Lean Startup applied in Healthcare: a viable methodology for continuous improvement in the development of new products and services", *IFAC Proceedings Volumes*, Vol. 46 No. 24, pp. 295-299.

Silva, D.S., Ghezzi, A., de Aguiar, R.B., Cortimiglia, M.N. and ten Caten, C.S. (2020), "Lean Startup, Agile Methodologies and Customer Development for business model innovation: a systematic review and research agenda", *International Journal of Entrepreneurial Behavior and Research*, Vol. 26 No. 4, pp. 595-628.

Silva, D.S., Ghezzi, A., Aguiar, R.B.d., Cortimiglia, M.N. and ten Caten, C.S. (2021), "Lean startup for opportunity exploitation: adoption constraints and strategies in technology new ventures", *International Journal of Entrepreneurial Behavior and Research*, Vol. 27 No. 4, pp. 944-969.

Solaimani, S. and van der Veen, J. (2021), "Open supply chain innovation: an extended view on supply chain collaboration", *Supply Chain Management*, Vol. ahead-of-print No. ahead-of-print, doi: 10.1108/SCM-09-2020-0433.

Solaimani, S., Gülyaz, E., van der Veen, J.A. and Venugopal, V. (2015), "Enablers and inhibitors of collaborative supply chains: an integrative framework", *Conference proceedings of the Production and Operations Management Society (POMS)*, Washington, DC, pp. 1-10.

Solaimani, S., Talab, A.H. and van der Rhee, B. (2019a), "An integrative view on Lean innovation management", *Journal of Business Research*, Vol. 105, pp. 109-120.

Solaimani, S., van der Veen, J., Sobek, D.K. II, Gulyaz, E. and Venugopal, V. (2019b), "On the application of Lean principles and practices to innovation management", *The TQM Journal*, Vol. 31 No. 6, pp. 1064-1092.

Stirzaker, R., Galloway, L., Muhonen, J. and Christopoulos, D. (2021), "The drivers of social entrepreneurship: agency, context, compassion and opportunism", *International Journal of Entrepreneurial Behavior and Research*, Vol. 27 No. 6, pp. 1381-1402.

Straus, A. and Corbin, J. (2008), *Basics of Qualitative Research 3E*, Sage, London.

Welter, F. and Gartner, W.B. (2016), *A Research Agenda for Entrepreneurship and Context*, Edward Elgar, Cheltenham.

Werwath, M. (2019), "Lean startup and the challenges with 'hard tech' startups", *IEEE Engineering Management Review*, Vol. 47 No. 1, pp. 22-23.

Yang, X., Sun, S.L. and Zhao, X. (2019), "Search and execution: examining the entrepreneurial cognitions behind the lean startup model", *Small Business Economics*, Vol. 52 No. 3, pp. 667-679.

Yordanova, Z.B. (2018), "Lean Startup method hampers breakthrough innovations and company's innovativeness", *International Journal of Innovation and Technology Management*, Vol. 15 No. 2, pp. 1-18.

York, J.L. and Danes, J.E. (2014), "Customer development, innovation, and decision-making biases in the lean startup", *Journal of Small Business Strategy*, Vol. 24 No. 2, pp. 21-40.

Zahra, S.A., Wright, M. and Abdelgawad, S.G. (2014), "Contextualization and the advancement of entrepreneurship research", *International Small Business Journal*, Vol. 32 No. 5, pp. 479-500.

About the authors

Sam Solaimani is a Research Associate at Nyenrode Business University and Senior Manager at Valcon, a consulting firm focussing on operations and digital transformation. Sam holds a PhD from the Delft University of Technology (the Netherlands), focussing on Business and Operations Model innovation in complex supply chains. He graduated Cum Laude in Business Information Systems from the University of Amsterdam (the Netherlands) and has a BSc. in Information Science from Utrecht University (the Netherlands). He has published in many peer-reviewed academic journals, some of which have recently appeared in *Supply Chain Management: An International Journal*, *European Management Review*, *Journal of Business Research*, *Information Systems Frontiers*, *Technological Forecasting and Social Change*, and *Information Systems Management*. His research and advisory activities focus on Lean Six Sigma, Process Architecture, Operational Excellence, Supply Chain Management, particularly, in combination with Emerging Technologies. Sam Solaimani is the corresponding author and can be contacted at: s.solaimani@nyenrode.nl

Tijl van Eck holds an Executive MSc. from Nyenrode Business University. He currently works as an independent contractor, specialising in Finance for Digital Transformation and Corporate Finance for large enterprises such as Dutch Railways and KLM. Previously, Tijl worked at KPN and WPP (London), fulfilling several managerial roles in corporate finance, in-house strategy consultancy, innovation and (incubating) startups. Besides, he acts as an independent adviser to several startups in the Netherlands.

Henk Kievit is Associate Professor (social) entrepreneurship and governance of (innovation) ecosystems and faculty director of the Centre for Entrepreneurship, Governance and Stewardship at Nyenrode Business University. He is also programme director of the Modular Executive MBA programmes for Business and Sustainable Transitions/Business & IT/Public and Private. He was appointed in 2013 as professor of Governance of Regional Ecosystems at the Christian Applied University of Ede, Foodvalley. He worked previously in IT and enterprise software systems and impact investments. He graduated with an MSc. in business economics from Wageningen University and holds a PhD from Nyenrode Business University on Social Venturing Entrepreneurship. Some of his publications appeared in *European Journal of Marketing*, *Corporate Governance*, and *The Entrepreneur and the Entrepreneurship Cycle*.

Kitty Koelemeijer is Full Professor of Marketing at Nyenrode Business University. Kitty holds a PhD from Wageningen Agricultural University and an MSc in Economics (summa cum laude) from Wageningen Agricultural University. She is a non-executive board member for multiple listed and non-listed international companies. She has published in peer-reviewed academic journals, including *Marketing Science*, *International Journal of Research in Marketing, International Journal of Medical Informatics, Information Technology and People, JMIR Human Factors, JMIR Research Protocols,* and *Journal of Retailing*. Her research focusses on digital transformation, growth strategies, innovation, customer behaviour, and retail management.