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Digital business model effectuation: An agile approach

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ABSTRACT

The radical changes in today's competitive environment created a “big bang” effect: companies and industries are being disrupted in an unprecedented short time. The challenge has shifted from predicting the unknown or conventional method of venture creation to agile actions, which is to act rapidly before the competition catches up and eliminate any advantage one may have, especially for entrepreneurs and small businesses with significant resource constraints. The objective of this research is to investigate alternative approaches under a time-constrained setting. A recent national open innovation initiative of Finland challenged practitioners and researchers to transform technologies into commercializable innovations in under six months. A high-tech case within the challenge piloted the agile effectuation of a business model with three parallel approaches: effectuation, causation and lean startup method, thus providing antecedent on how effectuation theory can be integrated with agile development and business model theory.

1. Introduction

Over the past few years, the adoption of agile practices in business has increased remarkably among high-tech companies (Olsson, Bosch, & Alahyari, 2013). The background for this broad adoption is that agile practices serve various benefits to the companies and their customers. Taking the information technology (IT) industry as an example, by shortening and accelerating the software development cycle, it improves the speed and responsiveness to customer needs (Olsson et al., 2013). Generally, agility is an ability to quickly respond to changes in an uncertain and changing environment. In digital business, agility means the ability to bring valuable product and/or service offerings to customers with the aim of achieving the same result in significantly shorter product or service development cycles than the traditional product development process (Suomalainen & Xu, 2016). This study aims to address the gap that despite the recognition of an agile concept's importance in business practices, limited research has been dedicated to understanding how different business creation approaches (causation, effectuation, and lean startup) would perform under time constraints, enabling agility in entrepreneurial venture creation.

Causation is defined as an approach where a business model is seen as a method for planning, communicating, and mapping for future operations (Duin and van der, 2006). Effectuation refers to a trial-and-error iteration to make something work in a non-predictive environment. A business model is considered to be crystalized from a business

opportunity through effectuation (Sosna, Treviño-Rodríguez, & Velamuri, 2010). A lean startup approach is also based on trial-and-error experiments. However, the fundamental difference to effectuation is that the initial business model is created before the experiments. A lean startup approach emphasizes the process of building, measuring, and improving business ideas or models in short time cycles (Ries, 2011). Thus, business model creation is a continuous dynamic process based on experimentation and learning the customer needs (McGrath, 2010).

1.1. A challenge to agile business creation

Finland has launched a new type of open innovation initiative nationwide in 2016, named “Challenge Finland”. Being the first of its kind, the objective is to diffuse entrepreneurial practices to a much wider context by getting public organizations, small and medium-sized enterprises (SMEs), large corporations, and research institutions to form teams and find next-generation commercializable innovations. The key is that the entrepreneurial teams (usually initiated by one organization) are required to develop commercial applications and business models, forming business consortiums by getting external partners, under the *six-month* limit. The winning teams were granted further funding for developing their innovations to commercial offerings. The challenge serves as an antecedent, laying out fertile ground to study entrepreneurial approaches in an agile and open innovation context for

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business model and venture creation. Effectuation, causation, and lean startup methods are identified to be relevant within one digital high-tech case (the FMA case hereafter).

1.2. Business model creation: causation, effectuation, or lean?

Business model has become one of the rapidly growing concepts in the last decade (Bahari, Maniak, & Fernandez, 2015). There are a vast number of ways in which the concept of a business model has been defined, such as a structure, an architecture or a business frame (George & Bock, 2011; Mason & Palo, 2012; Teece, 2010), or as a representation of a firm's relevant interactions and activities (Wirtz, Pistoia, Ullrich, & Göttel, 2016). Although scholars are still debating on a unified definition for the concept, the common view nevertheless is that business models act as pathways to fulfill unmet needs, profitability, and the promise of service (Wirtz et al., 2016), i.e. they can be seen as representations of the logic of value creation and capture (Shafer, Smith, & Linder, 2005; Teece, 2010). Zott and Amit (2010) see the exploitation of a business opportunity as the overall objective of the firm's business model. In the modern dynamic, markets driven by digitalization business models are often necessitated by technological innovations that create the need to bring discoveries to market (Teece, 2010). It is thus evident that a business model concept is relevant for startups, both as a tool providing guidance for operations and business logic as well as a representation of the value potential to the potential investors.

A brief history of business model research reveals that underlying logic of a business model is frequently emphasized as a forward-looking concept, the causation and prediction perspective is coherently elaborated in literature, for instance, the long run orientation (Chesbrough, 2010; Teece, 2010), a future-oriented strategic tool (Zott, Amit, & Massa, 2011), and forward-looking opportunity exploration and exploitation (Zott & Amit, 2010). Thus, the mainstream business model thinking favors a causation and prediction process.

Another vein of research has been emerging on the behavioral theories of the company and how a business model is created in an agile development process through the mean of trial-and-error to rapidly create, change, and innovate the business model, or the “lean startup” (Ries, 2011; Sosna et al., 2010). On the other hand, effectuation scholars, such as (Read, Sarasvathy, Dew, & Wiltbank, 2015), argue that effectuation is not merely trial-and-error iteration to make something work, rather it is a purposeful interaction between entrepreneur and its (potential) network, shaping aspects including identity, capability, and aspiration.

Bearing the above discussion in mind, we see a research gap arising as the need to deepen the understanding of effectuation's and trial-and-error experimentation's roles in business model creation. This is especially true when both approaches are considered as appropriate to tackle the unpredictable and unknown horizons in business (Baghai, White, & Coley, 2000; Sarasvathy, 2001).

Furthermore, Suomalainen and Xu (2016) suggest that the agile development approach has quite a different viewpoint on business and organizational practices by focusing on the short-term development cycle and effectuation rather than causal prediction, e.g. in software industry, the development cycle of new products or services can be in days. Therefore, the aim of this paper is to reconstruct the meaning of business model creation and to dedicate the question of how causation, effectuation, and lean startup approach could be incorporated into business model creation.

We have studied business model, business opportunity, causation, effectuation, and agile development literatures with the objective to review how theories can enable agile business model creation in the real-life setting of an entrepreneurial and open innovation. The paper also contemplates to compare causation, effectuation, and lean startup approaches, which are seemingly contrasting perspectives. The underlying goal is to advance the business model, innovation, and entrepreneurship research, bringing new perspectives to the existing body

of literature, but also shedding light on the mechanisms by which practitioners design the business model from the beginning. As stressed by Amit and Zott (2015), such areas call for further research. The results of the study show differences exist among the three different entrepreneurial approaches in terms of (1) final number of business models created, (2) business model “quality,” and (3) success in gaining next-stage funding.

The rest of the paper is organized as follows: section 2 describes “the state of the art” development in business models and its link to opportunity, outlining the three business model creation approaches investigated in this study. Section 3 states the research methodology. Results from the Challenge Finland pilot case are discussed in section 4. The analysis on the outcomes of the research are presented in section 5 and the theoretical and managerial implications arising from the study are discussed in section 6.

2. Literature review

2.1. Business model and opportunity are integral parts of entrepreneurial process

Based on Porter (1980), strategy is about being different, building a sustained competitive advantage within the long haul. A company's value creation process is therefore required to be distinct from the competitors. However, product innovation no longer offers sufficient competitive edge in differentiation (McGrath, 2011). Product life cycles have become shorter. IT technologies offer unprecedented opportunities to re-align value creation activities in new ways, thus companies consider business model innovation as a new way to build sustainable competitive advantage (Teece, 2010). Business model, therefore, becomes a favorite managerial tool (Osterwalder & Pigneur, 2010; Teece, 2010; Zott et al., 2011).

2.1.1. What is a business model?

A business model has been an important topic in various disciplines (Pateli, 2003). Various aspects have been studied in the literature, such as business model taxonomies (Timmers, 1998), business model applications (Shubar & Lechner, 2004), and business model ontologies (Gordijn, Osterwalder, & Pigneur, 2005; Osterwalder, 2004).

Business model research has recently emerged within the entrepreneurship literature as a construct that conceptualizes the value creation and value capturing of a company (Zott et al., 2011). Specifically, Chesbrough and Rosenbloom (2002) conceive the business model as a focusing device that explains how economic value might be extracted from a technology or service idea.

Magretta (2002) outlines the uniqueness of a business model lies in value creation and value capture. Teece (2010) has a similar conviction and defines it as the way in which a company generates value (value creation) and exactly how it captures this value as profit (value capture). Thus, an effective business model creation will usually embrace these two aspects. To be able to turn this “theory for the business” (Drucker, 1994, pp. 95–105) into a successful value-creation system.

2.1.2. Business model as a device to capture opportunity

Opportunity as a concept has gained scholarly attention (Short, Ketchen, Shook, & Ireland, 2010). The definition of business opportunity is broad and diverse, and in the literature, there have been several attempts to describe typologies of opportunity. Following the work of Schumpeter (1934), a business opportunity can be defined as a profitable recombination of resources in novel ways, focusing on the “what” aspect. Eckhardt and Shane (2003) stress the “when and where” side of opportunity, referring opportunity to the situations in which new goods, services, raw materials, markets, and organizing methods are introduced to form new means, ends, or means-ends relationships, and at greater than their cost of production (Hsieh, Nickerson, & Zenger, 2007). Baron (2006) defines opportunity as a mean of generating new

economic value, addressing the “how” aspect. Alsos, Clausen, Hytti, and Solvoll (2016) studied entrepreneur identity (Darwinian, Missionary, and Communitarian) in venture creation, which can be considered as the “who” aspect.

Through this paper, we'd like to expand this definition of “who” to practitioners who are engaged in such entrepreneurial processes. The identity of “who” may vary, whether it is a researcher or a corporate manager; as long as the person is engaged in the entrepreneurial process, they can be considered as a “practitioner”.

Literature suggests that opportunities are not businesses (Eckhardt, 2013). Practitioners must find ways to transform opportunities into new business. However, such processes are not clearly defined or specified, only that companies must identify potential opportunities and coordinate resources to capture those opportunities (George & Bock, 2011).

Numerous scholars seek solutions in business model studies, noting that the design of a coherent business model is essential for exploiting specific opportunities (Zott & Amit, 2010). Hence, business model complements the aforementioned gaps in opportunity study. Amit and Zott (2001) explicitly link business opportunity, value creation, and business model: “A business model depicts the design of transaction content, structure, and governance so as to create value through the exploitation of business opportunities” (p. 493).

2.1.3. A coherent framework to connect opportunity and business model

A promising way to advance the understanding of a business model requires a coherent perspective that links opportunity with a business model.

The individual-opportunity (IO) nexus theory is identified as relevant, since it conceptualizes the entire entrepreneurial process. According to Shane and Venkataraman (2000), entrepreneurship involves “the processes of discovery, evaluation, and exploitation of opportunities; and the set of individuals who discover, evaluate and exploit them” (p. 218). Eckhardt and Shane (2003) have coined the term individual-opportunity nexus to refer to this perspective, in which the entrepreneurial process is initiated when a practitioner perceives an opportunity and attempts to exploit it (Eckhardt, 2013). Davidsson (2015) deepened the concept with three key constructs: External Enabler, Venture Idea, and Opportunity Confidence, bringing clarity to the venture creation process.

External enabler refers to temporary external circumstances, such as technological, social, or political changes in the business context. As such, the construct mainly resembles the objective part of the opportunities as researched in opportunity identification studies. The external enablers can be considered as external catalysts to a potential business idea, acknowledging the existence of external triggers, which is in line with Davidson's (2001) theory on inter-subjectivity.

Venture idea is the combination of product/service offering, potential target market, and the means to bring the offering to life, creating and delivering value (Davidsson, 2015). It is a prerequisite for the new venture creation process. The ideas are highly perceptive within the mind of the practitioner. However, this does not imply that the idea is bound to a specific individual. In fact, Verstraete and Jouison-Laffitte (2011) suggest the possibility that different people simultaneously come up with nearly identical ideas. It is noticeable that the new venture idea very much resembles the notion of a business model. In fact, a business model can be considered as a conceptual and organized way to describe a venture idea.

Opportunity confidence refers to the individual evaluation of external enablers and new venture ideas (Davidsson, 2015). Opportunity confidence includes the desirability assessment initiated by individual, thus highly subjective, as the evaluation is contingent on one's perception and is influenced by an individual's own resource (Davidsson, 2015), including knowledge, experience, social capital (network of social relationships), and managerial cognition (mental models and beliefs), which can be significantly diverse across people (Helfat &

Martin, 2015). The opportunity confidence construct describes a crucial step within the venture creation process, as an individual will only decide to take action when one is confident that an opportunity exists and can be exploited (Davidsson, 2015).

Overall, IO nexus theory eliminates the significant overlaps and inconsistencies between different constructs and schools of thought within opportunity and venture creation studies. Taking contextual, individual, cognitive factors, as well as subjectivity and objectivity into account, it provides a more holistic perspective. To lay down a foundation for this research, we adopted the business model framework (Johnson, Christensen, & Kagermann, 2008) developed by Harvard Business School's Christensen for venture idea construct of IO nexus theory, since Davidsson's (2015) venture idea is not well-defined and operationalizable in an empirical setting. Johnson et al.'s (2008) business model framework includes four interlocking elements (a customer value proposition, a profit formula, key resources, and key processes) that are considered as keys in top business model literature, such as Chesbrough (2010) and Osterwalder and Pigneur (2010). The framework is concise (for example, Osterwalder and Pigneur's (2010) model has nine components) and fits Ries's (2011) minimum viable logic for rapid business creation; thus it can be considered as the *minimum viable business model*. Furthermore, we added identity evaluation as part of opportunity confidence, as it matches the similar steps in effectuation theory and showed relevance in the empirical part of the study. The adapted framework is thus named as “opportunity-business model link” (Fig. 1).

2.2. Agile business model effectuation

The agility concept was first introduced as a management concept in 1991 by the Iacocca Institute of Lehigh University (Kidd, 1994). Since the inception of the concept, it has become increasingly applied in many industries both as a management practice and as a subject of research. Agility has been expressed in different ways: 1) time-based competition (Stalk & Hout, 1990); 2) building on lean thinking (Womack, Jones, & Roos, 1990); 3) a total integration of business components, working towards a common goal (Kidd, 1994). Agility is an ability to quickly respond to changes in an uncertain and changing environment. On the other hand, agility is a way of further creating changes that are favorable to the organization (Zhang & Sharifi, 2000). To summarize, an agile business development process is about implementing business practices continuously in rapid parallel cycles, instead of pre-defined and conventional planning. On the other hand, agility does not just mean speed, as there are many examples of

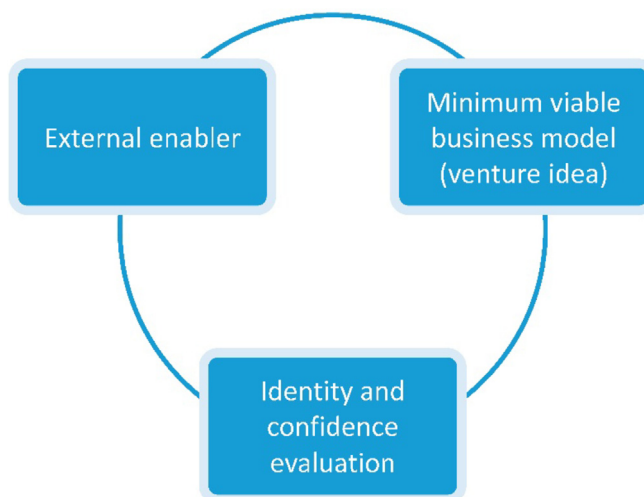


Fig. 1. Opportunity-business model link framework adapted from IO nexus theory.

traditional companies doing certain things fast, as a cruise can set a speed record, but it is hard to turn around.

To form the agile business model effectuation, the study identifies the importance of incorporating parallel development cycles to create a business model. Sarasvathy's (2001) effectuation and Ries's (2011) lean startup approach are well-recognized theories and practices in the entrepreneur community. Ries's (2011) approach is especially relevant to add the element of agility in the effectuation process. On the other hand, the study also includes causation approach to ensure holistic perspective as it is one of the main areas in entrepreneurship and business model studies. Overall, agility addresses the new ways of creating a business model and running a business to meet challenges, empowering a company with market-driven innovative capability, which will be the main source of competitive advantage of the future (Kidd, 1994).

2.2.1. Causation approach on business model

The previous discussion shows that the mainstream business model conceptualization dwells on *causation logic*. A business model is seen as a method for planning, communicating, and mapping for the future operations (Duin and van der, 2006). Ahead of its operation, a business model is considered as an ex-ante plan of the possible outcomes (Baden-Fuller & Morgan, 2010). Bringing future business opportunity to life implies the process of designing and executing a business model, focusing on what is expected to take place in the future (George & Bock, 2011).

A causal business model creation process often begins with opportunity recognition, which entails three elements: 1) the discovery and prediction of viable customer value propositions (McGrath, 2011); 2) a specific customer segment (Osterwalder & Pigneur, 2010); and 3) the means to configure value network for creating and delivering the customer value (Chesbrough & Rosenbloom, 2002; Zott & Amit, 2010).

2.2.2. Effectuation approach on business model

In dictionaries, "effectuation" is often explained as "causing to happen" or "accomplishing (something)", which means that effectuated business models exist in reality or practice, and not just in contemplated business plans. In contrast, causation business models are often the models that may theoretically exist in paper, but never take off in reality. As shown in effectuation research, expert entrepreneurs normally use non-predictive strategies in building a new offering, and creating new markets (Sarasvathy, 2001). Sarasvathy and Dew (2003) argue that causation-oriented planning and prediction may cause the companies to under-investigate new technologies in the market that may eventually become future disruptions. On the other hand, effectuation refers to the type of reasoning that has been shown to work in a relatively non-predictive situation, or the Knightian uncertainty (Sarasvathy, 2001). Drawing upon Sarasvathy's (2001) theory, it provides meaningful principles and logic, guiding decision making under environmental uncertainty. The overall logic of effectuation is based on the primacy of non-predictive control over predictive strategies.

In the business model domain, Li, Eden, Hitt, and Ireland (2008) argue that prediction is not the only point of leverage in achieving business outcomes, such as the creation of a business model. Planning and/or adapting to succeed in an essentially exogenous environment might be effective, but attempting to significantly influence/control an endogenous environment directly may also lead to favorable outcomes. Indeed, in the vein of *effectuation* research, a business model is considered to be crystalized from business opportunity through effectuation (Sosna et al., 2010).

Argyris (1976) marked that when organizational members take organizational actions, and detect and correct errors throughout the process, it produces learning. The iterative nature of this process allows the company to introduce variations that produce results that converge with goals, as well as fosters organizational collaboration. Taking business model creation into the picture, it is about both exploration

and exploitation of the opportunity, promoting organizational change or stability at differing times, as coined by Argyris (1976), the double-loop learning. In the specific situation of the Challenge Finland case, where there is no organization or consortium to take the technology forward, it can be considered as another layer of uncertainty, that the double-loop learning is used for organization and identity discovery.

What has not been incorporated in the business model literature is Sarasvathy's (2001) logic of non-predictive control. It is this logic that binds together the decision principles of Sarasvathy's (2001) effectuation and overcomes the problem of Knightian uncertainty by transforming the unpredictable into the nearly certain by eventually "creating" the desired business model.

Using effectual logic, practitioners start with a set of means, involving a creative and transformative process. The four effectuation steps relating to the themes of means-driven transformation are as follow (Sarasvathy, 2001, 2004):

- Step 1: Finding "who am I?", "what do I know?" and "whom do I know?"
- Step 2: Deciding "what can I do?" and "affordable loss";
- Step 3: Stakeholders interactions;
- Step 4: Leveraging contingencies

It is worth mentioning that effectuation makes no assumptions about the individual with regard to optimism or other personality traits, which is in line with Davidsson's (2015) assumption on venture idea construct that different individuals can come up with similar ideas regardless of their personality traits. Sarasvathy (2001) quoted the following, "both optimists and pessimists can become inventors; the optimist invents the airplane; the pessimist, the parachute" (p. 259).

2.2.3. Lean startup approach on business model

Speeding up business development has gained popularity recently with the emerging concept of *lean startup* and the process of "build, measure and improve," a business idea or model in significantly shortened time cycles (Ries, 2011). Writing a lengthy business plan does not work in the highly volatile world of startups. Situations change and new opportunities arise more rapidly, which leaves no time to keep up with the plan. Ries (2011) published his book *Lean Startup* that is widely adopted in entrepreneurship accelerator and incubator programs.

Rather than building an elaborate technical prototype based on a startup practitioner's vision and then trying to sell the prototype to reluctant customers, which is often the case, the lean startup method has a good practice to minimize risk by failing fast. Namely, one should talk to customers and ask the question "should this product be built at all?" One's attitude towards failure should be positive, as it leads to increased customer understanding and learning (Ries, 2011). As Zott and Amit (2010) pointed out, new business models need to be externally validated, along with being in line with the internal organization of the business and its external value network. Sosna et al. (2010) suggest that experiential "trial-and-error" learning, based on lean startup logic, is appropriate to deal with uncertainty and the viability of business models in changing market conditions, whereas the previous generation of business model research presented a static (causal) perspective. Hence, business models from "lean startup" approach can be viewed as effectuated, since they come to existence through effectuation and trial-and-error actions. However, it is key to distinguish that "lean startup" may not have a plan at the beginning, only until when the business models are proven to work through time.

A lean startup starts from an assumption or hypothesis, which one turns into a concept that is tested and evolves immediately or after some customer feedback rounds into Minimum Viable Product (MVP). In this study, the MVP is, in fact, the business model as the project outcome. The processes form a "build-measure-improve" cycle, which then repeats in the continuing cycles. Thus, business model creation requires experimentation and learning of customer needs (McGrath,

2010). On the other hand, business model creation may mean transforming the organization as well (Linder & Cantrell, 2000). McGrath (2010) observed that “business model is a job that is never quite finished” (p. 248). Overall, “lean startup” models are always effectuated, in the sense that they exist in real life, they may not have a plan until later, when what makes the model work is realized historically.

3. Research methodology

This research utilizes a combination of action research and case study approach to investigate how different entrepreneurial processes would create business models under the same time duration with the involvement of the same actors within the research consortium; thus the results cannot then be affected by personality, cultural differences, or the cognitive difference of the individuals. Especially, such approach allows developing theories by utilizing in-depth insights of empirical phenomena within their context (Dubois & Gadde, 2002). In this way, the paper takes a methodology that is similar to the grounded theory approach, where learning arises from doing.

IO nexus theory's elements and its adaptation, the “opportunity-business model link” framework, are embedded in the research design, to ensure a coherent process, where external enablers are primarily utilized in the causation/prediction approach, venture idea is operationalized as minimum viable business model, since business model is a more structured way to present venture ideas. The opportunity confidence is served as an evaluation measure to evaluate the business models created, and determine the most desired business model by the project consortium. Furthermore, it is also an evaluation of the consortium itself, when its identity is unfolding from the effectuation process.

3.1. Challenge Finland: an agile and open innovation case

In late 2016, Tekes (Finnish national funding agency for innovation) launched the Challenge Finland program. It is a competition that seeks commercializable technology solutions to tackle societal, environmental, and economic challenges faced nationally and globally. Ultimately, the goal of this national open innovation challenge is to bring technology, business research, as well as industrial partners together to accelerate the search and creation of new commercial innovations, which demonstrates open innovation at a national scale, and stimulate entrepreneurial practices across different sectors and organizational types (SMEs, large corporations and research institutions). In the Challenge Finland context, the key is to identify the opportunities and develop feasible business ideas or business models in under six months. The successful business proposals will be given the chance to obtain a larger funding for further development.

Generally, the Challenge Finland initiative sets the scene for an agile and open innovation approach to finding business opportunities and developing business models for the top-notch technologies at a national scale. The study is based on a real-life business model creation case of a ubiquitous internet-of-things (IoT) sensing technology and concept called FMA, developed by VTT (Technical Research Center of Finland). The initial case has no concrete business opportunities, business model, nor any consortium partners. The case utilized three approaches (effectuation, causation, and lean startup) in parallel. Within six months, the case identified eight opportunities areas with a concrete business model selected out of 56 alternatives, and a consortium formed with a number of SMEs, universities, and government agencies to jointly developed business applications for the technology. The case can be considered as an entrepreneurial process to bring technology to the market, and be fast. It is a close reflection of today's business environment, providing a relevant setting for this study to investigate effectuation, causation, and lean startup approaches, while linking entrepreneurial opportunity, process, and business model theories. The summary of the approaches employed in the case is presented in

Table 1.

4. Results: the three tracks of business model creation

The FMA case utilized and tested the three approaches under the same context without interfering with each other. Thus, the approaches integrated into the project as three independent tasks.

4.1. The causation/prediction track

As in Fig. 2, the causation/prediction track involves a process of discovering the opportunities for the focal FMA technology. The process can be broken down into two phases: the first phase is to explore the potential application areas of the FMA technology. From the initial water treatment sensing, three potential directions were identified, which are primarily focused in the same industry. The second phase involves further exploration, which led to the discovery of business opportunities in eight different industry sectors, which could be the potential application areas. Only after the opportunities and potential application areas are identified, the project moved into the second phase, which is to develop a business model that could capture the opportunities identified in the identification phase.

Overall, the causation/prediction track resulted in a significant number of potential opportunities identified, suggesting that the technology is promising to revolutionize a great number of key sectors globally. It is an opportunity amplifying process, expanding opportunity territories. However, when it moves to the business model creation phase, the real goal is to develop an optimal business model that could capture all the opportunities identified. It is then turned into a compression/reduction process, not to develop eight business models for specific opportunities, but rather an overarching optimal business model to capture all the opportunities. Thus, the entire process generated a great deal of predicted opportunities in comparison to just a few business models to be evaluated.

4.2. The effectuation track

Similar to causation/prediction track, the effectuation track (Fig. 3) can be considered as involving two stages, using the effectuation process proposed by Sarasvathy (2001), which is to first recognize the opportunity through an effectuation process, then the business models are developed in the latter phase. The first phase started with answering the questions such as.

- Who are we?
- What do we know?
- Whom do we know?

As an adaptation to Sarasvathy's (2001) original framework, which focuses on individual entrepreneurs, this study needs to take into consideration the identity of a consortium, covering actors from industry, technical research, and business research. Thus, the framework is adjusted to be used in the group collaboration setting.

In the first phase, who we know played an important role, which led the initial consortium to explore the potential partners within their existing network. It involves not only personal network, but also institutional network. Furthermore, as part of Challenge Finland, a networking event was organized for all the contestants and interested industrial companies. The challenge contestants are in groups to interact with industrial companies, consultants, researchers, funding organizations, and government agencies, which is a representation of the entire open innovation ecosystem of Finland.

In the effectuation process, the project consortium constantly reviewed *who we know* and *what we know*, which are adjusted to the expansion and reduction of the initial consortium. In other words, it is not only “who we are”, but also “who we are not”. The process generated a

Table 1
Summary of the three approaches.

Approach	Key process	Most significant contribution to the final business model
Causation	1 Identifying opportunity areas 2 Creating business model	Identified 8 opportunity areas/sectors
Effectuation	1. Expanding network and consortium with <i>Sarasvathy's (2001)</i> effectuation steps 2. Creating business model	Formed a consortium with 7 official partners and a number of companies and government agencies in advisory board; Identified 2 alternative opportunity areas with concrete business models
Lean startup	1. Creating business model upfront 2. Test-measure-improvement cycles	Collected 56 business model archetypes; Validated and selected the business model with confirmed customer segment and value proposition

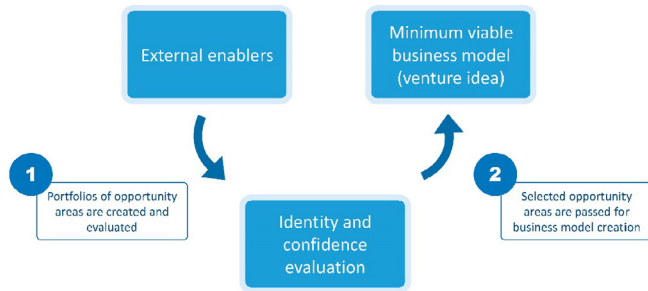


Fig. 2. The process of causation/prediction track.

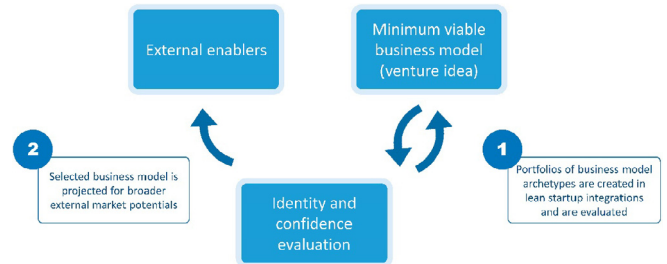


Fig. 4. The process of lean startup track.

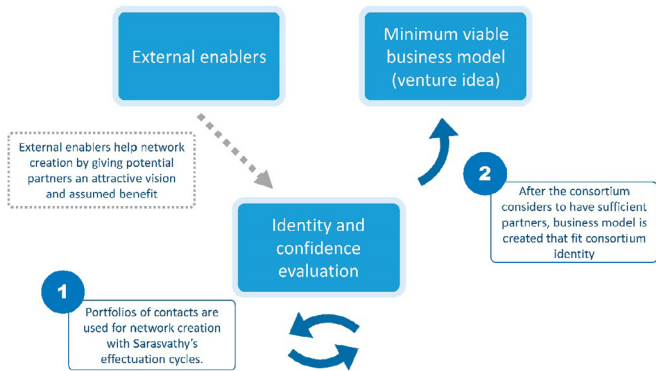


Fig. 3. The process of effectuation track.

large number of potential contacts and partners who could be joined together to form a smaller project ecosystem. The network interaction and contact become evident, together with the networking event, the FMA consortium gained exposure to over 100 organizations. Two opportunities emerged from the effectuation process, whereas one is to develop a solution for the government sector, while the other is to introduce the solution to India as a large market, where the solution can offer great benefit. There was also an opportunity to work with another Challenge Finland project to form a larger consortium. Comparing this to the causation/prediction track, such an approach rendered a smaller number of business opportunities; however, these opportunities are rather concrete and specific, leading to the three business models that could be developed according to the opportunities, which matches the opportunity exploitation logic in the business model studies. Only at this point, the business models are moved to the evaluation process by the final consortium.

4.3. The lean startup track

Referring to the lean startup approach (Fig. 4), the project initially developed a business model that is considered to be an appropriate approach for the FMA technology. In contrast with the previous approaches, the lean startup approach involves business model creation in the first place, with an experimentation approach for effectuating the

final business model desired by the consortium.

A collection of 56 business model archetypes were gathered and used to create business model options or portfolios. The entire process involves building, testing, and pivoting with the identified potential end users. The goal is to find a problem-solution fit, creating a solution that customers really want through the cycle of verification. The second phase involves an amplification step to expand the problem-solution fit and project it into a larger market context, rather than an individual customer.

In this process, a large number of potential business models are generated, in conjunction with customer validation, to find working solutions. The selected model is then evaluated on how well it can capture opportunities for different markets and sectors that have similar needs and wants. Overall, such approach fits Johnson et al.'s (2008) value creation process, by figuring out value proposition for the target market.

5. Discussion

The entire research project shows that when employing different processes, the inputs and outputs are significantly different.

The causation/prediction approach requires a large number of potential opportunities to be evaluated and selected before the practitioners can move to the business model creation phase. Through a minimal viable business model (adaption from IO nexus theory's venture idea construct), it starts with exploring the external enablers, then moving on to subjective evaluation or the confidence evaluation; only the opportunities that fit the evaluation criteria will be passed to the second stage, where the business model is to be developed based on the viable opportunities identified. However, the weakness of such approach is that the prediction is heuristic, and not entirely grounded on the reality, which is merely an estimation or assumption. The business model, built upon an assumption of what the market would want or need, could be problematic when it is brought to reality.

Furthermore, as Sarasvathy (2001) argued, in the reduction or elimination step of causation/prediction approach, some real opportunities may be missed or ignored due to the Knightian uncertainty. If the practitioners were to consider a linear prediction, it would create a false-positive for the business opportunity, thus leading to a false business model. Overall, the process generates opportunities in quantity over quality.

On the other hand, a true value of the causation/prediction approach is about creating a vision and a projected high business potential that get external partners on board. In the FMA case, it provided input for the effectuation process, getting partners' interest and willingness to shape the vision by providing new sets of resources, knowledge, expertise, and networks.

The effectuation process plays a huge role in getting potential partners, expanding the knowledge, resource, and network for the consortium; then it helps the identification of quality business opportunities and makes the business model creation stage proceed rather smoothly. Simultaneously, the onboarding of partners helps the consortium gain knowledge of new external enablers, which could then form a strengthening loop to further expand the network, shaping the identity of the consortium.

However, although it is initially classified as a control-emphasized approach, it is interesting to note that the opportunities and business models coming out of this approach is rather “out-of-control” or serendipitous. Mainly, new and unpredictable opportunities and business models emerge in a more creative and heuristic process (Sarasvathy & Dew, 2003), which does not go according to the plan. The research also gives evidence that contingency plays a very important part of the process, especially when time becomes the constraining factor.

The lean startup approach significantly emphasized business model creation, which in Davidsson's (2015) framework is to create a business idea first rather than identifying opportunities. It then moves on to the practitioner's evaluation, with a continuous “building, testing and pivoting” cycle. This approach could create the solutions that are actually wanted by customers instead of hypothetical guesswork, avoiding committing resources for a false-positive solution. Only when the business model or idea is validated and passed the confidence evaluation, it is then used to project the market potential of the opportunity, which turns out to be quite the opposite of causation and Sarasvathy's effectuation. Overall, the process gives more realistic results to help business practitioners gain real insight into what business model would work. Furthermore, the business models are tested from day one, which fits into the agile requirement of today's business environment.

Though it is pre-assumed as an effectuation-/creation-oriented process, the lean startup method is different from Sarasvathy's effectuation, in which it is believed that customer need (apparent or latent) should pre-exist to entrepreneur identity. It is built on the reasoning that the driver of developing network and partnership is through the identification of a real problem-solution fit as the main focus of effectuating, where Sarasvathy's (2001) effectuation emphasizes effectuating knowledge, resource, and network as grounded in the theories. Overall, the lean startup approach provides high quality versus quantity.

6. Conclusions

The current study investigated the use of causation, effectuation, and lean startup processes in an open innovation context. The study also utilized and tested these approaches in an agile environment, where business opportunity identification and business model creation are required in a very limited timeframe, to turn technology innovations into realistic business models. The setting is particularly important in addressing today's business reality.

The approaches adopted (causation, Sarasvathy's effectuation and lean startup) are employed in parallel through action research and case study. This approach is used to gather a higher degree of data and insight into the three approaches utilized within the research. It is further supported by a group of participants with diverse backgrounds, to avoid the traditional entrepreneurship research that individual traits or experience and cognitive capabilities are considered as a significant variable that affects the research outcome. Furthermore, the parallel approaches are employed in the same timeframe, which excludes the variables that may arise due to the difference in time.

This study shows that effectuation and lean startup (experiment-

oriented) approaches generated more realistic business models over the causation/prediction approach, although differences exist between Sarasvathy's (2001) effectuation and lean startup method. Moreover, the study demonstrated a new open innovation approach with ecosystem perspective that has been used in the national-level business innovation initiative of Finland, which could serve as evidence or an antecedent, as well as a new approach for innovation practices at individual and institutional levels. Such an approach can also support the government agency's policy-making and policy-stimulating actions for a nation's economic development.

The investigation into the three approaches demonstrates that each approach goes through a different set of processes, with different outputs in the form of portfolios of predicted opportunity, business models, and networks. In addition, the study gives an in-depth look into the effectuation process in an empirical setting, showing that no matter the causation or effectuation process, there is always the phenomenon of amplification and compression/reduction. However, depending on how such phenomenon takes place in different phases of the approach, the results can be significantly different. The study thus proposes that the utilization of the different approaches, in fact, affect the inputs and outputs of innovation or entrepreneurial process. There are differences in the (1) final number of business models created, (2) business model “quality,” and (3) success in gaining next-stage funding.

Empirically speaking, for the entrepreneurs with advantage in personal and professional networks, Sarasvathy's (2001) effectuation can be a highly effective approach, while for those with stronger technical skills, the lean startup approach can be a suitable choice, especially in high-tech space.

Theoretically speaking, although being considered as creation-oriented approaches (as opposed to causation-oriented approach), Sarasvathy's effectuation and the lean startup experiment have different logics, which result in different processes in practice. Thus, it requires researchers to distinguish their differences in future research. Furthermore, the study proves the IO nexus theory's validity in the Challenge Finland context, and further proposes an agile process that links business opportunity identification and business model creation by improving the existing theory, suggesting that the business idea of IO nexus can, in fact, be a business model or a minimal viable business model (MVBm).

Furthermore, this study confirms that differential importance exists among the three factors that are universal in the entrepreneurial processes (external enablers, venture ideas, and identity/confidence). For causation approach, the “external enabler” factor and “venture idea” factor are important, but the “identity/confidence” factor is not key. In contrast, the effectuation approach shows that “external enabler” factor is less important, but the “identity/confidence” factor is critical. Finally, the lean startup approach shows the significance of “venture idea”, and is less concerned with the other two factors.

In addition, the study also distills variables that are independent of the three approaches, but can potentially affect the results of business model creation. These factors include:

- Problem-solution fit, which determines if the solution created by entrepreneurs can really solve an existing or latent customer problem.
- Business network-ecosystem fit, which determines if the partners in a business ecosystem can effectively co-create value and share the same vision and identity, and if an ecosystem has the required expertise, knowledge, network, and resources to capture the opportunity. Such factors would provide answers to the questions in Sarasvathy's (2001) effectuation steps, but also to the questions of “who are we not?“, “what do we not know?“, and “whom do we not know?”

Through the paper, the authors recognized the challenge and limitation associated with the causation-oriented business model creation,

which is that the quality of such a business model cannot be evaluated through the use of traditional, fact-based managerial evaluation methods. However, the study provides evidence that the combination of causation and effectuation could establish new approaches that integrate the advantage of prediction, effectuation, and experimentation to create a desirable future, thus requiring further research efforts in this direction. The study also acknowledges its limit that the data from Challenge Finland do not cover whether the funded innovation would eventually have business success, as it may take years to see the result, and such results may not be reliable, as new factors and variables would be in play once the innovation is launched into the market.

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