

SIMULTANEOUS EXPERIMENTATION AS A LEARNING STRATEGY: BUSINESS MODEL DEVELOPMENT UNDER UNCERTAINTY

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Ventures operating under uncertainty face challenges defining a sustainable value proposition. Six longitudinal case studies reveal two approaches to business model development: focused commitment and simultaneous experimentation. While focused commitment positively affects initial growth, this commitment and lack of variety jeopardize long-term survival. Simultaneous experimentation implies lower initial growth levels, but facilitates long-term survival by enacting variety in a resource-effective manner. This article enriches organizational learning theory by demonstrating that not only distant search but also simultaneous experimentation results in variety. Moreover, simultaneous experimentation implies effectual behavior and reconciles the apparent juxtaposition between 'action' and 'planning.' Copyright © 2013 Strategic Management Society.

INTRODUCTION

Successful exploitation of an entrepreneurial opportunity requires translating that opportunity into a viable business model (Amit and Zott, 2001). However, for many ventures, this is not straightforward, given the considerable levels of uncertainty with which they are confronted, both in terms of technical and market feasibility (Anderson and Tushman, 1990). This is especially true in emergent industries where what the market will become depends on multiple decisions by various stakeholders, and clarity will only arise when entrepreneurial activities result in the industry's development (Dutta and Crossan, 2005). As a consequence, the set of feasible opportunities and viable business models is often not predictable in advance (Alvarez and Barney, 2007).

Keywords: business models; uncertainty; organizational learning; experimentation; variety

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Recent work (e.g., Gruber, MacMillan, and Thompson, 2008; Andries and Debackere, 2007) concludes that experimenting with and redefining, business models—based on consumer and market reactions—is highly instrumental under such uncertain circumstances. According to Sarasvathy (2001, 2008), traditional planning will not suffice in rapidly changing and uncertain environments. Instead, an effectual logic, in which entrepreneurs proceed with available resources to envisage a range of possible business opportunities and try to implement some of these opportunities through partnerships, is more suitable for leveraging unexpected events and feedback. If the outcomes of this experimentation process are negative, the initial business model is redefined and a new experiment is launched (Minniti and Bygrave, 2001; Vohora, Wright, and Lockett, 2004). Hence, experimenting with a variety of business models appears crucial under uncertainty.

However, current research offers little insight into what these business model experimentation processes actually look like and how they can be organized effectively. Organizational learning theory

suggests that different approaches to experimentation exist, but these have not been studied in the context of new ventures' business model development. This article, therefore, seeks to investigate how ventures develop their business models through experimentation. In particular, it intends to study (1) whether different experimentation and learning approaches exist and, if so, (2) what the rationale and implications of these approaches are.

Addressing these questions calls for fine-grained insights into the venture processes unfolding over time (Yin, 1994). Hence, we opt for a longitudinal case study design. We analyze in-depth six ventures active in various industries, all of them faced with considerable levels of market and technological uncertainty and displaying variety in terms of business model development. Relying on rich data obtained from 28 interviews, 17 business plans, 75 press articles, and 250 pages of other internal company documents, we analyze how these six ventures develop their business models over time.

Our study makes several contributions. Besides focused commitment to one single business model, our cases reveal a previously undocumented entrepreneurial learning strategy labeled 'simultaneous experimentation,' entailing the cost effective pursuit of a portfolio of business model experiments. Analyzing the rationale and implications of both learning strategies shows that, while focused commitment is initially instrumental in acquiring dedicated resources, it reduces the variety of business model experiments being pursued and complicates the financing and execution of subsequent compulsory searches, thereby jeopardizing long-term survival. Simultaneous experimentation, implying a portfolio of related but diverging searches, facilitates long-term survival by enacting variety in a resource effective manner.

Our research extends organizational learning theory by demonstrating that not only distant search but also simultaneous experimentation leads to variety in terms of business models. In addition, it suggests that simultaneous experimentation can be organized in a resource effective way. Due to this combination of resource efficiency and variety, simultaneous experimentation presents itself as a relevant learning strategy for entrepreneurial ventures alongside focused commitment and previously documented bootstrapping approaches.

The identification of a simultaneous experimentation approach adds to the effectuation literature since it is one of the first illustrations of how an effectual

logic translates into effectual behavior. As this approach combines experimentation with careful selection, deliberate planning, and efficient execution of specific experiments, it also reconciles the apparent juxtaposition between 'action' and 'planning.' While planning has traditionally been conceived as implying the *ex ante* selection of one specific business model, our findings reveal that simultaneous experimentation implies deliberate planning and selection, as well as effectual action and experimentation.

THEORETICAL BACKGROUND

As a conceptual framework for studying the business model development of ventures, we rely on two main literature streams: the literature on business models and their components on the one hand and organizational learning theory on the other. The business model literature formed the initial basis for this research, while the relevance of organizational learning theory emerged from the case study analyses (see recommendations by Suddaby, 2006). For reasons of clarity, both are discussed up front.

The business model and its components

Since the work of Amit and Zott (2001), researchers have defined the business model concept in a rather broad way, referring to a large variety of firm characteristics and decision variables, which translate entrepreneurial opportunities into particular configurations that create and capture value. Afuah (2003), for example, defines a business model as '*the set of activities a firm performs, how it performs them, and when it performs them as it uses its resources to perform activities, given its industry, to create superior customer value . . . and put itself in a position to appropriate the value*' (Afuah, 2003: 9).

As shown by Zott, Massa, and Amit (2011), there is a consensus in the literature that business models combine a broad variety of components or 'ingredients,' reflecting the fact that value creation arises from multiple sources, including: (1) transaction efficiency as a major way of reducing costs; (2) differentiation raising buyers' utility; (3) the combination and development of a set of scarce, durable, and difficult to imitate resources and capabilities; and (4) the density, centrality, size, and governance of the company's strategic networks.

According to a detailed literature review by Morris, Schindehutte, and Allen (2005), the most consistently emphasized business model components are: (1) factors related to the offering; (2) market factors; (3) internal capabilities; (4) competitive strategy factors; (5) economic factors, or how the venture makes money; and (6) personal/investor factors (i.e., the venture's time, scope, and size ambitions). A business model's performance depends not only on the content of these individual components, but also on the fit between them (Hamel, 2000). Just like a recipe, the business model includes both the main elements of a firm's activity and their integration. A change in one component interacts with many other components to determine the value of the business model as a whole. A business model can, hence, be described as a configuration of interdependent business model components.

Developing a business model through experimentation: insights from organizational learning theory

It is now generally accepted that entrepreneurial ventures—when operating under uncertainty—should experiment with a range of business models (Gruber *et al.*, 2008; Andries and Debackere, 2007). Through experimentation, the initial value proposition evolves into a viable business model by means of ‘*a series of trial and error changes pursued along various dimensions*’ (Nicholls-Nixon, Cooper, and Woo, 2000: 496). By experimenting with a specific business model and incorporating feedback from the environment, entrepreneurial ventures adopt an active stance to learning about the environment. If outcomes are negative, the initial business model is redefined and a new experiment is launched (Minniti and Bygrave, 2001), implying ventures will deviate from their initial business model configurations as they learn about and incorporate information that becomes available during the entrepreneurial trajectory (Gruber *et al.*, 2008).

The literature on organizational learning proposes two main approaches to learning and experimentation under uncertainty. Both approaches differ in the way configurations are adapted over time. On the one hand, organizations can develop through stepwise, incremental changes. In each step of the learning process, they alter one single component of their configuration and verify whether this change improves performance (Levinthal, 1997). This process is called ‘local search’ or ‘related

search.’ As a result of these incremental changes, the set of solutions in the immediate neighborhood of the existing configuration is examined (March and Simon, 1958; Cyert and March, 1963) and the organization will evolve toward a configuration that is closely related to its initial one (Minniti and Bygrave, 2001). On the other hand, organizations can make radical changes to their configurations by simultaneously altering multiple components of their configuration in each learning step. This learning process is called ‘distant search,’ ‘search through long jumps’ (Levinthal, 1997), or ‘path-creating search’ (Ahuja and Katila, 2004) because it leads organizations to experiment with configurations that differ to a large extent from their initial configurations.

In line with the literature on organizational learning, it would then appear that ventures can either change their business model configurations through local search, i.e., by changing one single business model component at a time, or through distant search, i.e., by altering multiple business model components in each new experiment. However, which of the two approaches is more suitable for entrepreneurial ventures operating under uncertainty remains unclear. With this article, we contribute to the literature by analyzing: (1) how ventures develop and redefine business models under uncertainty; (2) why they opt for a specific search approach; and (3) how these choices affect the development trajectory of the venture.

METHODOLOGICAL APPROACH

Case selection

Given our focus on the business model development process, we have opted for longitudinal case studies (Eisenhardt, 1989), with ventures as the unit of analysis. We started by studying a sample of 21 new ventures in the framework of a broader research project on incubation, venture creation, and venture financing. These 21 ventures were initially selected to reflect industry variety. Since the current contribution focuses on different approaches to business model development under uncertainty, we have retained only the subset of ventures that, at the time of their launch, were clearly faced with uncertainty regarding their technology and markets while, at the same time, displaying variety in terms of business model development. Indeed, as argued by Eisenhardt

and Graebner (2007), including a diverse set of cases is more likely to result in robust insights (for a recent illustration in the field of entrepreneurship, see Clarysse, Bruneel, and Wright, 2011).

This approach resulted in a set of six ventures, all faced with considerable degrees of uncertainty at the time of founding, and active in diverse industries, including machine visions systems, software for advanced laser applications, E-commerce, and software development related to emerging Internet use (see Table 1 for an overview of the cases). It turns out that the six cases also vary in terms of success, although this was not a selection criterion. Image and L-goritm¹ identified viable business models, turned breakeven, went public, and eventually became global players in their market niches. @Music and OOPs both failed to identify a viable business model and went bankrupt. At the time of data collection, it was not yet clear whether or not SiS' and Regmed's efforts would result in sustainable revenues.

Data collection

For each venture, we have documented the period from the emergence of the idea to establish a company until: (1) the point in time at which the venture ceases to exist (in our cases, either through bankruptcy or voluntary closure); (2) the point in time where the company turns breakeven; or (3) for firms that still exist but have not yet turned breakeven, the point in time when the data collection is terminated (i.e., the first quarter of 2005). This implies that, for some companies, we observe more years than for others (see Table 1). Also, one case in our sample—namely Image—was significantly older than the other five cases, and we had to go back further in time to document the initial business model development.²

A historical description of each company has been created, based on the information from semi-structured interviews and document analysis (see Table 1). Data collection and interviews were conducted from the first quarter of 2004 to the first quarter of 2005. Available documents (including

company Web sites and press articles) were analyzed in preparation for the interviews. Twenty-eight interviews were conducted (see Table 1), lasting approximately two hours on average, with the shortest taking about 50 minutes and the longest taking almost three hours. For each case, we interviewed at least one founder and one person not part of the founding team. Wherever possible, we included external views such as those of investors, consultants, and technology transfer officers involved. The interviewees provided complementary documents after the interviews. For each case, interviews and document analysis were performed until a consistent case account could be constructed. When inconsistencies between interviews and documents emerged (e.g., in @Music and OOPs), additional interviews were conducted to clarify pending issues.

In total, four company Web sites, 17 business plans, 75 press articles (including online articles), and approximately 250 pages of other internal documents have been analyzed. The resulting historical descriptions were presented to the interviewees to assess accuracy and completeness. In some cases, information has been added, refined, or corrected. We triangulated the documentation of our central constructs and involved key informants in each venture to review our historical descriptions in order to increase construct validity (Gibbert, Ruigrok, and Wicki, 2008). This analysis results in narrative descriptions of the entrepreneurial trajectory.

Central constructs: business models and their relatedness

When engaging in case study analysis, the use of a set of central constructs is beneficial in documenting phenomena of interest systematically (Eisenhardt, 1989). As we aim to analyze ventures' approaches to business model development, we document and interpret the business model concept as it changes over time. This construct stems directly from our research questions and is, hence, specified *a priori*.

Whereas conceptually business models are broadly conceived as the entirety of interrelated activities performed to create and capture value (Afuah, 2003), most empirical research on business models adopts a more narrow measurement of the concept. As summarized by Zott *et al.* (2011), researchers often adopt idiosyncratic business model descriptions and typologies. While this fits specific research questions, it hinders cumulative progress in the field. In addition, most existing approaches are,

¹ The names of the ventures in our case study have been changed for reasons of confidentiality.

² We are convinced that—due to the availability of detailed business plans and privileged access to two consecutive CEOs—retrospective biases for the Image case are comparable to the other five cases.

Table 1. Case study overview

Company	Activity	Uncertainty at founding	Data sources	Time period
@Music	E-commerce	<p><i>Market:</i> awareness of critical issues, such as impact of Internet on individuals' buying behavior, musical genres, geographical scope; however, rate of diffusion unknown; regulation for sales through Internet not existing</p> <p><i>Technology:</i> technical solutions for sales through Internet not existing</p>	Three business plans, 250± pages of internal documents (e-mail correspondence, meeting reports, financial reports), four press articles, 11 interviews with three founders (one was interviewed twice), two investors, and five employees	Sept 1998 to July 2002
OOPs	SW products that enable E-commerce	<p><i>Market:</i> implicit assumption that B-to-C will be considerable market; unawareness of the distribution approach, of market interest in B-to-B</p> <p><i>Technology:</i> unawareness of the discrepancy between the technological difficulties in adapting standardized solution to real settings</p>	Two business plans, three press articles, six interviews with one investor, one consultant, one employee, and two founders (one was interviewed twice)	Jan 1998 to Feb 2003
Image	Machine vision systems	<p><i>Market:</i> difficult to estimate size of market and subsegments; high number of applications in different industries possible, but unclear which one is commercially interesting</p> <p><i>Technology:</i> high number of applications in different industries possible, but unclear which one is feasible from technical point of view</p>	Company Web site, five business plans, 37 press articles, two interviews with two former CEOs (of which one was the founder)	Jan 1983 to Oct 1988
L-goritm	SW for advanced laser applications in product design	<p><i>Market:</i> unawareness of relevance of sales approach and geographical scope</p> <p><i>Technology:</i> impact of software versus hardware technology unknown</p>	Company Web site, three business plans, 21 press articles, three interviews with one founder/CEO, one cofounder, and one finance manager	Dec 1995 to Dec 2001
SiS	Secure communication services	<p><i>Market:</i> high expectations, but also high uncertainty regarding impact of Internet on individuals' buying behaviors; uncertainty regarding market potential of three potential applications; lack of knowledge of international marketing and lack of knowledge of fierce competition on home market</p> <p><i>Technology:</i> technology platform still under development; uncertainty regarding technical feasibility of three potential applications</p>	Company Web site, two business plans, three press articles, three interviews with one founder (interviewed twice), and one technology transfer officer	May 2000 to May 2005
RegMed	Biomedical regenerative medicine	<p><i>Market:</i> lack of market knowledge; FDA testing procedures for biomedical products not existing</p> <p><i>Technology:</i> uncertain results of clinical studies</p>	Company Web site, two business plans, seven press articles, three interviews with two founders, and one technology transfer officer	Jan 2000 to Jan 2005

to some extent, sector specific, making them less appropriate for mapping and analyzing the business model evolution process across different industries (Demil and Lecocq, 2010).

Consequently, limited progress has been made in empirically operationalizing the business model concept in line with its definition as a broad set of decision variables related to the creation of a competitive advantage. An important exception is the detailed coding scheme by Morris *et al.* (2005) comprising a wide variety of business model components. For our empirical analysis, we rely on this coding scheme because it has three important advantages. First, it represents multiple sources of value creation and value capturing and, therefore, fits the conceptual view of the business model as a system-level, holistic approach to explaining how firms do business (Zott *et al.*, 2011). Second, even though this coding scheme is very detailed, it can be applied across industries. And finally, it allows for documenting changes over time.

For each case, we document and analyze changes in the business model components listed by Morris *et al.* (2005): (1) the (nature of) the offering, including the distribution approach; (2) the market; (3) internal capabilities; (4) the competitive strategy; (5) economic factors, i.e., the venture's revenue/margin model; and (6) personal/investor factors, i.e., the venture's ambitions. We adapt the list of sub-items provided by Morris *et al.* (2005) in a way that allows us to code not only changes in the business model, but also the number of business models experimented with.

Based on the adapted coding scheme in Table 2, we document changes in sub-items for each venture. We regard any observed combination of these sub-items as one specific business model. If a company experiments with two or more such combinations at the same time, we classify these as different business models. For example, if a venture simultaneously sells a product directly and indirectly (through distribution partners), we regard both activities as two different business models. If a venture evolves from offering services only to offering both products and services, we consider this the introduction of one additional business model. A similar logic applies if the venture changes from fixed to both fixed and flexible pricing. If a venture switches from fixed to flexible pricing or from business-to-business to business-to-consumer activities, we regard this as the abandonment of one business model and the adoption of another business model.

In line with the organizational learning literature, a second central construct adopted is the relatedness of a venture's experiments.³ We analyze whether ventures develop their business models through local or distant business model searches, and we also map the overall variety of business models being explored over time. To do so, we compare each newly introduced business model to other business model(s) on the venture's development path. More specifically, we calculate four distance measures for each new business model, representing its distance to the venture's most similar and least similar business models (developed previously, as well as simultaneously).

First, we compare the new business model with the most similar business model used up to that point in time. We count on how many business model components they differ. This implies comparison with (1) business models used both before and after that specific point in time, as well as (2) business models that had been used up to that specific point in time but were abandoned afterward. So, if a venture at a specific point in time is experimenting with three business models and introduces a new business model, we calculate how many components this new business model differs from each of the three previously used business models, irrespective of whether or not these three are discontinued. We take the lowest value of these three differences as an indication of the new business model's relatedness to previous experiments.

Second, we compare the new business model with the most similar business model used from that point in time onward. We count on how many business model components they differ. This implies comparison with (1) business models that had been introduced beforehand and were still maintained at that specific point in time, as well as (2) business models that were introduced at that specific point in time but had not been used beforehand. This gives us an indication of the new business model's relatedness to simultaneously conducted experiments.

Third, we perform similar coding to map the difference between each new business model and its least related counterpart. More precisely, we count

³ The inclusion of relatedness as a central concept emerged when conducting the case study analysis. Thus, our methodological approach combines longitudinal case methods guided by central constructs with more 'grounded' approaches in line with recommendations advanced recently by Suddaby (2006).

Table 2. Subcomponents of the business model (adapted from Morris *et al.*, 2005)Offering*How does the company create value? (select one from each set)*

- product / service
- standardized / some customization / high customization
- internal manufacturing or service delivery / outsourcing / licensing / reselling / value-added reselling
- direct distribution / indirect distribution

Market*Who does the company create value for? (select one from each set)*

- type of customer (b-to-b / b-to-c)
- local / regional / international
- position of customer in the value chain: upstream supplier / downstream supplier / government / institutional / wholesaler / retailer / service provider / final consumer
- broad market / niche market
- transactional / relational

Internal capabilities*What is the company's source of competence? (select one or more)*

- production / operating systems
- selling / marketing
- information management / mining / packaging
- technology / R&D / creative or innovative capability / intellectual
- financial transactions / arbitrage
- supply chain management
- networking / resource leveraging

Competitive strategy*How does the company competitively position itself? (select one or more)*

- image of operational excellence / consistency / speed
- product or service quality / selection / features / availability
- innovation leadership
- low cost / efficiency
- intimate customer relationship / experience

Economic factors*How does the company make money? (select one from each set)*

- pricing and revenue sources: fixed / flexible
- operating leverage: high / medium / low
- volumes: high / medium / low
- margins: high / medium / low

Personal / investor factors*What are the company's ambitions? (select one)*

- subsistence model / income model / growth model / speculative model

the number of business model components for which the new business model differs from the least similar business model used up to that point in time and, finally, we count the number of components for which it differs from the least similar business model used from that point in time onward. Whereas the first two distance measures allow us to assess the use of local and distant search, the latter two are indicative of the level of overall business model variety enacted by the venture.

ANALYSIS AND FINDINGS

Not only does longitudinal case study research benefit from the use of central constructs, but it also implies different levels of analysis (Pentland, 1999)—from describing the actual process of business model development within each venture to interpreting the observed findings by means of the central constructs and by situating the findings in relation to the current literature. Moving from description to

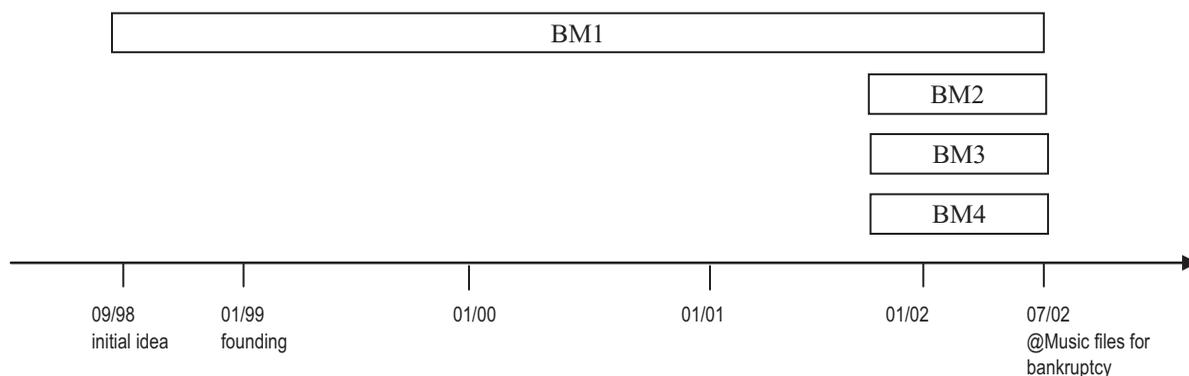


Figure 1. Event history of @Music

analysis implies an iterative process consisting of within-case analysis and between-case comparison (Eisenhardt, 1989). We analyze business model development in each venture in our sample and compare the development pattern over the six cases.

Based on the historical description constructed for each case and using the coding scheme in Table 2, we coded whether and when the business models of the six ventures in our sample changed. These changes include instances in which new business models were introduced and/or previous business models were abandoned. In a next step, we coded how many business models were added and dropped in each instance. We then used the coding scheme in Table 2 to map each new business model in detail. In a final step, we used these detailed mappings to calculate the distance measures discussed earlier in the Methodology section.

Coding was performed independently by two of the authors, who identified the same 23 changes over all six ventures; i.e., the same 23 points in time at which the business model changed. Of these 23 events, 19 were initially coded as the exact same number of abandoned and adopted business models. Taking into account the different categories used by the two coders, this implies a Cohen's kappa of 0.59. The differences in coding have been resolved through discussion and by obtaining additional information from the ventures, resulting in consensus for all events in a second and final round. In a next step, the two authors independently mapped each business model in detail and calculated its relatedness to other business models, immediately reaching full agreement. For each case, the coding was visualized in (1) a timeline representing the number of business models added or dropped over time and

(2) a detailed mapping of each new business model and its relatedness to the venture's previously and concurrently developed business models. Figures 1 and 2 and Tables 3 and 4 illustrate this for the case studies of @Music and Image.⁴ A summary for all cases can be found in Table 5.

A first striking observation is that, for most ventures, consecutive and concurring business models differ on multiple aspects (see median distance measures in Table 5). For all ventures except RegMed, the majority of business models differ on three or more components from the least-related business model developed previously and also from the least-related business model developed concurrently. These differences indicate that the ventures generate a considerable variety of experiments when searching for a viable business model.

However, visual comparison of the timetables of the different cases indicates that the six ventures differ significantly with respect to how they arrive at creating variety. Four of them (@Music, OOPs, SiS, and RegMed) focus on one (in the case of RegMed, two) business model(s) very early on and commit to this decision for several years (see Figure 1 for @Music). Only after a considerable time period do @Music, OOPs, and SiS abandon their initial business models and launch new business model experiments. So, whereas these four ventures focus on and commit to one specific business model initially, three of them switch to new business model experiments later.

⁴ Due to space limitations, the figures and tables for the four other cases are not included in this article. They are available from the authors on request.

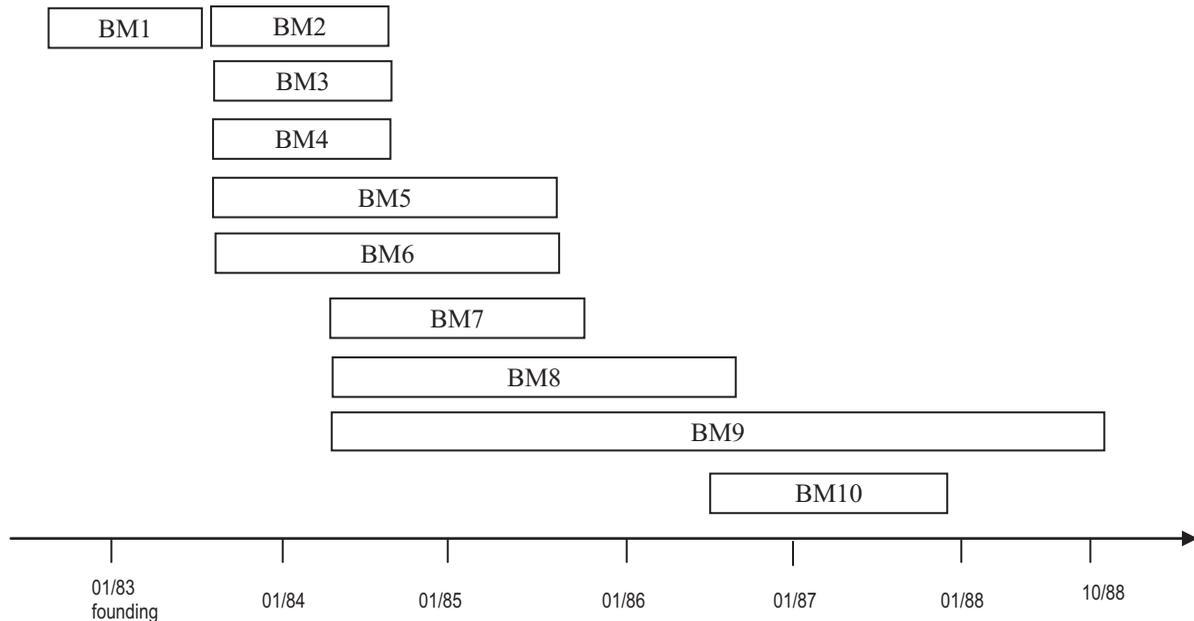


Figure 2. Event history of Image

Image's and L-goritm's timelines display distinct patterns (see Figure 2 for Image). They spend two to five years developing a large portfolio of business model experiments simultaneously, which they then gradually narrow down to one business model. As indicated by the median distance measures in Table 5, the majority of these business model experiments differ with respect to only one or two business model components from the most similar previous experiments in the portfolio and with respect to only one business model component from the most similar concurrent business model experiment. Stated otherwise, newly introduced business models are highly related to already existing business models in the portfolio.

Image and L-goritm are, hence, developing portfolios of simultaneous, local, business model searches. While these search paths start from the same experiment initially, they spread out in various directions over the performance landscape. So, although individual search paths in the portfolio consist of related business model experiments, the ventures end up experimenting with a set of business models that, in the end, vary significantly. This can be seen in the median distant measures in Table 5: while a new business model differs, in most cases, only with respect to one component from the most similar business model previously or concurrently

developed, it often differs on three components from the least similar business model in the portfolio.

Consequently, we identified two distinct experimentation approaches in our sample: (1) focused commitment followed by consecutive business model search and (2) simultaneous experimentation. In a next step, we carried out an in-depth analysis of these two approaches. More specifically, we revisited the historical case descriptions and investigated why each venture opted for a specific approach and what the implications, advantages, and disadvantages were. We then compared our findings across all cases adhering to the same experimentation strategy.

Focused commitment followed by a period of business model experimentation

We find that some ventures select one specific business model very early on and then commit to this business model for several years. One could consider this an extreme case of local, path-deepening search (Ahuja and Katila, 2004) in which the venture keeps experimenting with the exact same model in the hope that it will become viable. Only when, after a significant period of time, initial assumptions fail to materialize, do these ventures begin to experiment with alternative business models.

Table 3. Business models used by @Music

BM	Offering	Market	Internal capabilities	Competitive strategy	Economics	Personal/investor factors	Distance to closest previous BM	Distance to closest current BM	Distance to furthest previous BM	Distance to furthest current BM
1	downloadable noncommercial quality music; high customization; value-added reselling; direct sales	b-to-c; international; niche market; transactional	operating systems; Web design; marketing	innovation leadership	commission per song sold; medium operating leverage; high volumes; low margins	growth model	n.a.	n.a.	n.a.	n.a.
2	customized CDs; some customization; value-added reselling; direct sales	b-to-b; national; niche market; transactional	marketing	product features	flexible pricing; medium operating leverage; medium volumes; medium margins	growth model	5 to BM1	5 to BM1	5 to BM1	6 to BM3, BM4
3	concerts; high customization; internal service delivering; direct sales	b-to-c; national; niche markets; transactional	networking	service quality	flexible pricing; low operating leverage; medium volumes; medium margins	income model	6 to BM1	4 to BM4	6 to BM1	6 to BM1, BM2
4	Web design services; high customization; internal service delivering; direct sales	b-to-c; national; broad market; transactional	operating systems; Web design	service quality	flexible pricing; low operating leverage; medium volumes; low margins	income model	6 to BM1	4 to BM3	6 to BM1	6 to BM1, BM2

Table 4. Business models used by Image

BM	Offering	Market	Internal capabilities	Competitive Strategy	Economics	Personal/investor factors	Distance to closest previous BM	Distance to closest current BM	Distance to furthest previous BM	Distance to furthest current BM
1	General purpose machine vision systems; standardized; internally developed; direct sales to users	b-to-b; national; broad; relational	image processing technology	innovation leadership	flexible pricing; high operating leverage; medium volumes; medium margins	growth model	n.a.	n.a.	n.a.	n.a.
2	Machine vision system for flower inspection; customized; internally developed; direct sales to users	b-to-b; national; niche; relational	image processing technology	innovation leadership	flexible pricing; high operating leverage; medium volumes; medium margins	growth model	2 to BM1	1 to BM3, BM4	2 to BM1	3 to BM5, BM6
3	Machine vision system for fruit inspection; customized; internally developed; direct sales to users	b-to-b; national; niche; relational	image processing technology	innovation leadership	flexible pricing; high operating leverage; medium volumes; medium margins	growth model	2 to BM1	1 to BM2, BM4	2 to BM1	3 to BM5, BM6
4	Machine vision system for automotive parts inspection; customized; internally developed; direct sales to users	b-to-b; national; niche; relational	image processing technology	innovation leadership	flexible pricing; high operating leverage; medium volumes; medium margins	growth model	2 to BM1	1 to BM2, BM3	2 to BM1	3 to BM5, BM6
5	Machine vision system for automotive parts inspection; standardized; internally developed; direct sales to system integrators	b-to-b; international; niche; relational	image processing technology	innovation leadership	fixed pricing; high operating leverage; high volumes; high margins	growth model	3 to BM1	1 to BM6	3 to BM1	3 to BM2, BM3, BM4
6	Machine vision system for pharmaceuticals; standardized; internally developed; direct sales to system integrators	b-to-b; international; niche; relational	image processing technology	innovation leadership	fixed pricing; high operating leverage; high volumes; high margins	growth model	3 to BM1	1 to BM5	3 to BM1	3 to BM2, BM3, BM4
7	Machine vision system for automotive parts inspection; standardized; internally developed; indirect sales through OEMs	b-to-b; international; niche; relational	image processing technology	innovation leadership	fixed pricing; high operating leverage; high volumes; high margins	growth model	2 to BM5, BM6	1 to BM9	3 to BM2, BM3, BM4	3 to BM2, BM3, BM4, BM8
8	Machine vision system for semiconductor inspection; standardized; internally developed; direct sales to system integrators	b-to-b; international; niche; relational	image processing technology	innovation leadership	fixed pricing; high operating leverage; high volumes; high margins	growth model	1 to BM5, BM6	1 to BM5, BM6	3 to BM2, BM3, BM4	3 to BM2, BM3, BM4, BM7
9	Machine vision system for semiconductor inspection; standardized; internally developed; indirect sales through OEMs	b-to-b; international; niche; relational	image processing technology	innovation leadership	fixed pricing; high operating leverage; high volumes; high margins	growth model	2 to BM5, BM6	1 to BM7	3 to BM2, BM3, BM4	3 to BM2, BM3, BM4
10	'second optical' machine vision system for semiconductor inspection; standardized; internally developed; indirect sales through OEMs	b-to-b; international; niche; relational	image processing technology	innovation leadership	fixed pricing; high operating leverage; high volumes; high margins	growth model	1 to BM9	1 to BM9	2 to BM8	2 to BM8

Table 5. Overview of business model changes

Case	Approach	Average # of new business models per year	Mean distance to closest previous BM	Mean distance to closest current BM	Mean distance to furthest previous BM	Mean distance to furthest current BM
@Music	Focused commitment	1.00	6	4	6	6
OOPs	Focused commitment	0.83	4	4	4	4
SiS	Focused commitment	0.50	5	n.a.	5	n.a.
RegMed	Focused commitment	0.40	n.a.	1	n.a.	1
Image	Simultaneous experimentation	1.67	2	1	3	3
L-goritm	Simultaneous experimentation	1.57	2	1	3	3

In the case of OOPs, the founders—soon after inception in 1998—commit to the development of ‘Spoot,’ a software product for B-to-C applications. Previous consulting activities were discontinued in 1999 to concentrate solely on product development and sales. Even though many technical problems were encountered and sales did not materialize as planned, the company stuck to its business model until 2001. At that point in time, the founders started to analyze the lack of sales in-depth. They radically changed the business model’s offering, the competitive strategy it entailed, and its economics. About a year later, they refined this business model by identifying a niche market. Again, sales did not materialize and yet another redirection imposed itself.

In SiS, a very similar story unfolded. Although the founders initially identified three possible applications, they decided to develop communication services only. After two years of disappointing sales, a radical shift to storage applications took place. This implied a complete overhaul in terms of envisaged customer segment, technology, and geographical market. Also @Music (see Figure 1 and Table 3) focused from the very beginning on one specific business model, namely online B-to-C sales of niche music labels. When, after three years, sales had still not materialized, they started to experiment with additional business models, such as concert organizing, Web design, and the production of custom-made CDs (B-to-B). RegMed was slightly different from the other three cases in the sense that (1) it committed very heavily to two parallel business models and (2) although these business models were still not generating sales after four years, no redirections were planned. The fact that RegMed was active in

biotech, a sector with long time horizons, probably explains this persistence.⁵

Rationale for focused commitment

From the historical descriptions, we find that early commitment by the ventures in our sample was not due to a lack of awareness regarding uncertainty; it was, in fact, a deliberate choice in the face of uncertainty. Founders and investors actually acknowledged at the start that many factors affecting the business model’s viability were uncertain. They acknowledged technical uncertainties, uncertainty about how the market would evolve in terms of customer behavior and competition, and uncertainty regarding regulation (see Table 6). Nevertheless, they decided to persistently focus on the development of one (or in the case of RegMed, two) specific business model(s).

In our interviews (see Table 6), stakeholders mentioned two main reasons for committing to one specific business model despite the presence of uncertainty. First, they focused early to capitalize on learning effects. Both founders and investors were convinced that by putting all their efforts into one single business model, they would learn quickly about technical and market issues. They believed this would enable them to stay ahead of the competition and capture a large market share. As one founder of OOPs put it: ‘We just had to be first on that market.

⁵ The case of RegMed, which pursues multiple business models over longer time frames, is an example of what Westhead and Wright (1998) call ‘portfolio entrepreneurship.’ Of course, such persistent adherence to multiple business models multiplies resource requirements compared to a persistent focus on one single business model.

Table 6. Quotations on focused commitment

	Rationale	Promise of achieving learning effects and first-mover advantages	Dedicated organizational structure and considerable expenditures	Implications	Difficulties in acquiring external investment when assumptions fail
@Music	<p><i>Acknowledgement of uncertainty</i></p> <ul style="list-style-type: none"> We had this vision that the era of the traditional music business would be over soon. It was expected that throughout the world, the Internet would completely change consumers' buying behavior. Of course, nobody knew when and how this would happen. 	<p><i>Promise of achieving learning effects and first-mover advantages</i></p> <ul style="list-style-type: none"> The guys from the author rights authority didn't know what to do with us. They had never dealt with online music sales... We were actually sitting with them, writing regulations about author rights protection and tariffs for online sales. It was, of course, a great advantage to do that. 	<p><i>Dedicated organizational structure and considerable expenditures</i></p> <ul style="list-style-type: none"> The investors had this idea that to get online sales going, we should launch a big marketing campaign. An international marketing manager was attracted to do that. We were burning cash like hell. But we were told that that's the way you should do it. 	<p><i>Implications</i></p> <ul style="list-style-type: none"> These things had nothing to do with the initial idea. It was not what I signed up for. I wanted to work for a company selling music online, going completely against the traditional music industry... I had left my job for that. I wasn't interested in Web design or in organizing concerts. 	<p><i>Difficulties in acquiring external investment when assumptions fail</i></p> <ul style="list-style-type: none"> They were desperately trying to generate revenues from concert organizing. Web design and other stuff. These were not the types of activities we wanted to invest in as venture capitalists.
OOPS	<p><i>Rationale</i></p> <ul style="list-style-type: none"> We were quite happy with the revenues coming from our consulting activities. At least it provided some kind of income... that could partially support the development of Spoot. But the investors were not interested in yet another consulting company. They wanted us to put all efforts on product development. 	<p><i>Promise of achieving learning effects and first-mover advantages</i></p> <ul style="list-style-type: none"> We just had to be first on that market. We would be way ahead of competitors: by the time they even understood the opportunity. 	<p><i>Dedicated organizational structure and considerable expenditures</i></p> <ul style="list-style-type: none"> The investors brought in a big shot with tons of sales experience from a big firm... He brought his employees with him. Suddenly, we had an incredibly expensive sales team of 20 people. Still nothing sold. We had separate R&D and service divisions. People from these divisions were kept apart. They were in opposite sides of the building... We had this idea that they should not interfere with each other, but should focus on their main task. 	<p><i>Implications</i></p> <ul style="list-style-type: none"> The sales manager and his entire sales team were fired. Instead, the marketing team became responsible for sales. To improve our insights in customer needs, all developers had to start working directly for the customer... Although I still think this was a good decision, it also posed problems. Some of these developers were really technical people, typical 'nerds' let's say. Not the type of people you want to send to a customer. 	<p><i>Difficulties in acquiring external investment when assumptions fail</i></p> <ul style="list-style-type: none"> Suddenly, one of the investors... comes up with the idea to form a joint venture... He just didn't believe anymore that we could make it on our own. Now, while this merger probably would be beneficial for him, there was nothing in there for me, and I didn't agree... I came up with an idea for a whole new market... There was no support whatsoever on the board. I immediately realized that the company could not go on without the support of the investors... Two months later, I filed for bankruptcy.
SIS	<p><i>Rationale</i></p> <ul style="list-style-type: none"> It was a tight plan. Everybody could easily understand what they wanted to do... The story was easy to sell. 	<p><i>Promise of achieving learning effects and first-mover advantages</i></p> <ul style="list-style-type: none"> Of course there was a lack of clarity about what the market would look like... But in any case, you wanted to be there first—to obtain market share in case it became a success. 	<p><i>Dedicated organizational structure and considerable expenditures</i></p> <ul style="list-style-type: none"> With the money from the first financing round, we immediately started to hire people... to execute our plan. 	<p><i>Implications</i></p> <ul style="list-style-type: none"> This was really a complete overhaul. We would now focus on this new application, but we didn't have the expertise. We had to start sourcing in technology from external partners, because we didn't have the capabilities to develop it ourselves. 	<p><i>Difficulties in acquiring external investment when assumptions fail</i></p> <ul style="list-style-type: none"> Our investor wasn't interested anymore. Luckily, this was all before the dotcom crash. We were able to attract new investors and with this new capital injection, we basically started all over again.
RegMed	<p><i>Rationale</i></p> <ul style="list-style-type: none"> This is a biotech start-up, right. There's always uncertainty about whether the technology will work, whether you'll get FDA approval, and things like that. 	<p><i>Promise of achieving learning effects and first-mover advantages</i></p> <ul style="list-style-type: none"> We really need to invest all possible efforts in this product. It could become the first biotech product getting FDA approval. This would open up incredible market opportunities. 	<p><i>Dedicated organizational structure and considerable expenditures</i></p> <ul style="list-style-type: none"> You can't just hire generalists for this type of work. You need researchers with specific knowledge about joints and cartilage. 	<p><i>Implications</i></p> <ul style="list-style-type: none"> (did not occur in period documented) 	<p><i>Difficulties in acquiring external investment when assumptions fail</i></p> <ul style="list-style-type: none"> (did not occur in period documented)

We would be way ahead of competitors by the time they even understood the opportunity.' Persistent focus is, hence, seen as a way to quickly reduce uncertainty over a specific business model and to create first-mover advantages.

Second, our interviews with founders and investors further reveal that focus on one specific business model improves the clarity of the value proposition for different stakeholders. The fact that the companies have well-delineated business models allows them to attract motivated employees and to convince strategic partners. In all four cases, the independent venture capitalists (VCs) involved were very much in favor of a persistent focus on a specific business model. In the case of OOPs, the investors were actually pushing the founders to focus solely on product development, as one founder recalled: *'We were quite happy with the revenues coming from our consulting activities. At least it provided some kind of income . . . that could partially support the development of Spoot. But the investors were not interested in yet another consulting company. They wanted us to put all efforts on product development.'*

Implications of focused commitment

Our historical case descriptions and our interviews (see Table 6) demonstrate that focusing on a specific business model results not only in mobilizing power but also in clarity regarding the venture's organizational configuration. Objectives and activities are developed in line with the envisaged value proposition, and employees whose competencies reflect the objectives outlined in the business model are attracted. As an OOPs employee testified: *'The investors brought in a big shot with tons of sales experience from a big firm . . . He brought his employees with him.'* This results in a dedicated organizational structure, consisting of different functional departments, as indicated by that same employee: *'We had separate R&D and service divisions. People from these divisions were kept apart. They were in opposite sides of the building.'* The development of these dedicated activities implies significant expenditures. Our case studies clearly show that external investors are supportive of these costly initiatives, believing these will enable ventures to achieve fast growth. One @Music founder pointed out that: *'The investors had this idea that to get online sales going, we should launch a big marketing campaign. An international marketing manager was attracted to do that. We were burning*

cash like hell. But we were told that that's the way you should do it.'

Over time, the venture develops the chosen business model and thereby reduces uncertainty pertaining to the underlying assumptions. This process can yield outcomes ranging from full confirmation of initial assumptions to the complete opposite. In three out of the four case studies—OOPs, @Music, and SiS—crucial assumptions proved to be too optimistic. As the founder of SiS testified: *'The competition on the home market turned out to be much fiercer than expected (because) this one big player decided to become active.'* In multiple cases, including @Music, consumer buying behavior turned out to be different than expected, as one employee recalled: *'Only later, we realized that people were just downloading to listen, but were simply not willing to buy.'*

Our case studies show that when ventures are faced with discrepancies between initial assumptions and unfolding reality, change becomes inevitable for their survival (see Ambos and Birkinshaw, 2010, on the role of cognitive dissonance in ventures' development processes). From our analysis, it became clear that OOPs, @Music, and SiS turned to consecutive business model search. These redirections had serious implications for the ventures' internal organization. These ventures have attracted specialized personnel and have introduced dedicated organizational structures—commitments, all in line with their initial focus. Redefining the business model then becomes complex, as it requires changing the mind-set of the entrepreneurial team and its stakeholders. It implies choosing a different set of activities, skills, and structures (Miller and Friesen, 1984). Some of the specialized competencies may become obsolete, while others may be missing. The ventures' core capabilities might, therefore, turn into core rigidities (see also Dougherty, 1995, and Ambos and Birkinshaw, 2010, on disruptive transitions). In the case of OOPs, founders decide to drastically adapt their development and sales approach after having undertaken an in-depth analysis of negative sales results: *'To improve our insights in customer needs, all developers had to start working directly for the customer . . . Although I think this was a good decision, it also posed problems. Some of these developers were really technical people, typical "nerds" let's say. Not the type of people you want to send to a customer.'* Moreover, our case studies confirm that employees themselves are not always willing to take part in this change process. Or, as one @Music employee indicated: *'These*

things had nothing to do with the initial idea. It was not what I signed up for. I wanted to work for a company selling music online, going completely against the traditional music industry . . . I had left my job for that. I wasn't interested in Web design or in organizing concerts.'

In addition, the case studies demonstrate that it is difficult to convince investors to fund reconfigurations, since these investors question whether the initial business model was wrong or whether the problems are simply due to lousy execution by the venture's founders (cf. Bhidé, 1992). This weakens investor confidence. As one OOPs founder explained (see Table 6): *'Suddenly, one of the investors . . . comes up with the idea to form a joint venture with another company in his portfolio. He just didn't believe anymore that we could make it on our own. Now, while this merger probably would be beneficial for him, there was nothing in it for me, and I did not agree . . . I came up with an idea for a whole new market . . . There was no support whatsoever on the board. I immediately realized that the company could not go on without the support of the investors . . . Two months later, I filed for bankruptcy.'* OOPs and @Music did not succeed in mobilizing resources for executing consecutive business model searches and went bankrupt.

Summary and propositions on focused commitment

Our case studies show that some ventures persistently focus on a specific business model. This focus is a deliberate choice in the face of uncertainty since it is instrumental in mobilizing different stakeholders (among whom independent VCs figure prominently), and ventures believe it can result in first-mover advantages. This approach entails significant expenditures: launching dedicated campaigns, developing an elaborate organizational structure, and hiring specialized personnel with skills matching the chosen business model. Given that focused commitment is instrumental in mobilizing resources, it facilitates rapid organizational growth during the initial phases of the venture's life.

However, our case studies illustrate that, in reality, these first-mover advantages might not materialize (see also the work by Dowell and Swaminathan, 2006, showing that the occurrence of first-mover advantages in emergent industries is indeed a rare event). When the initial assumptions underlying the business model prove to be incorrect, the ventures in our study turn to consecutive searches and experi-

ment with new business models. As our cases illustrate, such change processes are hazardous and painful since they require the venture to become flexible again with regard to its assumptions and its organizational configuration. Given the specialized capabilities and dedicated organizational structure, this becomes very difficult. Our case studies show that founders and employees are not always capable or willing to do so and that investors are reluctant to finance such changes. The ventures' organizational rigidities and financing problems reduce the possibility of exploring new business models, thereby hampering the venture's ability to identify a viable business model and, hence, also its long-term survival. Based on these findings, we propose that:

Proposition 1: Focused commitment has a positive effect on the initial growth of ventures operating under uncertainty.

Proposition 2: Focused commitment jeopardizes the long-term survival of ventures operating under uncertainty.

Simultaneous experimentation

We find that some ventures do not commit early on to a specific business model, but develop diverging search paths by engaging in a series of related business model experiments. L-goritm initially experimented with a variety of business models simultaneously. In the first year of its existence, the company developed software enabling the use of advanced laser applications in product design, including applications for reverse engineering as well as for quality control. The latter were sold in combination with quality control services. During the entire period of 1997 to 1999, the company experimented with a combination of indirect and direct sales of these software products. From 2000 onward the company discontinued some of these activities, ending up with one business model by 2001. This business model was viable in the sense that it generated sufficient income for the company to break even, grow internationally, and become world leader in its niche market.

Image, however, began with one single business model but immediately developed it into a portfolio of five different business models (see Figure 2 and Table 4). After four years, the venture gradually narrowed down its business model portfolio and, by 1988 (i.e., five years after inception), one viable

business model remained. In this case too, the business model was the start of a highly prosperous international trajectory and a successful IPO.

Rationale for simultaneous experimentation

From interviews with stakeholders (see Table 7), we found that multiple search paths of related business model experiments were executed in parallel for two reasons. First, although each new experiment was related to another experiment in the portfolio, the fact that these search paths developed in different directions implies that ventures end up experimenting with a variety of business models. Ventures consider this instrumental in addressing uncertainty. It allows them to learn and, hence, reduce uncertainty about a relatively broad range of opportunities. If one business model proves unviable, there is still a chance that one of the other options may prove successful. In doing so, the ventures manage risk and retain strategic flexibility (Raynor, 2007; de Weerd-Nederhof *et al.*, 2008). As one founder of Image related: *'It was impossible to foresee which market niches would emerge and which ones would become profitable. We just had to spread our chances.'* Or, as the CEO of L-goritm testified: *'The (indirect) sales approach didn't work . . . We had to abandon it. That wasn't a problem really, because we already had experience with direct sales.'* The ventures in our sample used a combination of multiple search paths to generate a variety of business model experiments and, thereby, avoided preliminary commitment to a suboptimal business model.

Second, learning about one option can also reduce uncertainty about other options, especially when new business model experiments are related to at least one other business model in the portfolio. We observe that ventures use the knowledge acquired from exploring one option to reassess and redefine the nature of, and the priorities for, the activity portfolio as a whole. L-goritm gathered knowledge and expertise from its service activities and—based on this experience—decided to add hardware components to its product offerings, as the CEO testified: *'What we saw when doing consulting activities is that customers didn't realize that it is the software that determines total performance. They were always talking about the hardware. We realized that if we wanted to develop a profitable software tool, we would have to include hardware in order to sell it and to drive up the price.'* Hence, ventures explicitly regard engagement in an additional business model

experiment as instrumental in re(de)fining other business models in the portfolio.

Our case study analysis reveals that also investors were following this rationale. They did not regard these experiments as resource-consuming errors that needed to be avoided, but as appropriate and necessary ways to select the most interesting entrepreneurial opportunity (see interview quotes in Table 7). In the cases of L-goritm and Image, both public sector and independent VCs were willing to invest in ventures that explicitly acknowledge uncertainty and develop various related business model search paths in parallel. L-goritm's investors—when closing the investment agreement—were fully aware and supportive of the venture's plan to experiment with various business models, as L-goritm's cofounder testified. *'The investors did not mind. On the contrary. They understood that we could not know in advance what would work.'* In addition, the case studies reveal that investors were closely monitoring progress and—instead of providing a major capital injection upfront—were staging their investments accordingly. As L-goritm's cofounder observed: *' . . . they were monitoring pretty closely what we were doing in all these areas, just to make sure that we were making progress overall. They didn't provide us with a large investment sum you sometimes saw in other companies. Instead, they infused additional capital as some of our projects turned out to be promising.'*

Implications of simultaneous experimentation

The cases reveal that, although investors are supportive of experimentation with a portfolio of business models, they refrain from injecting large amounts of capital in the initial stages of the ventures' life and instead stage their investments as progress is made. We observe that to deal with these initial resource limitations, ventures adopt cost-effective strategies. First, business models are included only if they entail significant technical or commercial overlap with other business models in the portfolio. By developing multiple search paths of related business models, ventures can redeploy activities in different business model logics, thereby creating spillovers between the different activities undertaken. Second, they use low-cost probing strategies to find out which products and services the markets prefer (cf. Brown and Eisenhardt, 1997), as the founder of Image recalled: *'In these early days, our projects consisted mainly of pilots. We set up a prototype and checked whether it*

Table 7. Quotations on simultaneous experimentation

	Rationale		Implications
	<i>Risk management</i>	<i>Knowledge spillovers</i>	<i>External investors' support</i>
			<i>Cost efficiency</i>
			<i>Gradual evolution from project-based organization to more elaborate structure</i>
Image	<ul style="list-style-type: none"> It was impossible to foresee which market niches would emerge and which ones would become profitable. We just had to spread our chances. 	<ul style="list-style-type: none"> Of course we didn't just do anything. We deliberately selected projects where we could generate some kind of cross-fertilization, where the things you learn in one project can be used for refining your other activities. 	<ul style="list-style-type: none"> In these early days, our projects consisted mainly of pilots. We set up a prototype and checked whether it could do the job. In the beginning, we were doing everything ourselves. I was helping him to develop the software, but I was also selling and doing quality control services. I was a salesman, a consultant, and a product developer all in one person. By 2001, we had developed a professional structure, including an R&D team, a sales management team, a marketing and sales support team, and a finance and administration unit.
L-goritm	<ul style="list-style-type: none"> The (indirect) sales approach didn't work . . . We had to abandon it. That wasn't a problem really, because we already had experience with direct sales. 	<ul style="list-style-type: none"> What we saw when doing consulting activities is that customers didn't realize that it is the software that determines total performance. They were always talking about the hardware. We realized that if we wanted to develop a profitable software tool, we would have to include hardware in order to sell it and to drive up the price. 	<ul style="list-style-type: none"> This software would take time to develop. So we needed other activities to generate money. Offering services for quality control was the easiest way to do that. The investors did not mind. On the contrary. They understood that we could not know in advance what would work. But they were monitoring pretty closely what we were doing in all these areas—just to make sure that we were making progress overall. They didn't provide us up front with a large investment like you sometimes saw in other companies. Instead, they infused additional capital as some of our projects turned out to be promising.

could do the job.' And finally, they include business model experiments with short-term cash-generating potential in their portfolio. Similarly, the founder of L-goritm stated: *'This software would take time to develop. So we needed other activities to generate money. Offering services for quality control was the easiest way to do that.'*

The development of the ventures' organizational structures is in line with the chosen portfolio approach. An organic project-based configuration emerges, which resembles the project-based nature of R&D departments and provides flexibility (Fiegenbaum and Karnani, 1991). During the first years, L-goritm's founders took care of all business activities themselves. After awhile, three employees were hired, but the structure remained project oriented rather than functional. Over time, specific project teams were formed, each of them focusing on business models considered worthwhile pursuing. The founder's quotations in Table 7 illustrate this: *'In the beginning, we were doing everything ourselves. I was helping him to develop the software, but I was also selling and doing quality control services. I was a salesman, a consultant and a product developer all in one person.'*

Since these ventures acknowledged that the various conceivable business models are all characterized by uncertainty, they postponed the decision to commit to one option until more information with respect to a range of value propositions became available. As uncertainty decreased, the companies gradually narrowed down the range of business models until a viable business model remained. L-goritm gradually narrowed down its activity range from 2000 onward and ended up with one successful business model by the end of 2001. A similar process took place in Image. This portfolio reduction entailed organizational changes. The ventures evolved from loose configurations resembling R&D departments' project-based characteristics to more elaborated structures, as they narrowed down the range of business models. Or as the CEO of L-goritm testified: *'Later on, once we had a better view of what our core market would be, we of course organized in a more professional way. You know, with real functional divisions and things like that. We also attracted more people.'*

Summary and propositions on simultaneous experimentation

Our case studies reveal that some ventures developed a portfolio of business model experiments in order to

learn about a broad variety of potential business models. Both public sector and independent investors are supportive of this approach, as they consider it appropriate to select the most interesting entrepreneurial opportunity. However, instead of injecting large amounts of capital in the initial stages of the ventures' life, they stage their investments as progress is made. This limits initial organization growth and leads to the development of a project-based organization of limited scale.

To deal with these initial resource limitations, ventures deploy low-cost probing strategies, include business model experiments with short-term cash-generating potential, and enact knowledge and cost spillovers. The latter is achieved by including only business models that are related to at least one other experiment in the portfolio. The ventures, therefore, do not select experiments at random, but do so in a deliberate manner. Although each new experiment is related to at least one other experiment in the portfolio, the parallel search paths develop in various directions. As a result, the ventures reduce uncertainty with respect to a wide variety of business models. This uncertainty reduction facilitates the selection of viable options over time. Staged investments and the evolution of the ventures' organizational structures from informal and project-based to more formal and divisional, reflect this process. The fact that ventures learn about a wide variety of business models in a cost-effective manner increases their chances of identifying viable business models and, hence, facilitates their survival in the long run. Based on these findings, we propose that:

Proposition 3: Compared to focused commitment, simultaneous experimentation reduces the initial growth of ventures operating under uncertainty.

Proposition 4: Compared to focused commitment, simultaneous experimentation facilitates long-term survival of ventures operating under uncertainty.

DISCUSSION

In this article, we have analyzed how ventures confronted with uncertainty develop their business model through experimentation. In particular, we investigated (1) whether different experimentation and learning approaches exist and, if so, (2) what the rationale and implications of these approaches are.

In doing so, we drew on business model literature and organizational learning theory. The latter proposes two main experimentation approaches to learning under uncertainty: (1) local or related search versus (2) distant search or search through long jumps. While local search is expected to result in a low to moderate variety, distant searches are often deemed necessary to generate considerable levels of variety.

Some ventures in our sample indeed tried to explore a broader range of business models through a sequence of distant business model searches, once their initial business models proved to be unviable. However, altering business models after a period of focused commitment is hazardous and painful. The ventures in our study all had considerable difficulties in mobilizing stakeholders and additional resources for these subsequent experiments, leading to bankruptcy in several cases.

At the same time, our research shows that there are less hazardous ways to enact variety in terms of business models. Ventures can develop multiple diverging search paths of related business model experiments. These simultaneous search paths initially start from the same business model but spread out in various directions. As a result, ventures end up experimenting with different business models. The parallel pursuit of different business models creates a considerable variety of (real) options, which increases the odds for survival and growth (Gunther McGrath, 1999). This finding enriches organizational learning theory by going against the assumption that only distant search can lead to considerable levels of variety. Our findings reveal that a portfolio of related search paths is equally instrumental in enacting variety.

Our findings not only reveal how simultaneous experimentation generates variety in terms of business models, but also demonstrate how it does this in a cost-effective manner. By including only business models that are related to at least one other experiment in the portfolio and adhering to low-cost probing strategies, the ventures can enact spillovers efficiently. Simultaneous experimentation, therefore, presents itself as a relevant learning strategy for ventures operating under uncertainty, alongside previously documented bootstrapping approaches (Bhide, 1992; Winborg and Landström, 2001).

Our work not only extends organizational learning theory, it also contributes to the lively discussion on causation and effectuation. Sarasvathy (2001) discusses the relevance of causation and effectuation

processes to firm creation. Causation processes imply that entrepreneurs choose specific means (a specific organizational structure, specific employee skills, etc.) to create a desired effect (such as a specific business model). Effectuation processes, however, imply that ventures draw on their knowledge and networks and select between possible effects that can be created with this set of means. Whereas existing work discusses effectuation as cognition or logic, research on how effectual logic translates into effectual behavior is scarce (exceptions include recent contributions by Fisher, 2012, and Mauer, 2009). In an effectual logic, the basis for taking action is means driven, investment decisions involve a commitment limit in terms of affordable loss, and stakeholders and unforeseen events heavily influence the development direction (Read *et al.*, 2009; Sarasvathy, 2008).

In our study, ventures deliberately develop portfolios of business model experiments, starting from initial ideas, available capabilities, and experiences. They add specific business models to the portfolio and redefine others based on experiences and information gathered in the course of previous business model experiments. Simultaneous experimentation consequently represents an effectual logic, since it takes a set of means as a given and focuses on selecting between possible effects that can be created with this set of means. Focused commitment, however, follows a causal logic where ventures choose specific means (a specialized organizational structure, specialized personnel, and significant expenditures) to create a desired effect (namely, the implementation of one, *ex ante* chosen business model).

In addition, the fact that simultaneous experimentation involves careful selection of related experiments suggests a reconciliation of the notions of 'action' and 'planning.' In Sarasvathy's work (Sarasvathy, 2001), effectuation is partly driven by coincidence: '*Whoever first buys . . . becomes, by definition, the first target customer. By continually listening to the customer and building an ever-increasing network of customers and strategic partners, the entrepreneur can then identify a workable segment profile*' (Sarasvathy, 2001: 247). Other authors have also attributed an important role to 'initial coincidences' in the creation of entrepreneurial opportunities (Alvarez and Barney, 2007). However, we find that the ventures in our case study do not just 'go with the flow' in developing a portfolio of business model experiments. Instead, they consciously select and design these experiments.

Ventures deliberately select business model experiments that are related and that offer cross-fertilization opportunities, allowing them to exploit their means and strengths efficiently across a variety of business models. Simultaneous experimentation, therefore, implies both effectual experimentation building on the venture's own means and strengths and the conscious planning and selection of specific business model experiments to be included in the portfolio.

Whereas 'planning' and 'action' or 'planning' and 'learning' have been juxtaposed in management literature (e.g., Liao and Gartner, 2006), our findings suggest that these two notions can be reconciled as complementary aspects constituting the simultaneous experimentation approach. Moreover, our findings suggest that this combination of action and planning results not only in substantial variety, but it can also be organized in a cost-effective manner and, therefore, it offers good prospects for the survival and growth of entrepreneurial ventures operating under uncertainty. Simultaneous experimentation, thus, reconciles Sarasvathy's (2001) preference for effectual cognition with Liao and Gartner's (2006) preference for planning as a way to deal with uncertainty.

Our work also demonstrates that some investors (including both public sector and independent VCs) are supportive of this combination of planning and action. They finance ventures while being fully aware of their intentions to experiment with multiple business models. Those investors do not regard these experiments as resource-consuming errors that need to be avoided but as necessary efforts to select the most interesting entrepreneurial opportunity. Thus, these findings refute the widely held belief that VCs are willing to finance only ventures with a focused business plan. Whereas investment in focused companies requires managing risk at the level of the portfolio, financing ventures engaged in simultaneous experimentation implies that risk is also managed within the boundaries of the venture. We suggest that this approach has the potential to increase the overall success rate and, hence, the value of VCs' investment portfolios.

Finally, we believe our work contributes to the development of empirical studies on business models in general and on business model innovation in particular. As shown by Zott *et al.* (2011), researchers' use of idiosyncratic definitions and coding schemes hinders cumulative scientific progress. While our coding scheme is highly demanding in terms of information gathering, it allows for ana-

lyzing changes in a wide variety of business model components across various industries and facilitates the development of an encompassing view on the business model as the firm's underlying architecture. We hope it can be an inspiration for other researchers.

LIMITATIONS AND FUTURE RESEARCH

In discussing our research, some limitations should, of course, be kept in mind. It is clear that one cannot generalize empirically from six cases and that the propositions developed in this article require further testing. Our case studies suggest that focused commitment fosters short-term growth but limits variety, thereby jeopardizing long-term venture survival. In addition, we suggest that simultaneous experimentation restricts initial growth but introduces higher levels of requisite variety in a resource-effective manner which, in turn, fosters long-term survival. Further research is certainly warranted on how different approaches to business model development influence short-term growth and long-term survival. Such assessments would involve translating our case study findings into an adequate panel-oriented longitudinal research design comprising both focused ventures and ventures engaged in simultaneous experimentation (e.g., De Carolis *et al.*, 2009). At the firm level, indicators of economic growth could be regressed on the number of business models being explored simultaneously, controlling for human and financial resources invested as well as for complementary success factors identified in previous research (such as industry characteristics, founding team characteristics, legitimacy, and available assets, including patents, alliances, and geographical location). Hazard models could be used to assess the impact of the number of simultaneous business model experiments on survival, again controlling for resources and other firm and industry characteristics.

Moreover, we observe only two distinct (combinations of) experimentation approaches in our case studies: (1) simultaneous experimentation and (2) focused commitment followed by consecutive business model search. Although we have sampled ventures with quite different business model development trajectories, it goes without saying that further engagement in in-depth case studies may result in additional insights with respect to both the delineation of additional, relevant approaches and

the combination of different approaches over time. For example, it is conceivable that ventures may begin with a sequence of distant business model searches—thereby identifying the most promising direction for subsequent development through related business model searches—or they may use a sequence of related business model searches to identify a first client, which puts them in a better position to attract external investment and focus singularly on that one specific business model. Other temporal combinations can be imagined, and further research aimed at identifying these approaches, their rationales, and their implications seems highly appropriate.

Finally, our research also points to the need and relevance of further inquiry into the nature and consequences of different types of investor behavior. When and why are investors willing to support simultaneous experimentation versus when and why are they inclined to restrict funding to ventures with a clear focus? (How) does this depend on VC fund characteristics and investment managers' human capital characteristics, as can be expected from existing literature (Knockaert *et al.*, 2010; Wright, Vohora, and Lockett, 2004)? To what extent do ventures with portfolios of simultaneous business model experiments affect the overall performance of VC investment portfolios? VCs usually spread their risk by investing in several focused ventures with different business models. Simultaneous experimentation, though, spreads risk within the venture. As business models are in constant flux, the act of balancing risk both within and between ventures introduces interesting research questions on optimizing investment portfolio management and outcomes. We hope this study contributes to and inspires future research in this area.

CONCLUSIONS

While existing literature suggests that ventures should experiment to develop and improve their business models, it is unclear how they should organize these experimentation processes in an effective manner. This study extends organizational learning theory by analyzing (1) whether ventures use different experimentation and learning approaches under uncertainty and, if so, (2) what the rationale and implications of these approaches are.

Based on six longitudinal case studies, we identified two distinctive approaches to business devel-

opment under uncertainty: (1) focused commitment versus (2) simultaneous experimentation. While the former is conceptually related to organizational learning approaches identified in the literature, the identification of ventures developing a portfolio of diverging related searches is less straightforward. These ventures spend from two to five years developing their portfolios of business models through related business model search, which they gradually narrow down until a viable business model remains. Our research reveals that while focused commitment is initially instrumental in acquiring dedicated resources, this dedication hinders the financing and execution of subsequent searches. As a result, focused commitment limits the variety of business model experiments and hampers long-term survival. Simultaneous experimentation with carefully selected business models, executed in a disciplined manner, however, increases the chance of identifying a viable business model and, hence, of surviving in the long run.

Our research extends organizational learning theory by demonstrating that enacting a variety of business model experiments does not intrinsically require distant search. Simultaneous experimentation also allows ventures to explore a broad variety of business models. In addition, it is far more efficient in this respect than focused commitment. As simultaneous experimentation implies a combination of means-driven experimentation with the conscious planning, execution, and selection of experiments, our study is one of the first to illustrate the translation of effectual logic into effectual behavior and also reconciles the apparent juxtaposition between 'action' and planning.'

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