
Lost in the canvases: Managing uncertainty in lean global startups

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Abstract: The main objective of this paper is to suggest a dynamic double canvas approach to business model development that would reduce ambiguity during the adoption of a specific business model canvas by executive managers of technology-based lean global startups. We start with a conceptual analysis and continue with empirical research approach based on four technology-based startups, two in Denmark and two in Canada, in order to justify the need for managers to start with the lean canvas, suggested by Ash Maurya (2012), and then shift to the business model canvas, suggested by Osterwalder and Pigneur (2010). The logic of such shift was conceptualized by focusing on the key differences between the lean canvas (problem, customer segment, solution, value proposition, key metrics and unfair advantage) and business model canvas (key partners, value propositions, key activities, resources, customer relationships). The second contribution consists in examining the application of business model canvases to the context of lean global startups by emphasizing the importance of relationships with global partners, the adaptation of the value proposition to different global markets, and the activities and resources specific to a particular global market. The third contribution is to provide a comprehensive categorization of risk that could be used within the context of lean global startups. The findings would be relevant for entrepreneurship scholars, researchers focusing on business model innovation and entrepreneurs. It should help entrepreneurs to adopt a dynamic approach to business model development that would reflect the realities of their competitive business environment.

Keywords: Lean global startup, lean canvas, business model canvas, uncertainty and risk management, technology entrepreneurship, business model

1 Introduction

The canvas approach has become the most popular tool for the articulation and refining of business models in both startups and established firms (Blank, 2013; Osterwalder & Pigneur, 2010). It is especially important in the case of startups where the managers need a tool for framing their initial hypotheses and documenting their learning, as they iterate through the early stages of their businesses. At the same time, there appears to be a structural mismatch between the composition of the business model canvases and the functional priorities emerging during the early stages of Lean Global Startups (LGS) - lean startups interested in, or already pursuing, a global commercialization strategy, where the nature of the relationships with global partners is becoming particularly relevant and there is an ongoing process of adaptation of the value proposition to different global markets together with the specific activities and resources that could enable the delivery of such global value proposition. The traditional and most popular canvas is the Business Model Canvas (BMC) suggested by Alexander Osterwalder and Pigneur (2010).

Table 1. Business Model Canvas structure.

KEY PARTNERS	KEY ACTIVITIES	VALUE PROPOSITION	CUSTOMER RELATIONSHIPS	CUSTOMER SEGMENTS
<ul style="list-style-type: none"> - Who are our key partners? - Who are our key suppliers? - Which key resources are we acquiring from our partners? - Which key activities do partners perform? 	<ul style="list-style-type: none"> - What key activities does our value proposition require? - Our distribution channels? - Customer relationships? - Revenue streams? 	<ul style="list-style-type: none"> - What value do we deliver to the customer? - Which one of our customers' problems are we helping to solve? - What bundles of products and services are we offering to each segment? - Which customer needs are we satisfying? - What is the minimum viable product? 	<ul style="list-style-type: none"> - How do we get, keep and grow customers? - Which customer relationships have we established? - How are they integrated with the rest of our business model? - How costly are they? 	<ul style="list-style-type: none"> - For whom are we creating value? - Who are our most important customers? - What are the customer archetypes?
	KEY RESOURCES		CHANNELS	
	<ul style="list-style-type: none"> - What key resources does our value proposition require? - Our distribution channels? - Customer relationships? - Revenue streams? 		<ul style="list-style-type: none"> - Through which channels does our customer segment want to be reached? - How do other companies reach them now? - Which ones work best? - Which ones are most cost-efficient? - How are we integrating them with customer routines? 	
COST STRUCTURE			REVENUE STREAMS	
<ul style="list-style-type: none"> - What are the most important costs inherent to our business model? - Which key resources are most expensive? - Which key activities are most expensive? 			<ul style="list-style-type: none"> - For what value are our customers really willing to pay? - For what do they currently pay? - What is the revenue model? - What are the pricing tactics? 	

Source: Osterwalder & Pigneur (2010).

Table 1 shows its nine building blocks together with a number of questions that could help in the process of their formulation. The BMC provides the main structure of a business model with a focus on ease of use, flexibility and transparency, including the key drivers of a business: *customer segments, value propositions, channels, customer relationships, revenue streams, key activities, key resources, key partnerships and cost structure*. There are two important practical points that should be mentioned with respect to the use of the BMC. First, the BMC is just a tool that helps the formulation and the continuous refinement of the business model as a key component of the overall business planning process. It is not the filling up of the building blocks on the canvas that will make a business successful but the proper managerial actions and activities associated them. Second, the BMC is not a dogmatic framework but just a starting point that could be modified or refined depending on the specific business context, technological solution or customer base. This is why there have been publications suggesting modified versions of the BMC that could be better adapted to specific business circumstances. Examples of such modified versions are the *Lean Canvas* (Maurya, 2012) and the *Business Model Snapshot* (Furr & Dyer, 2014). Both of them focus on providing more systematic tools to mitigate risk in new product, service and business development. The Business Model Snapshot just seems to be a reduction of the BMC (fewer elements, but retaining their names), whereas the LC focuses on a subset of the elements most relevant to new startups and expands them. In this sense, the Lean Canvas (LC) approach proposed by Ash Maurya (Table 2) appears to be more intuitive and better suited to address the multiple uncertainties and risks that are typical of the context of new technology startups.

Table 2. The Lean Canvas structure.

PROBLEM Top 3 problems	SOLUTION Top 3 features	UNIQUE VALUE PROPOSITION Single, clear compelling message that states why you are different and worth paying attention	UNFAIR ADVANTAGE Can't be easily copied or bought	CUSTOMER SEGMENTS Target customers
	KEY METRICS Key activities you measure		CHANNELS Path to customers	
COST STRUCTURE Customer acquisition costs Distribution costs Hosting People etc.		REVENUE STREAMS Revenue model Life time value Revenue Gross Margin		

Source: Maurya (2012).

The LC is shown in Table 2. It helps in deconstructing the business model into nine distinct components that are then systematically tested starting with the ones having the highest and moving to the lowest risks. The main objective behind the introduction of the LC was to make it as actionable as possible while staying as close as possible to a specifically entrepreneurial context. The way to make the canvas actionable was to focus its use on capturing what was most uncertain and most risky. Given the popularity of the BMC, the design of the LC was justified by articulating its benefits with respect to the BMC.

The LC design implicitly accounts for one of the key characteristics of Lean startups, i.e. the operation under conditions of extreme uncertainty (Eric Ries, 2012). The intention was to make the canvas actionable by capturing the most uncertain and risky aspects of the business which required a specific conceptualization of uncertainty and risk. Maurya

used Douglas Hubbard's definitions (2014): uncertainty is the lack of complete certainty whenever there are multiple possibilities; risk is a state of uncertainty where some of the possibilities involve a loss, catastrophe, or other undesirable outcome. The advantage of Hubbard's definitions is that they consider uncertainties and risks on a similar plane, i.e. an approach that facilitates their conceptualization in an entrepreneurial context. Such approach allows to demonstrate that the BMC is missing some of the things that are very high risk while other things on the canvas could not be associated with a high enough risk in order to be kept as part of the new canvas design (<http://leanstack.com/why-lean-canvas/>). The space constraints required some BMC modifications that were based on "trading" some of the boxes as follows.

- *Trading "Key partners" for "Problem"*. Most startups fail because they waste time, money, and effort building the wrong product. This is most often due to a lack of proper understanding of the problem or the job-to-be-done of the customers. That is why Maurya made the "Problem" box explicit and not a derivative of the Value proposition. He emphasizes that the initial focus of a startup is on the articulation of the problem-solution fit and not on finalizing the ultimate partnership decisions. In fact, for a brand new startup with an untested product, pursuing key partnerships from day one can be a form of waste. It is true that over time, the specific choice of partners could become critical to the process of optimizing the business model but the risk in such optimization would not be the lack of partners but can rather be traced back to inefficiencies in the cost structure and the distribution channels which should be addressed in the existing boxes of BMC.
- *Trading "Key activities" for "Solution"*. The explicit articulation of the problem allows for a clear articulation of the potential solution. The positioning of the solution in one of the nine BMC boxes has the additional goal of reminding entrepreneurs that the solution is just one of the components of the business model as well as that the real product is not really the product but the business model. Keeping the solution box small correlates well to the logic of the Minimum Viable Product (MVP) concept. According to Maurya, the Key activities box could be replaced by the Solution box since the key activities should be really derived from the Solution box after the MVP has undergone some initial testing and validation.
- *Trading "Key resources" for "Key metrics"*. With the numerous Open Source and Cloud computing resources which are globally available on the Internet, startups need fewer resources than ever to get a product to the market. This makes the Key resources align more closely with the Unfair advantage box rather than having it as a formal business model component at the early stages of a new business. On the other hand, a startup can only focus on a few key metrics. Failure to identify the right key metrics at the early stages of a startup can be catastrophic leading to wasteful activities like premature optimization or running out of resources while chasing the wrong goal. Initially the key metrics should center on the potential for value creation and later shift towards key drivers of growth.
- *Trading "Customer relationships" for "Unfair advantage"*. The Unfair advantage box refers to the specific competitive advantage or barriers to entry. If a startup achieves some level of initial success, it is inevitable that competitors and other fast-followers will soon enter its market segment. If the startup does not have a unique differentiation as a defense mechanism against them, it will stand the risk of being made extinct. On the other hand, the commercialization of every product should start with a more direct customer relationship and then focus on selecting the best path to customers in accordance with their Solution and Customer segment. According to Maurya, all these aspects of the relationships with customers could be captured by the existing Channels box.

In summarizing some of the key points in the above analysis one could point out that the BMC provides a valuable visual ontology of a sustaining business, but it is missing some of the key elements of the business model design context of new startups where the articulation of the problem, the solution and the entire value proposition play a key role.¹ In the BMC, the problem, the solution and the value proposition are all packed into one box in order to make space for other elements that are important for a sustaining business – key partnerships, activities, resources and established customer relationships. In the LC canvas, the value proposition is unpacked in a way that each of its key elements has its own box. Having separate boxes for problem, solution, and value proposition allows entrepreneurs to formulate and test hypotheses around each of these elements independently. Many startups fail not because of a fatal flaw in the innovation, but because the team fails to understand the real problem it is solving, thus failing to reach a viable problem-solution fit. Having separate boxes for the problem, the solution and the value proposition is critical to avoiding this mistake.

As it appears, A. Osterwalder has realized and addressed the above issues by introducing an additional Value Proposition Canvas (VPC)². The VPC expands the value proposition and customer segment boxes of the original BMC into three sections: the solution/job to be done, the positive value of the solution (gain creators), and the ways to deal with the negative value of the solution (pain relievers).³ This means that there are now two canvases that must be used in parallel in order to address the early stages of a new business. As Osterwalder points out, the two tools work best in combination and one does not replace the other. On the other hand, Maurya claims that the LC had been used successfully from ideation to product-market fit and beyond, and the risks captured on it are not just early stage risks but morph and evolve throughout the startup lifecycle. According to him, the most important role of the canvas approach is that it should help a startup in documenting its key business model assumptions and its learning in a portable format that could be shared and discussed with people other than the startup managers.

2 Problem formulation and research objective

As it appears from the analysis suggested in the introduction, there is a problem with the ambiguity for entrepreneurs in choosing among two different types of business model canvases (LC type vs BMC type). A proper addressing of the ambiguity requires a thorough analysis of how well the two different canvas approaches address the uncertain business environments of Lean Global Startups (LGS) which are the subject of the present study. It was just recently that the LGS was conceptualized as a new type of firm (Tanev, Rasmussen, Zijdemans, Lemming, & Svendsen, 2015; Rasmussen & Tanev, 2015). Tanev et al. made a comparative analysis of the research streams focusing on lean startups and born global firms, and provided some first empirical evidence that helped in identifying two potential paths for lean startups interested in a global commercialization

¹ Peter Koen's blog, "Osterwalder's Business Model Canvas Doesn't Work for Startups", Thursday, August 14, 2014, <http://www.frontendinnovation.com/blog/08/14/2014/osterwalders-business-model-canvas-doesnt-work-for-start-ups>, accessed Feb. 4, 2016.

² Alexander Osterwalder's blog, "Achieve Product-market Fit with Our Brand-new Value Proposition Designer Canvas", August 29, 2012, <http://businessmodelalchemist.com/blog/2012/08/achieve-product-market-fit-with-our-brand-new-value-proposition-designer.html>, accessed Feb. 4, 2016.

³ Peter Koen's blog (as above).

strategy. The first path is associated with the opportunity for lean start-ups to go global by undertaking a rapid internationalization strategy. Such lean-to-global startups (L2GS) establish themselves by using the lean startup approach on a local or national level and then engaging in a more traditional born-global journey by exploring valuable internationalization opportunities short after their inception. The second path is associated with the opportunity for globally operating startups to adopt the lean startup approach since their very inception by seamlessly synergizing their global business and lean startup activities. It might be appropriate for such new firms to be qualified as being both lean and global from the start or as lean and global start-ups (L&GS).

The goal of the present submission is to suggest a blended approach which uses the LC approach at the very early stages of a LGS and then moves to the adoption of the BMC approach to describe the operational logic of the globally established business. In this sense, the process of uncertainty and risk management could be considered as a shift from a LC to BMC approach.

3 A double canvas perspective on uncertainty and risk management

The present section will focus on the interplay between the LC and BMC approaches to managing uncertainty and risks during business model development in technology-based LGS. There are several reasons for the adoption of such blended approach. We believe that Maurya has a point in claiming that the composition of the LC addresses in a better way one of the key characteristics of lean startups, i.e. the fact that they operate under conditions of high uncertainties and multiple risks. We would argue however that after using Maurya's approach to uncertainty/risk management, a startup gradually moves to the adoption of a relatively well-defined business model including the right key partners, activities and resources which are better addressed in the BMC. The logic of such shift could be conceptualized by focusing on the key differences between LC (problem, customer segment, solution, value proposition, key metrics and unfair advantage) and BMC (key partners, value propositions, key activities, resources, customer relationships). While the LC focuses on the articulation of the customer value proposition, the BMC focuses on the multiple value propositions to customers and key partners including the key activities and resources enabling the value creation process (Fig. 1).

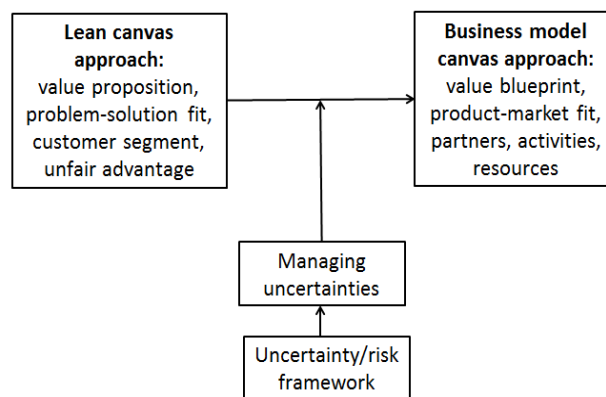


Fig. 1. A visual representation of the shift from a Lean canvas to Business model canvas approach.

These differences indicate that some of the concepts of the wide lens approach suggested by Ron Adner (2012) could be quite appropriate in describing the above shift of focus. Adner argues for the initial value proposition should be translated into a visual value blueprint in order to visualize the emerging relationships between the multiple key partners, key activities and resources, as well as enable the assessment of alternative configurations leading to a shared understanding and agreement among the partners as to how the different business model elements should be optimized. By making these relationships clear, the value blueprint forces all relevant actors to confront the challenges that lie beyond their own immediate responsibilities, to consider how they want to organize and address the risks that are inherent in every collaborative endeavor, and to deal with these issues proactively. The value blueprint approach to the articulation of the multiple value propositions for all relevant actors in the emerging business ecosystem could be enhanced by the concept of Minimum Viable Footprint (MVF) – the smallest configuration of elements or partners that can be brought together and still create unique commercial value (Adner, 2012). The benefit of using this concept is that it emphasizes the fact that the initial business model design should result into a viable business ecosystem that could be further developed by adding additional elements to the MVF (in Adner's language this is called a *staged expansion*) so that each new element benefits from the system already in place and increases the value creation potential for the subsequent element to be added. In this sense, the emergence of a MVF should indicate the moment in time when the BMC should be adopted instead of the LC.

There is still the question of how really the initial adoption of the LC approach will help the management of uncertainties and risks. The LC approach framework is organized around three meta-principles: a) documenting a plan A; b) identifying the riskiest part of the plan; c) systematically testing the plan. Entrepreneurs start by documenting their Plan A, focusing on the identification of potential customer segments and then continue sketching out their first guesses about their business models including the potential solutions and customer channels. When this first step is done, the entrepreneur will have multiple versions of a Plan A, i.e. multiple LCs, which are ready to be ranked in terms of three types of risk: product risk – getting the product right, customer risk – building a path to customers, and market risk – building a viable business. The objective is to find a business model with a big enough market that can be reached, with customers who need the product around which a viable business can be built (Maurya, 2012). The multiple aspects of the three types of risk should be however prioritized in order to facilitate the process. The weighting criteria used by Maurya to prioritize the different aspects of risks are: customer pain level (the problem), ease of reach (the channels), price/gross margin (revenue streams and cost structure), market size (the customer segment) and technical feasibility (the solution). The ranking of the multiple LCs with respect to these criteria results in a single LC that captures the key business components that could be further tested and validated. Systematically testing the initial plan is the third step where all assumptions made during the articulation of the business model are transformed into hypotheses that can be either validated or invalidated through running experiments with customers. The validation should open the way to the adoption of the BMC focusing on the key partners, activities and resources that would shape the MVF and provide a basis for potential startup scale-up and growth.

The suggested blended approach leads to several open questions. For example, is Maurya's categorization of risk, i.e. in terms of product, customer and market, enough to capture the variety of risks and uncertainties that are typical of the LGS business environments? Are there other categorizations or types of risk that could better account for the operating conditions of a lean technology startups operating on a global scale? How to incorporate a more comprehensive uncertainty/risk framework into a double canvas approach that would adopt a temporal perspective on prioritizing risk?

4 Research methodology

The present study adopts a qualitative research approach consisting of a conceptual component and an empirical component. These two components are combined to address: (i) the relationship between the LC and the BMC in a way that could justify the emergence of the suggested double-canvas approach to business model development in LGS; (ii) the conceptualization of various categories of uncertainties and risks described in entrepreneurship and management literature as a basis for building a more comprehensive uncertainty-risk framework; and (iii) the relationship between the uncertainty-risk framework and the double canvas approach to business modelling within the context of LGS operating in the technology sectors.

The empirical component comprises four in-depth interviews with start-ups from Denmark and Canada as well as a two-week stay in Ottawa, Canada, to take part in the daily life of Carleton University's Technology Innovation Management (TIM) accelerator. The connections to the two Canadian startups were formed during this visit. The Danish startups belong to the entrepreneurial ecosystem of the Product Development and Innovation program at the University of Southern Denmark in Odense. The four companies are at different stages of development, ranging from a very early stage to having an almost complete first product and potentially scalable business model. The selection of the specific startups allows for acquiring a temporal perspective that could substantiate the claim of a potential double-canvas split. The interviews were carried out using a semi-structured interview guide based on findings from the initial literature review. Each of the four interviews lasted about 45 minutes. The questions were asked after a brief lead-in to describe the topic of the thesis, the purpose of the interview, and its structure. The following main areas were addressed: a) the current overall status of the company including its age, product and value proposal, customer segment, competitive profile, resource base, and global footprint; b) the entrepreneurial story of the venture including its leap-of-faith assumptions, MVPs, early adopters, and learning process; c) an in-depth focus on each of the categories from the newly established uncertainty-risk framework to elicit as many details as possible about their experiences, concerns, and insight regarding the types of uncertainty and risk that had been relevant to the shaping of each venture; d) the past, present, and future priorities regarding each framework category.

5 An uncertainty-risk framework that is applicable to lean global startups

It should be pointed out that the specific focus on the systematic management of uncertainties has been identified as a major issue by all scholars and practitioners inspired by the lean startup paradigm. For example, Scott Antony (2014, p. 14) speaks about the need to adopt a scientific method to the management of strategic uncertainty by referring to the works of Mintzberg and Waters (1985) focusing on the distinction between deliberate and emergent strategies, of McGrath and MacMillan (1995) on discovery-driven planning, of Blank (2013)¹ and Ries (2011) on the experimentation aspects of the lean startup approach. The high degree of uncertainties in lean global startups is particularly relevant within the context of new technology firms (Yadav et al., 2006). Moriarty and Kosnik (1989) identify two different types of uncertainty that could be directly related to the context of lean technology start-ups – market uncertainty and technology uncertainty. The market uncertainty is associated with issues such as: the kind of needs that are supposed to be met by the new technology and how these needs would change in the future; whether or not the market would adopt industry standards; how fast will the innovation spread and how large is the potential market (Yadav, Swami and Pal, 2006). The technological

¹ See also Blank and Dorf (2012).

uncertainty is associated with issues such as whether or not: the product will function as promised; the delivery time-table will be met; the vendor will give high-quality service; there will be side-effects of the product; the new technology will make the existing technology obsolete (Yadav, Swami and Pal, 2006). A third type of uncertainty could be associated with the competitive volatility of high technology markets (Shanklin and Ryans, 1987). It refers to changes in the competitive landscape such as identifying emerging competitors, their product offerings or the tools they use to compete (Yadav, Swami and Pal, 2006). For example, quite often new technologies are commercialized by companies outside of a specific industry or sometimes a key partner at the early stages of a firm may later become a competitor (Cooper and Schendel, 1976). The new players are not viewed as disruptive and are frequently dismissed by both new firms and incumbents. However, they end up changing the ways of competing and may lead to reshaping the industry rules of competition for all other players (Hamel, 1997). Furr and Dyer (2014) have pointed out that many scholars do not realize the extent of the increase in uncertainty over the past thirty years. The greater degree of uncertainty has created the need to change the way most organizations and especially start-ups are managed. According to Furr and Dyer there are three types of uncertainty that influence firm's ability to create customers: demand uncertainty, technological uncertainty and environmental uncertainty which is associated with the overall macroeconomic environment and government policy. These three types could be considered as corresponding to the technology, market and competitive uncertainties that were discussed above (Yadav et al., 2006).

Adner (2013) suggested another way of conceptualizing uncertainty and risk by emphasizing that an overemphasis on the challenges associated with internal execution creates a blind spot by hiding key dependencies that are equally important in determining success and failure and makes companies fall victims to the innovator's blind spot by "failing to see how their success also depended on partners who themselves would need to innovate and agree to adapt in order for their efforts to succeed" (Adner, 2013, p. 4). By adopting an ecosystem perspective Adner takes into account two other types of risk in addition to the one associated with the focus internal execution – the uncertainties rooted in co-innovation and adoption chain risks. Co-innovation risk is the extent to which the success of an innovation depends on the successful commercialization of other innovations. Adoption chain risk is the extent to which partners will need to adopt firm's innovation before end consumers have a chance to assess the full value proposition. Examining these additional types of uncertainty could help LGS to better address hidden dependencies. Interestingly, Girotra and Netessine (2014) have suggested recently a classification of risk as part of a business model development and innovation framework that could be related to the classification suggested by Adner (2013). According to them the key choices executive managers or entrepreneurs make in designing a business model either increase or reduce two characteristic types of risk – information risk, when one makes strategic operational decisions without enough information, and incentive-alignment risk, when entrepreneurs need to make assumptions about the expected incentives of all the relevant stakeholders involved in the company value creation network. Girotra and Netessine (2014) are fully aware that there are other types of risk such as financial and technological but believe that by mitigating information and incentive-alignment risk firms can improve their ability to tolerate all other risk categories.

Arteaga and Hyland (2014, p. 26) suggested another categorization focusing on technical, market, resource and organizational uncertainties. Technical uncertainty is associated with the challenges of understanding technology drivers, value, and economic feasibility. The authors refer to uncertainty with respect to the technical feasibility and capability of the product, the intellectual property (IP) landscape, and the specifications of the product or solution. Market uncertainty is associated with the need to learn about market drivers, value creation, and business viability. There is uncertainty about the possible

application, value proposition, business potential, business model options, early adopter experiences and the market entry strategy. Resource uncertainty is associated with the challenges of accessing money, project-specific people and capabilities both internally and externally. It relates to the availability of funding, competent staff, innovation talent and developing potential partnerships. Organizational uncertainty refers to the challenges of gaining and maintaining organizational legitimacy for projects aligned with business units operating on a longer time horizon, or projects where there is not a clear organizational home.

Last but not least, Servo (2005) discussed some aspects of uncertainty within the context of business planning of firms driven by scientists and engineers. One of them was related to challenges of financing since technology start-ups often face difficulties raising capital during their initial R&D phase. Investors perceive new technologies to be very risky and prefer to wait until the technology is proven in terms of preliminary customer acceptance. On the other hand, there is always uncertainty about the potential market size. This is because technology start-ups frequently deal with emerging markets for which the actual market size and rate of adoption is unknown. Factors that influence this are for example legislation and regulations, competition, breakthroughs in associated technologies, and synergistic effects such as the installed base and complementarities. An additional uncertainty could be associated with issues related to intellectual property (IP) management. Patents and other forms of IP constitute valuable assets to a company and investors may require patents to be in place prior to financing. Technology start-ups need to be familiar with IP and know how to best leverage this asset.

It should be pointed out that taking into account the cross-border (international or global) business aspects will only inject some additional degree of uncertainty that could be taken into account as part of any risk management framework. As Shrader, Oviatt and McDougall (2000) suggest, successful entrepreneurs should manage the multiplicity of risks involved in cross-border businesses by exploiting the simultaneous trade-offs between these risks. The analysis of the different categorizations of uncertainty and risk allows identifying the following distinctive types of risk that could be relevant in the context of lean global technology startups: product, customer, competitive environment and industry trends, including cost structure, pricing and revenue models, technology/intellectual property, financing, partnerships, resources and global aspects. Table 3 shows our definitions of these different aspects of uncertainties and risk. The table was used as a basis for the construction of the semi-structured interviews with customers.

Table 3. Suggested categorization of uncertainties and risks

Uncertainty or risk	Description	Source
Product	Uncertainties associated with the design and commercialization of a product that is able to address a major customer problem with a high degree of problem-solution fit and demonstrate a unique customer value proposition.	Maurya (2012)
Customer	Uncertainties with respect to the specific path to customers through the identification of a viable segment of early adopters and reaching that segment through outbound and/or inbound channels. Uncertainty about whether target customers will buy the product given the accelerating rate of change in customer preferences and shorter customer retention periods. Ambiguity about the type and extent of customer needs that can be satisfied by the particular technology. Uncertainty about changing customer needs in ways that cannot be predicted due to lack of standards or dominant designs that may stimulate customer anxiety. Uncertainty about the customer preferences in emerging markets for which the actual market size and rate of adoption is unknown.	Maurya (2012), Furr and Dyer (2014), Yadav et al. (2006), Servo (2005)

Uncertainty or risk	Description	Source
Competitive environment and industry trends	Uncertainty due to changes in the competitive landscape including existing and emerging competitors, their product offerings, competitive strategies, price levels, cost structures and revenue models. Uncertainty about market drivers, emerging value creation practices and market entry strategies. Macroeconomic events or changes in government policy that could affect company's ability to do business. Potential threats from disruptive technologies that are commercialized outside of the home industry and could end up changing how the industry operates. Uncertainty about emerging legislation and regulations.	Yadav et al. (2006), Furr and Dyer (2014), Arteaga and Hyland (2014)
Technology / intellectual property (IP)	Uncertainty about whether the technology or the company providing it can deliver on its promise to meet the specific customer needs in an economically feasible way. Will it function as promised? Will it be available on time? Are there any concerns about the supplier of the new technology and its service? Are there any unanticipated side effects of a technology? Uncertainty regarding the increasing rate of invention that could lead to new competitive technologies. Uncertainty about key technology drivers, standalone value, network effects such as the installed base and the availability of complementary products. Uncertainty about any intellectual property (IP) issues and potential dependencies that could slow down technology development.	Furr and Dyer (2014), Yadav et al. (2006), Arteaga and Hyland (2014), Servo (2005)
Financing	Uncertainty about availability and sources of external funding as well as about the degree of product/market fit that would enable the necessary large-scale funding. Uncertainty about how investors perceive the risk level of the new technologies which may slow down financing because of the need to demonstrate preliminary customer acceptance.	Arteaga and Hyland (2014), Servo (2005)
Partnerships	Uncertainties due to the co-innovation challenges and the need for successful commercialization of other innovations by key partners. Uncertainties due to the adoption challenges by key partners who need to adopt the company innovation before end consumers have a chance to assess the full value proposition. Uncertainties due to the need for the alignment of the incentives of all co-innovation and adoption chain partners.	Adner (2012), Girotra and Netessine (2014), Arteaga and Hyland (2014)
Resources	Uncertainty about the availability and access to any additional specialized human or technical resources, assets or tools that would be necessary for the firm to execute their initial technology, product development and commercialization plan. Uncertainty about the degree of complementarity of specific resources that could be potentially valuable in achieving a strong market position.	Adner (2012), Arteaga and Hyland (2014)
Global	Managing the multiplicity of risks involved in cross-border businesses by exploiting the simultaneous trade-offs between these risks.	Shrader, Oviatt and McDougall (2000)

6 Summaries of technology startup cases

The four cases that are the subject of the present study include four technology-based startups: *Interactive Studios* developing information terminals to help visitors navigate shopping malls, locate shops, and see offers; *Tarfée* – a multi-sided web platform to connect football scouts with football players, enabling the creation of verified individual player profiles including video; *Sensohive*, developing wireless networked low-energy temperature and humidity sensors and wireless temperature monitors for refrigerated foods; *Mimac*, developing eco-friendly high-quality sleeves for Apple MacBooks. Some of the key facts about the four cases are summarized in Tables 4-7.

Table 4. Summary of facts about Case # 1: Interactive Studios (Canada)

Case # 1: Interactive Studios (Canada)	
Aspect	Description
Company age	2 years
Category	Lean and global start-up
Product description	Information terminals to help visitors navigate shopping malls, locate shops, and see offers. The terminal collects advanced demographic data such as visitor age, gender, searches, time of day, etc.
Customer segment	Large property owners and facility management companies with multiple malls.
Value proposition	Improved service for visitors and deep customer insight for the owners.
Key differentiator	Quality of service, demographic data, secure and robust platform.
Global aspects	Potential worldwide market, Asia and North America in particular. Ambitions to begin selling and manufacturing and selling in Asia in the near term.
Current status	The company is currently selling and making money. The product is ready for global sales as soon as it has undergone final large-scale testing to build confidence in the solution.

Table 5. Summary of facts about Case # 2: Tarfee (Canada)

Case # 2: Tarfee (Canada)	
Aspect	Description
Company age	1 year
Category	Lean global start-up
Product description	A multi-sided web platform to connect football scouts with football players. The platform enables the creation of verified individual player profiles including video. Local institutions or professionals with access to players manage the profiles. Football scouts can search for players online and watch them play without the need for long-distance travel. Football scouts can post opportunities from clubs or athletic scholarships at academic institutions.
Customer segment	Customers are professionals and organizations within academia and football. Football scouts represent North American or European academic institutions or football clubs. They generate the demand. Organizations and coaches from South America and Africa supply the players.
Value proposition	The platform improves efficiency and lowers transactions costs for both sides. It lowers the cost of searching for football scouts. It helps football academies, NGOs, and other institutions to provide opportunities for young people. It increases the chances of young players of being discovered.
Key differentiator	There are no competing platforms targeting these customer segments at the moment. The platform reduces costs and increases global opportunities for all stakeholders.
Global aspects	Tarfee's head quarter is located in Canada; most scouts are located in the United States. The company is a born-global. The talent mass the platform currently addresses exists in South America and Africa. The vision is to address other continents later. The company outsourced web development to a team of developers in Vietnam via a local Vietnamese businessman. Two team members speak Spanish, which is required for communication with South American stakeholders. There is one local partner in Nigeria. It would be impossible without the international team members and African partner
Current status	The platform is ready and provides the required functionality. There is a clear value proposal, and there are users on the platform. The platform generates no revenues because current users are not paying. A business model has been articulated, and it is working except for the lack of revenue. Investment is needed.

Table 6. Summary of facts about Case # 3: Sensohive (Denmark)

Case # 3: Sensohive (Denmark)	
Aspect	Description
Company age	1.5 years
Category	Lean and global start-up
Product description	Product 1: Wireless networked low-energy temperature and humidity sensors. Product 2: Wireless temperature monitor for refrigerated foods. Both products are automatically configured in a plug-and-play fashion. Both products have a 5-minute sampling interval and internal memory in case of lost connectivity. Product 1 has a 4-day memory, product 2 12-14 days. The difference in memory is due to different applications; please refer to customer segments.
Customer segment	Product 1 targets industrial greenhouses. Product 2 targets logistics operators carrying refrigerated cargo.
Value proposition	Product 1 offers precise monitoring of local conditions inside large industrial greenhouses. This enables increased control over growing conditions with potentially increased yield and less resource consumption. Product 2 offers precise temperature tracking of cold storage food items to benefit quality control.
Key differentiator	Price is lower than competitors, ease of installation and use, robust communication protocol, and much more internal memory.
Global aspects	No international activities yet but clear international market potential.
Current status	Close to commercialization. The product delivers according to the value proposal (devices, software, network). 400 sensors sold to date. The company still manages its own direct sales activities. The electronics are the final version. Assembly by a manufacturing partner began six months ago. The cases are 3D printed. The company is about to invest in plastic molding tools to finalize the product and give it a mass-market appeal. The main focus is on business economics, in particular crafting a sharp value proposal and maintaining a sound cash flow. There are on-going negotiations for venture funding. The company is currently looking for sales partners (integrators) that will design and install solutions for customers. The company wishes to focus exclusively on product development.

Table 7. Summary of facts about Case # 4: Mimac (Denmark)

Case # 4: Mimac (Denmark)	
Aspect	Description
Company age	6 months.
Category	Lean global start-up.
Product description	High-quality sleeves for Apple MacBooks. The sleeves are made of eco-friendly materials like recycled wood, felt, and leather. Vision: bespoke and customer co-created MacBook accessories on demand via digital platform. The company considers its brand and co-creation platform to be the venture's ultimate products. Trends change, and the company must be able to respond quickly to changes in customer preferences.
Customer segment	Individual style-conscious owners of Apple products. Companies and professionals for branding purposes.
Value proposition	Stylish, eco-friendly protective cases at a moderate price.
Key differentiator	Price, aesthetics, and quality.
Global aspects	Buying from Asian manufacturers. Planning international sales.
Current status	There is demand from several niches. The company currently experiences technical issues with its web platform and digital channels due to outsourcing problems associated with development. A logistics partner is serving Mimac at a friendly price in anticipation of continued cooperation at higher volume in the future. Some local menswear shops act as additional channels. They have the products on display but do not sell them. Instead, they refer to Mimac's home page.

7 Analyzing uncertainties and risks from the double canvas perspective

This section presents a dynamic view of the relationship between the different uncertainty/risk categories and the double canvas approach to business model development. The analysis is based on two assumptions: a) particular uncertainty/risk categories (for example, the ones associated with product and customers) could be better associated with the LC, while others (for example, the ones associated with partnerships and resources) with the BMC; b) some of the uncertainty/risk categories are expected to become more relevant at the early stages, while others at the later stages of the startup lifecycle. The two assumptions suggest that a study of the relevance of the different types of uncertainties/risks in time may help in identifying the need of starting with one of the canvases and gradually moving to the second one. That is why the analysis focuses on when in time each category of uncertainty and risk was most frequently mentioned in the interviews. The number of statements was interpreted as an indication of the presence of a specific type of uncertainty and its relevance in the past (T-1), present (T=0), or future (T+1). Such a map therefore provides a perspective on how the relevance of different types or categories of uncertainties changes over time. For example, a high count for the category *product* in the *past* indicates that product-related issues have been the focus of attention in the past. A lower count in the present and in the future indicates that product-related uncertainties would be less of a concern at the present moment and in the future compared to what it used to be in the past. The results were produced by performing a frequency analysis on the temporal perspective or reference of each statement, and visualizing the resulting count according to the category of uncertainty/risk it belongs to as well as the specific period it belongs to. This was done by going through every category and statement, and counting the frequency of references to a particular time period (Table 8).

Table 8. Frequency analysis generated by counting the number of references in the interviews to a particular uncertainty/risk category and presenting them according to their point in time, uncertainty/risk category, and company case. The temporal dimensions are: past (T-1), present (T=0) and future (T+1).

Uncertainty and risk vs. company	Case # 1: Interactive Systems				Case # 2: Tarfee				Case # 3: Sensohive				Case # 4: Mimir			
	T-1	T=0	T+1	Sum	T-1	T=0	T+1	Sum	T-1	T=0	T+1	Sum	T-1	T=0	T+1	Sum
Product	8	3	0	11	4	0	1	5	8	0	0	8	5	2	3	10
Customer	8	1	3	12	5	0	0	5	3	0	0	3	2	5	4	9
Competitive environment	1	4	3	8	0	0	2	2	2	7	5	14	3	3	1	7
Technology/IP	2	6	5	13	0	0	2	2	3	1	3	7	1	2	4	7
Financing	1	0	1	2	0	0	1	1	3	0	1	4	1	1	2	4
Partnerships	2	2	3	7	5	5	0	10	1	0	4	5	2	2	7	13
Resources	1	1	0	2	2	0	0	2	3	1	1	5	4	4	8	16
Total	23	17	15	55	16	5	6	24	20	9	14	46	18	20	29	66

For each company, the vertical sum of each time period shows the total number of statements for that time period across all categories of uncertainty and risk. This enables a relative comparison between the three discrete intervals, which may be used to interpret whether the company in question found the total resultant uncertainty to be most prevalent in the past, present or future. This provides an idea of how much and what type of uncertainty a company has already managed, is managing, or needs to manage in the future. For example, Interactive Systems shows a declining degree of uncertainty with the bulk of its uncertainty belonging to the past. Tarfee is in a similar position. Sensohive has also had the bulk of uncertainty in its past, but is expecting an increasing uncertainty in the future. Mimir is a mirror image of Interactive systems and shows that most of its uncertainties are expected in the future.

The above picture corresponds well with the overall qualitative impression of the degree of maturity of each of the startups. The first three companies are quite ahead in their process, while Mimir is still struggling to discover what it is all about and has a little more at the moment than a pocketful of ideas and a stockpile of sleeves waiting to be sold. Such an interpretation puts the first three companies closer to the chasm, while Mimir is still far from it. For the first three companies, the product and customer uncertainties have been addressed in the past. For Mimir, the distribution of the relevance of the different types of uncertainties looks more random. The product and customer categories are key components of the LC, suggesting that companies that are close to the chasm have dealt with these issues already thus shifting their focus on optimizing their partnerships, resources and activities which are key components of the BMC.

The uncertainties about technology/IP and the competitive environment appear to follow a different pattern. These uncertainties are vital to the mission of crossing the chasm, and do not go away when a start-up has validated its MVP. By considering the relative count of statements about the competitive environment and technology/IP, one can see (Table 8) that the numbers are higher in the present and future than in the past. This indicates an ongoing concern about these categories that extends over time into the future. This is quite unlike the uncertainties about product and customer, which were previously shown to decline over time.

To sum it up, the data shows that, on average, as product and customer uncertainties decline, concerns about uncertainties associated with competition and technology begin to increase. Perhaps the clearest example of this dynamic is Tarfee, whose uncertainties about the first two categories appear to have been addressed (counts of 0 and 1 for present and future) while there are concerns about future issues of competition and technology (future count of 2 for both). Tarfee knows what the solution is, but there is a potential threat of competitors entering the market before network effects emerge and become a competitive entry barrier. Tarfee's priority is to grow the number of users and interactions, monetize the platform, and capitalize on their first-mover advantage.

Uncertainties about competitive environment and technology/IP arguably belong to the strategic domain because these uncertainties are continuously and directly related to a firm's competitive strategies in terms of how it chooses to limit and design its business activities in the pursuit of a competitive advantage (Porter, 2011). Furthermore, these issues are affected by globalisation and industry cycles (Christensen et al., 2000) as well as changing patterns in customer demand and technological innovation (Furr and Dyer, 2014). In the case of Sensohive, the founder explained how the overall competitive landscape and the availability of new technologies within that landscape contributed to their product idea and drove their choice of marketing strategy. While they are currently selling directly to customers, their ultimate goal is the formation of partnerships with integrators. Their business is therefore deeply rooted in extant market factors as it rides a technology wave and is adopting a common business model from the adjacent sector of industrial automation.

Returning to the discussion of Table 8, the distributions of the latter categories, i.e. financing, resources, and partnerships, which are exclusively linked to the Business Model Canvas, show no clear pattern in themselves. Instead, they seem to be relevant across time in ways that are not clearly identifiable using this form of analysis. When considering their ties to the BMC and how the BMC defines them, Osterwalder and Pigneur (2010) attribute these aspects to the delivery of a company's value proposition. They are therefore viewed as enablers of other aspects of a venture's business objectives.

The uncertainties and risks associated with the global aspects of LGS deserve a special attention. LGS operate in a more challenging business environment since it is enacted through relationships with global partners, the adaptation of the value proposition to different global markets, and activities and resources that are distributed across national and geographical borders. One of our key findings was that the global aspects of the uncertainties and risks are inherent to all other uncertainty and risk categories. In this sense, taking into account the global aspects of the LGS operations requires a thorough re-examination of all components of the specific version (whichever it is) of the business model development canvas.

8 Conclusion

The logic of our findings suggests that the dual-canvas approach is applicable to the LGS context, and that LC is indeed a suitable starting point for a process that eventually ends up in a transition to the BMC. It should be pointed out however that the findings do not provide any clearly distinguishable point of transition from LC to BMC. The cases themselves suggest some more complexity than a mere shift to the BMC as soon as the entire LC process has been completed. The problem is that, for example, some of the startups needed partners from the very beginning to build an MVP. Clearly, these companies would be working to fill out the problem, solution, customer and unfair advantage boxes of the LC at such an early time. And yet, partnerships are nowhere to be found on the LC. This points to the presence of at least one link between LC and BMC that would require putting both canvases on the table to gain a complete picture of what is going on and how it ought to be managed. For all the startups partnerships were already present in the background as an important part of the process before a switch to BMC would have seemed necessary. This suggests that the LC could be also incomplete as a tool to adequately address all necessary management considerations even at the earliest stages for which it was specifically designed. This situation calls for future research shedding more light on what issues there might be, and how they might be relevant to the application of both canvases as tools in the entrepreneurial process.

The main contribution of this submission was to suggest a dynamic double canvas approach to business model development that would reduce the ambiguity in adopting a specific business model canvas by executive managers of technology-based LGS. The second contribution was to consider the challenges of applying business model canvases within the context of LGS. LGS operate in a more challenging business environment since it is enacted through relationships with global partners, the adaptation of the value proposition to different global markets, and activities and resources that are distributed across national and geographical borders. The third contribution was to provide a comprehensive categorization of uncertainties and risks that could be used within the context of LGS research.

The findings would be relevant for entrepreneurship scholars, researchers focusing on business model innovation and entrepreneurs. They should help entrepreneurs to adopt a dynamic approach to business model development that would reflect the realities of their globally competitive business environment.

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