

The Business Experiments Navigator (BEN)

An Approach for Validating Business Models with Experimentation

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Abstract—Early reduction of risks in a startup or an innovation project is highly important. Appropriate means for risk reduction, such as testing business models with different kinds of experiments exist. However, deciding what to test and how to select the right test, is challenging for many startups and innovation projects. This article presents the so-called Business Experiments Navigator (BEN), a toolkit to assist startup and innovation processes. It compliments other tools such as the Business Model Canvas or the Lean Startup process. The main contribution of BEN is to bridge the gap between the riskiest assumptions of a business model and the multitude of available testing techniques by providing assumption templates. The Business Experiments Navigator has been validated in several workshops. Results show that it creates awareness among the workshop participants that a business model is based on assumptions, which impose risks and need to be validated. Further, users of BEN were able to identify relevant assumptions and map different kinds of assumptions to appropriate testing techniques. The process applied in the workshops, as well as the assumption templates, helped the participants understand the main concepts and transfer their learnings, to their own business ideas.

Keywords—Business modeling, lean startup, continuous experimentation, continuous innovation, product management, entrepreneurship, startups, innovation

I. INTRODUCTION

Developing or transforming business models in highly dynamic environments imposes many risks to startups and innovation managers. Important success factors such as customer behavior, market demand, cost and design are difficult to predict. Typically, a business model is based on many unknown assumptions that impose risks. There are many different assumptions. As mentioned by Ries, “every vision for a business is based on assumptions about what is possible to build, what customers want, what kind of customers want it, [and] what distribution channels are available [...]” [4]. Assumptions can be seen as a starting point for every business model. In the beginning, the risk is very high because it is unknown if the assumptions are right or wrong. Therefore, it is necessary to find the fatal flaws as fast as possible to have the possibility of pivoting or changing an idea [12].

To reduce relevant risks, assumptions should be tested with experiments [15]. An assumption is a statement that is often

inadvertently taken for granted. However, we do not know if it is right or wrong until we validate it. Sometimes, startups and product teams do not recognize that they have to test the assumptions underlying their business model or those underlying the opinions of their stakeholders. They are often unaware that they need to identify the riskiest assumptions first in order to test them with experiments. In a study, the authors identified that many startups have a lack of knowledge about experimentation techniques but they are open to learning and improving their capabilities in order to increase the odds of their success [11].

One of the fundamental aims of startups or product teams is to transform their ideas into products or services that customers really need and want. There can be many uncertainties along the way when developing such products or services. To reduce these uncertainties startups or product teams need to validate their assumptions. An assumption can be defined as “something that you accept as true without question or proof” [13]. With the limited time teams usually have for development, they cannot test every assumption at the start. They need to prioritize the assumptions in a way that they can find out which ones are not important or dangerous for reaching their vision. To de-risk their vision, teams can test the dangerous assumptions with experiments, learn from the results and validate them. Eric Ries calls those dangerous assumptions “Leap-of-Faith Assumptions” in the context of the Lean Startup approach [5]. A first step towards testing the riskiest assumptions is to transform them into testable hypotheses. These hypotheses should be tested in an appropriate order as soon as possible. This procedure helps to avoid proceeding based on wrong assumptions (e.g., implementing features nobody needs). Various techniques to test assumptions exist [16]. The Lean Startup approach [4] strongly focuses on experimentation. The heart of this approach is a build-measure-learn feedback loop in which hypotheses are tested by applying experiments. An experiment is defined as “a procedure carried out to support, refute, or validate a hypothesis” [14]. Based on the results of these experiments decisions on further steps should be made.

In this paper, we introduce the “Business Experiments Navigator” (BEN). Its aim is to support startups and product teams in their current situation, help them to identify the right assumptions and bridge the gap between the identified riskiest assumptions and finding the right experiment to de-risk their vision. Firstly, BEN should be easy for startups and product teams to use with their current knowledge. Secondly, we want to give them a tool to quickly find and prioritize an appropriate experiment for testing their assumptions.

In order to better understand how to support startups and product teams with identifying the riskiest assumptions and finding appropriate testing means, we developed the Business Experimentation Navigator (BEN) and formulated the following research questions that we address in this article:

RQ1: How can startups and product teams be supported in easily identifying the right business experiment?

RQ2: How can we design the Business Experimentation Navigator so that it is easy to use for startups and product teams?

Research Approach: We did an analysis of related work to identify suitable tools for determining and prioritizing risks and mapping them to appropriate testing methods. Afterward, we developed the initial Business Experimentation Navigator that includes a workshop facilitation guide. We tested this initial Business Model Navigator in the context of four workshops: The first workshop was given as a one-hour-workshop at a startup conference with participants from startups and corporates (overall 29 participants). The second workshop was conducted with university students and university staff (overall 10 participants) in the context of a half-day business model validation tutorial. The third workshop was given half-day as part of an interdisciplinary entrepreneurship course with students from business informatics and economics at a university (overall 15 participants). The fourth workshop was conducted as part of an advanced accelerator program. The workshop took 3 hours with 22 participants from startups (including one entrepreneurship teacher among the participants). Each workshop was used to gain experience about BEN and its application. Learnings were constantly integrated into BEN and applied in the next workshop.

The article is structured in the following: Section 2 sketches the Business Experiments Navigator, and Section 3 describes the findings and lesson learned. Section 4 gives an overview of related work. The final Section provides conclusions and an outlook on future work.

II. BUSINESS EXPERIMENTS NAVIGATOR

The BEN consists of a process, artifacts such as assumption templates, a workshop facilitation guide and visual means such as posters. In addition, BEN provides guidelines on how to test these assumptions with appropriate methods such as experiments.

A. Business Model Validation Process

The BEN is embedded in an overall process to identify business model assumptions, identify the riskiest ones, map them to appropriate experimentation techniques, run

experiments, and decide how to proceed based on the results. The BEN especially focuses on how to explain the underlying

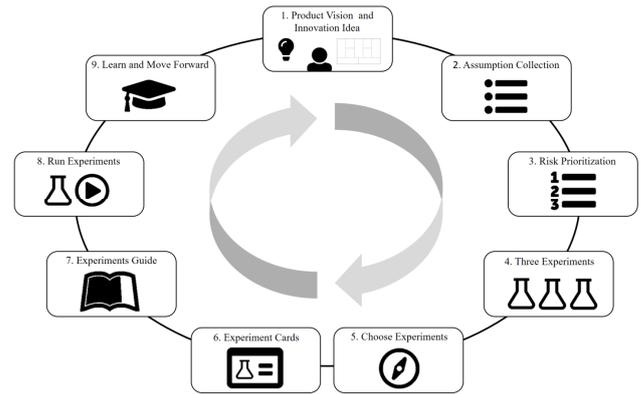


Fig. 1. BEN’s Business Model Validation Process

concepts and how to map risky assumptions to appropriate experimentation techniques. In the following, each step of the overall process is briefly described. In the description, we use the “team” as a generic term for a startup team, a product team or another group of people that work on tasks such as business model validation or product discovery. Currently, the BEN supports the steps 3, 4, 5, and 7.

Step 1: Product Vision and Innovation Idea. First of all, the authors recommend that the team develops a product vision or an innovative idea and sketches one or several variants of a business model canvas. This step is outside the focus of BEN. Many techniques exist for developing such a product vision and business model canvas (i.e., business model generation, product vision board, lean canvas).

Step 2: Assumption Collection. Secondly, the team should identify all the assumptions regarding their business model. This step is also not in the focus of BEN. Several techniques exist to identify assumptions (e.g., Assumption Mapping, see Section V). The assumptions are the input for BEN which starts with Step 3. As a prerequisite for the application of BEN, each assumption should be written on a sticky note.

Step 3: Risk Prioritization. In order to prioritize the assumptions, BEN provides a poster with a matrix. The matrix has two axes: The y-axis describes the magnitude of impact and the x-axis describes the time to impact. In the matrix, there are four different quadrants, i.e., on the top left “high impact and test distant”, on the top right “high impact and test soon”, on the bottom left “low impact and test distance”, and on the bottom right “low impact and test soon”. The next step is to classify each of the assumptions into the different quadrants. If the team has classified all the assumptions. The matrix is based on a technique proposed by Ries for prioritizing leap-of-faith assumptions [4]. In order to work with the assumptions further, the risk classes (corresponding to the different quadrants) are noted on each sticky note.

Step 4: Brainstorming different test techniques with the “Three Experiments” template. In the next step, templates called “Three Experiments” are provided to the participants. The participants select assumptions from the quadrant “high impact

and test soon" and use the "Three Experiment" template to brainstorm potential testing techniques. The "Three Experiments" template has three different boxes. In each box, the participants can write down a potential experiment that could be used to test the assumptions. The aim of the three experiments is to think freely and creatively about different experiment techniques. The boxes represent different cost levels for the experiments, i.e, cheap experiments should be written down in the "cheap" box etc. For the "cheap" box, the participants should think about the cheapest possibility to test this assumption. For the "expensive" box, they should think about a highly expensive way to test the assumption. Finally, the third box is called "dream". The participants should think about the ideal experiment they would wish to conduct to test the assumption even if it is not possible to conduct this experiment in the real world. The "Three experiments" template is also based on a technique proposed by Ries [4].

Step 5: Choose Experiments. Afterward, each team takes all assumptions from the quadrant "high impact and test soon" and puts them together on a table. Every participant rereads these assumptions. Now, the participants can use the provided Navigator Assumption Templates which are printed on cards (see Fig. 2). These templates provide patterns for typical assumptions. The participants should compare the assumptions from the quadrant "high impact and test soon" with the provided assumption templates in order to find matches. If an assumption matches an assumption template, appropriate testing techniques are written on the back of the card. If they cannot find a useful pattern that matches an assumption, they can also freely think of another possible experiment type. This is facilitated by a provided comprehensive list of experiment techniques.

Step 6: Experiment Card. After the team has found an experiment type for an assumption, they can take the sticky note and put it on the experiment card template. This card helps transfer the assumption to a testable hypothesis and to design an appropriate experiment.

Step 7: Experiments Guide. In the guide, the teams can read some information about the experiment type. It has a short description of each experiment with some tips and warnings. With the guide, the team gets a clear view of the different experimentation types. This also helps them to formulate their experiment description in the next step.

Step 8: Run Experiment. This step is outside of BEN. The team can now execute the experiments and document all their findings.

Step 9: Learn and Move Forward. This last step of the overall process is outside of BEN. It focuses on learning from the experiment results and making decisions about further actions. The step relates to the "pivot or perseveres" step in the Lean Startup approach.

B. Business Experimentation Navigator Assumption Templates

The assumption templates are printed on cards. On the front side, there is a pattern for an assumption and on the other side, a list of suitable experiment types to assumptions that match this

pattern. Fig. 2 sketches three example templates. A list of the typical pattern for assumptions is provided in Table 1.

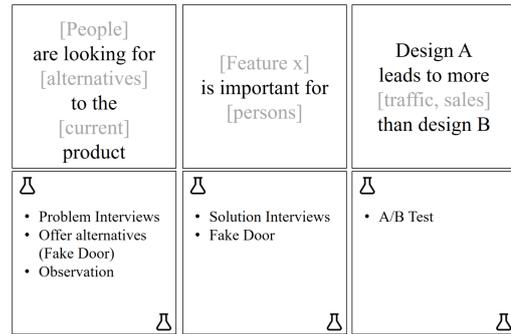


Fig. 2. BEN-Assumption Templates

We illustrate the usage of the assumption templates with an example that is inspired by the AirBnB business model. Consider the following assumptions:

- Travelers seek alternative experiences to hotels.
- Design A of the search page leads to more bookings than design B.
- The cleanliness of the apartment is very important for the travelers.

With the given templates in Figure 2, we can identify which template is suitable for which assumption:

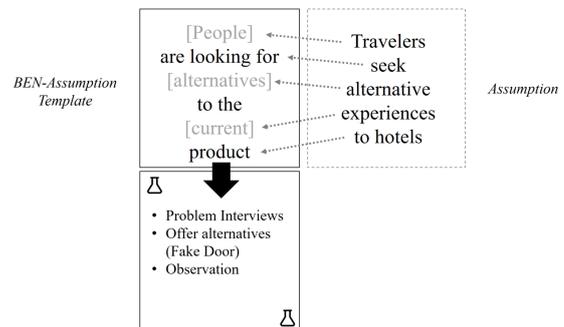


Fig. 3. Match with the Assumption Template

In Fig. 3, the first BEN-Assumption Template matches to the first assumptions in Fig. 2. The second assumption matches with the template three from Fig. 2. The last assumption matches with the second assumption template. Until now, we have created 11 different assumption templates that are listed in Table 1.

TABLE 1

Business Experiments Navigator - Assumption Templates	
1	[People] are looking for [alternatives] to the [current] product
2	[Feature x] is important for [people]
3	Design A leads to more [traffic, sales,...] than Design B

Business Experiments Navigator - Assumption Templates	
4	[People] accept [statement]
5	[Product/service] can be developed
6	[Feature x] is easier to use than [feature y]
7	With an [advertisement] we get more [traffic, sales,...]
8	With an [action or characteristic] we get more [traffic, sales,...]
9	[People] feel [positive or negative] with [object x]
10	Add [feature x] leads to more [traffic, sales,...]
11	[People] are ready to use [solution]

C. Workshop Facilitation Guide

The BEN is accompanied by a workshop facilitation guide that aims to support people to apply BEN in a workshop. The workshops can be conducted for teaching purposes and for selecting appropriate tests for individual business models. Currently, the workshop covers the steps 3, 4, 5, 7 of the Business Model Validation Process.

In the following, we sketch the essential elements of the workshop facilitation guide: At the beginning, the teacher should introduce the topic, introduce lean startup principles, and explain why experimentation is important. It is recommended to use real examples (e.g., Zappo, AppFog, Etsy) for illustration purposes. This introduction should last 30 minutes maximum.

Step 3: Risk Prioritization

Preparation guideline: Before starting this step, the assumptions should be printed: Choose around 20 assumptions and print a set of them for each team on a piece of paper. Cut them out and stick them on small sticky notes. Print out the "Prioritize your Leap-of-Faith Assumption" poster, one for each team.

Group considerations: We suggest a maximum of five people and a mixed team if possible, with people of different backgrounds.

Timing: We recommend 40 minutes + 5 minutes for each team.

Exercise guides: Explain the poster (10 minutes). Each team gets the prepared sticky notes pack and the poster "Prioritize your Leap-of-Faith Assumption" and they can start the exercise (30 minutes). When they have finished this task, discuss the risk matrix with each individual team (5 minutes for each team).

Learning objectives: The participants should learn how to prioritize assumptions. They should get a feeling of which assumptions are the riskiest ones in relation to the business model. They should learn how to get a team understanding of the assumption they used.

Step 4: Brainstorming different test techniques with the "Three Experiments" template.

Preparation guideline: Print out the "Three Experiments" template on a sheet of paper. Each participant should get two copies.

Timing: We recommend 50-55 minutes.

Exercise guides: Explain the exercise (5 minutes). Give every participant two sheets. Each participant in the team should select two of the riskiest assumptions to work with. The participant should use one sheet for each of these two assumptions. First, each participant should work on their own in silence and fill out the two templates (5 minutes). After that, the participants should talk to the other participants in the group and exchange their ideas (5 minutes). Ask each team to write the identified experimentation types on sticky notes. Each sticky note should have one experimentation type. All teams should bring their sticky notes to a board or table where they can stick them (15 minutes). If all teams are ready, start to talk with all of them about the experiment techniques they have chosen (15-20 minutes).

Learning objectives: The participants learn how assumptions can be tested with different means. They should get a feeling for the costs related to different experiment types.

Step 5: Choose Experiments

Preparation guideline: Print out the "Assumption Templates" on a piece of paper. Cut all the 11 actual assumption templates and stick the front and backside together. Prepare one Assumption Template pack for each team. Also, print the "List of Experiments" for each team.

Timing: 45 minutes

Exercise guides: Give every team a list of experiments (5 minutes). Explain the experimentation techniques which they do not know (15 minutes). Explain the assumption template with one example and the exercise. The teams should work with the two riskiest assumptions from step 4 (10 minutes). Give every team an Assumption Template pack (5 minutes). Give them time to find an experiment type for each assumption (10 minutes).

Learning objectives: The participants should get an overview of existing experimentation types and how they are suited for specific assumption types. Each participant should work on their own.

Step 7: Experiment Card

Preparation guideline: Print out the "Experiment Card" on a piece of paper (two copies for each participant).

Timing: We recommend 50 minutes.

Exercise guides: Briefly explain the "Experiment Card" and the exercise; the participants should work with the two riskiest assumptions they chose in step 5 (10 minutes). Give every participant two experiment cards (5 minutes). Give the teams time to fill out the experiment cards and help those who are having problems (25 minutes). If all participants are ready, they should give the experiment cards to another participant, who should then understand what assumption, hypotheses and experiment were chosen and how the experiment works (15 minutes).

Learning objectives: Participants should learn to document their experiment clearly. They should learn how to translate the assumption into a testable hypothesis. They should learn how to make an experiment description that guides the experiment.

III. FINDINGS & LESSONS LEARNED

In the following, we describe lessons learned that were gained by observing the participants during the workshops. After each workshop, lessons learned were documented by the workshop facilitators. The learnings were used to improve the process and the materials for subsequent workshops.

In the first workshop, the participants were divided randomly (rows of seats) into 4 groups. Each group had between seven and eight participants. Most participants knew AirBnB and understood "Airbnb's" business model and the provided assumptions. The groups needed around 55 minutes to estimate the risks associated with the assumptions. This was much more time than the planned 25 minutes. Most of the time was consumed by gaining an agreement on where to position an assumption into the prioritization matrix. In the next exercise, the participants were asked to assign different experimental techniques (which were printed on sticky notes) to the problem, solution, and growth stage. This turned out to be an exercise that was too difficult for the workshop format. On the one hand, not all participants were familiar with all experiment techniques. On the other hand, the assignment is not obvious in many cases and it was not clear to the participants why they should do this assignment. As a result, the facilitators started to explain to the teams all experiment techniques that were unknown. Due to these problems, the exercise was modified for the second workshop. In the next step, the riskiest assumptions were assigned to the experiments. In the end, the participants were so enthusiastic that they continued to finish this exercise during a break that succeeded the workshop.

Based on our experience from the first workshop, we reduced the team size to 3-4 people and as mentioned, we skipped the assignment of experiment types to startup stages. We increased the time for the risk prioritization exercise. Overall, the workshop went well and no major problems occurred. Some persons did not understand the meaning of the "time to impact", i.e., the time until when a risk might get relevant. The facilitator explained the concept to these persons and this helped the teams to proceed.

In the third workshop, a new exercise was introduced (i.e., "Three Experiments") to stimulate the participants' imagination for experimentation and to give them a sense of the cost of doing certain experiments. This exercise was well received by the participants and led to a lot of creativity. However, we observed that often one person in each team dominated the discussion during this exercise. Therefore, we changed this group exercise to an exercise on an individual level in the following workshops. Overall, the workshop went smoothly.

For the fourth workshop, we explicitly described the process of the workshop and provided a visualization of the process to the participants (similar to Fig. 1). For step 5, we have designed the assumption templates to quickly match an assumption onto a template that represents a typical class of assumptions. The assumption templates are printed on the front side of cards. On the back side of each card suitable experiment techniques are listed. Thereby, the participants could easily map assumptions to appropriate experiment techniques. In addition, we have put together a list of many more experiment techniques to illustrate the variety of different techniques that might be relevant beyond

the example. In step 7, we created a simple experiment card that includes information about the assumption, the hypothesis, and an informal description of the experiment. This experiment card aims at helping the participants to get from the assumption to the testable hypothesis and to document the experiment.

In this fourth workshop, we learned that the first task to prioritize the assumptions was no problem for them. Step 4 (i.e., the exercise "Three Experiments") was done on the individual level and inspired the participants to come up with many proposals. They enjoyed this exercise. Before starting with step 5, the facilitator explained all experiment techniques that were unknown to the participants. This helped to get a balanced level of knowledge about experimentation techniques. The assumption templates worked well overall. For some participants, it would probably have been better to show an example of an assumption template before conducting step 5. With the help of the Experiment Card, the participants were able to translate the assumption into a testable hypothesis and also to document the experiments.

Overall, we gained the following lessons learned:

The workshop helped to explain the main concepts of assumption identification and prioritization. The participants were able to quickly understand the meaning and relevance of these concepts in the context of business modeling. The participants also got a comprehensive overview of the different experiment techniques and first impressions about when to use these techniques. In consequence, main learning goals were reached.

The provided examples (i.e., a list of concrete assumptions and experimentation techniques) helped to focus on the main aspects of the workshop and to speed up the exercises. In addition, the participants got an impression of how assumptions could look like in a real setting. The authors have experience with similar workshops where the participants had to create their own business models upfront and to come up with assumptions by themselves. Compared with these workshops it was much easier and faster to introduce the main concepts with a given business model and a ready-made list of prepared assumption.

We used many posters and visual elements in the workshop. In addition, the explanations during the workshop and in the exercises provided a common vocabulary. Both helped significantly to communicate the teaching content and it also facilitated communication between the participants.

The authors expect that the participants are able to identify and prioritize assumptions for their own business models or new ones easier with experience from the workshop. They clearly reached a higher level of understanding and the process from the workshop provides guidance on which activities to perform. The authors expect that the workshop is a more effective way to teach important principles about experimentation compared to reading books. This is especially important because many startup founders and innovation managers do not read books in order to get relevant knowledge. The latter is based on the experience of the authors.

IV. RELATED WORK

Several approaches for identifying and prioritizing assumptions exist. In addition, many types of experiments and experiment libraries are documented in literature. In the following, we sketch important related approaches and literature and describe differences and commonalities to our approach. We will examine the following: "Assumption Mapping" from D. Bland [1], "Prioritization Matrix" from J. Gothelf and J. Seiden in Lean UX [2], "Lean Canvas Prioritisation" from A. Maurya [3], "Prioritizing Leap-of-Faith Assumption" matrix from E. Ries [4], "The Matrix" from The Real Startup Book [6], the testing process from the Value Proposition Design book by A. Osterwald et al. [7], the "Rapid Experiment Loop" from Moves the Needle [8], and "Test your assumptions in a logical order" from J. Fjeld [10].

A. Assumption Mapping

The idea is to de-risk the startups product or service vision. The assumption mapping should be done with a designing lean team, which is cross-functional with Engineering, Product, and Design. The method identifies three types of assumptions: Desirable, Viable and Feasible. For each type, there are questions to answer to identify which assumption fits with which type. In the first step, the team writes the assumptions down on different sticky notes with different colors, one color for each type. After writing down the assumptions on the sticky notes, the team has to map them in a 4 of 4 matrices. The x-axis goes from known on the left side to the unknown on the right side. The y-axis goes from unimportant at the bottom to important at the top. After mapping all the sticky notes to the matrix the team can learn from the map. Stay away from the assumptions at the bottom left as they are unimportant and known. The most important quadrant is the top right because important unknown assumptions are there, which have the highest risk for the teams' vision.

B. Prioritization Matrix from Lean UX

The team starts to write down, every assumption from every participant and put them all together in an assumption list. Out of your list, you have to prioritize the riskiest assumptions to test them first. Therefore the prioritization matrix is with 2 axes. The x-axis starts on the left side with the known and goes to the right side to the unknown. The y-axis has at the bottom low risk and at the top high risk. You have to map your assumptions in the different quarters. The quarter on the top right is the most important quarter with high risk and unknown.

C. Lean Canvas Prioritization

The Lean Canvas is adapted from the Business Model Canvas. The idea of the Lean Canvas is to write down your whole business idea on a piece of paper. That makes it easier to discuss and think about all the different areas of a business model: problems, customer segments, unique value proposition, solutions, unfair advantage, revenue streams, cost structure, key metrics, and channels. Those areas are important for the business model and you can write your actual assumptions in each area. Ash divided risk into three categories: Product risk, Customer risk, and Market risk. For the risk areas, he suggests an order in

which you can validate your risks. In the Product risk, he suggests problem, solution, unique value proposition and key metrics. In the Customer risk, he suggests customer segment, early adopters and channels. In the Market risk, he suggests existing alternatives, revenue stream and cost structure. Ash said, "Tackling all these risks at once can be overwhelming, which is why you need to prioritize them based on the stage of your product and tackle them systematically."

D. Prioritizing Leap of Faith Assumptions

Eric Ries describes his Lean Startup process in the following way. Write down the assumptions, with the team, in a way that is clear and simple to understand. Secondly, with experiments quickly determine which assumptions are true and which are wrong and learn from the results. Identify the riskiest assumptions and focus on them with the prioritizing leap-of-faith assumptions template. The template has a matrix with 4 quarters and two axes. The y-axis describes the magnitude of impact from low on the bottom to high on the top. The x-axis describes the time to impact from distant on the left to soon on the right. The most important quarter is the one on the top right where the magnitude of the impact is high and the time to impact is soon. Those are the assumptions that should be tested first. Ries said, "Focus on actions that present the greatest opportunities for learning."

E. Question Matrix from The Real Startup Book

The question matrix is a 2x2 matrix. The y-axis is on the left with an evaluative experiment on the bottom and generative research on the top. The x-axis has the market on the left side and product on the right side. The matrix includes an Index of Questions and with them, it can be identified where to find oneself in the matrix. If the right quadrant is identified (market or product), an Index of Methods additionally is provided which helps to identify experiments teams could do.

F. Testing Process from the Value Proposition Design

Before starting the Testing Process, a Business Model Canvas and a Value Proposition Canvas have to be filled out. The process has six different steps. Step one - Extract Hypotheses: In the first step of the process, the hypotheses are extracted out of the Business Model Canvas and the Value Proposition Canvas. Step two - Prioritize Hypotheses: What could kill the Business? Prioritize the hypotheses from critical to survive to less critical to surviving. Step three - Designing Test Cards for Experiments: The aim of the Test Cards is to structure experiments, they have 4 different sections. In section one, hypotheses are described. In section two, the experiment is written down to verify whether the hypothesis from section one is correct or not. Next, the most critical hypothesis is tested with more than one experiment, therefore more than one test card can be filled out. It is recommended, to always start with the cheapest and quickest experiment. In section three, the kind of data that should be measured in the experiment is defined. In section four, a target is defined to validate or invalidate the hypotheses. Step four - Prioritize Tests: Rank and prioritize different Test Cards from the top, critical to survival to the bottom, less critical to surviving. The hypotheses with the highest risk should be the first to test. Step five - Run Tests: Run

the experiments in the previously defined prioritization from the critical to service to less critical to surviving. Step six - Capture Learnings: The learnings are written down in a Learning Card. The Learning Card captures all the insights from the experiment. The Learning Card has four different areas. The first area is the hypotheses. In the second area, the observation result can be documented. The third area is for learnings and insights. In the last area, the actions are described which are taken away from the learned results. The result of the Learning Card could be Invalidated, Learn more or Validated.

G. Rapid Experiment Loop

The Rapid Experiment Loop from Move the Needle is a cycle consisting of six steps. The tool supports teams to prioritize assumptions, perform experiments and learn from the results. Step one is to brainstorm with the thought of which assumption must be true for the solution to work. Step two is to prioritize the assumptions. Which assumption is the most critical and at least unknown for the success? Step three is to design and run the experiment and answer the following four questions: What’s your hypothesis? What will you build? What behavior do you expect? What is the data result which you expect to see? Step four, perform the experiment. Step five evaluate the results. Step six, make a decision on what to do next.

H. Test your Assumptions in a logical order

Jon Fjeld states, “Testing assumptions in a logical order gives the team the best chance of making course corrections early – and not wasting time and money”. He describes a two-step approach. The first step is to identify the assumptions and unknowns. The second step is to resolve these assumptions with three parameters. Parameter one is severity, it is the impact which is expected if the assumption is wrong. The second parameter is the probability, it is the probability that the assumption is right. The last parameter is the cost of resolution. The teams should consider what evidence they need to confirm the assumption. Then, they should choose the simplest and cheapest experiment. In the end, if they have identified, for all assumptions all experiments and all probability you can

calculate the ratio of risk (i.e., severity times probability) to the cost resolution. Finally, you get a ranking of assumptions, the teams can now start to work with the riskiest assumptions first.

For a better overview, Fig. 4 provides a rough comparison of techniques that we previously described along a general business model validation process. The Assumption Mapping, the Prioritizing Matrix from the Lean UX and the Prioritizing Leap-of-Faith Assumptions Matrix, cover the points Assumption Collection and the Risk Prioritization from the process. The Lean Canvas prioritization covers the Assumption Collection and can be used as a starting point for prioritizing assumptions. The Question Matrix from the Real Startup Book covers the Assumption Collection and Design & Select Experiments. Test your Assumptions in a logical order covers Assumption Collection and risk ranking based on the ratio of risk to the cost resolution. The Testing Process from the Value Proposition Design and the Rapid Experiment Loop cover the most of the process. They cover the Assumption Collection, Risk Prioritization, Design & Select Experiments, Run Experiments and Learn and Move Forward. All described techniques have some strengths in a specific area, the most of them aim at identifying the riskiest assumptions. What is missing in all these approaches is support for mapping the riskiest assumptions to appropriate testing techniques in a simple way.

V. CONCLUSIONS AND FUTURE WORK

The presented Business Experimentation Navigator (BEN) has been used in four workshops. The results from the workshops indicate that BEN is an appropriate means for identifying risky assumptions, for gaining a common understanding of these assumptions in a team and for finding appropriate experiment techniques to test those assumptions. The provided example in the workshop helped the participants to quickly understand the main concepts and to conduct the business validation process in a short amount of time. However, it can be expected that the application of the process for other business models, especially those that are self-defined by the participants, might take longer and might require a more detailed

General Business Model Validation Process	Assumption Mapping	Prioritization Matrix	Lean Canvas Prioritization	Prioritizing LoF Assumptions Matrix	Question Matrix	Testing Process	Rapid Experiment Loop	Assumptions in a logical order	Focus of BEN
1 Product Vision and Idea									
2 Assumption Collection	X	X	X	X	X	X	X	X	
3 Risk Prioritization	X	X	x	X		X	X	X	
4 Map Assumptions to Experiments									X
5 Design & Select Experiments					X				X
6 Run Experiments						X			
7 Learn and Move Forward						X			

Fig. 4. Assumptions Experiments GAP

explanation and guidance. The authors recommend to first conduct the workshop with the example business model provided and then apply the process to other business models afterward. Compared with related approaches, the BEN focuses on the mapping of assumptions to appropriate testing methods. BEN supports this mapping based on finding similarities between concrete assumptions and typical patterns for assumptions. The experiences from the workshops show that this mapping could easily be done by the participants without comprehensive training.

The approach has several limitations. First, this mapping does not replace a thorough analysis of the suitability of testing methods for specific assumptions. However, the results from the workshops show that most of the assumptions were assigned to the right testing techniques. Second, the provided set of assumption templates is incomplete in the sense that all types of assumptions have not been covered. Third, the templates also need a more detailed analysis and potential improvement with respect to their scientific validity.

It is planned to address these issues in the future work. In addition, further validation is planned (including validation of the approach with product teams in the industry), a customization for specific domains (e.g., FinTech, SaaS startups, hardware startups, healthcare), to develop further process features (e.g., simulation of experiments such as A/B tests) and to integrate further process steps depending on identified needs of startups and product teams. This might lead to extended formats such as day-long workshops.

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