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Understanding business model innovation: Recommendations for future business model tooling by an action research.

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Abstract: In Research and Development (R&D) projects, Business Model Innovation (BMI) is a challenging issue given the high degrees of uncertainty regarding technologies, products and markets. The purpose of this research is to investigate how business model exploration is facilitated with the use of business model tooling and what are the gaps in the current business model repository in supporting business model exploration as part of the BMI process. These gaps can be addressed in the design of future business model tooling. We do so by supporting the business model exploration within a specific complex setting, introducing changes in the business models, and evaluating their effects. For 12 months we actively participated in an R&D project funded by European Union focused on building a digital service that will improve mobility safety. We observed that business model exploration is an indispensable process when the value offering is not clearly defined, or when there are new business opportunities. Based on the observations, our recommendations regarding business model exploration are: (a) to start with an initial business model even if the final offering is not clear, (b) to create alternative business models and explore their potentials, and (c) use tools or practices that can contribute on the decision making regarding BMI.

1. Introduction

Business Model Innovation (BMI) is an important issue when it comes to Research and Development (R&D) projects. BMI is defined as the '*businesses' change in their logic for creating and capturing value' (Bouwman, et al., 2018, p.15).* BMI refers to the process of innovating a company's architecture of value, that is, how an incumbent or start-up generates value for its customers, delivers such value to them, and captures a share of the value generates to guarantee is economic and financial viability. While the traditional R&D projects focus on researching if a business idea will capture value, R&D projects that focus on BMI could reduce risk and uncertainty, explore potential value from new ideas. However, the focus on BMI within R&D is still not systematic (Guppta, 2016).

Especially in cases where industries are fundamentally changing due to sudden external factors (e.g. new technologies), enterprises are in need to explore how to redevelop and reinvent their business models. There are different reasons why BMI is necessity. For instance, digital technologies are fundamentally reshaping organisations (Bharadwaj, El Sawy, Pavlou, and Venkatraman, 2013). Reinventing and reconsidering their business models can support enterprises to stay competitive (De Reuver, Bouwman, and Maclnnes, 2009; Sosna, Trevinyo-Rodríguez, and Velamuri, 2010). Additionally, business model exploration can support the identification of new ideas, insights and developments that can lead to new business model opportunities (De Reuver et al. 2016; McGrath, 2010; Baden-Fuller and Morgan, 2010).

However, existing business model approaches (e.g. business model tooling) do not extensively and clearly support the business model exploration process when technology triggers opportunities. A solution would be to investigate the actions that teams within organisations take towards the development of business model(s) and what problems encounter in the process. Observations and practical experience can lead to updated business model tooling.

The objectives of this research are to investigate how the business model exploration is facilitated by existing business model tooling, and how future business model could be designed and developed so the business model exploration could be facilitated in an efficient way. We collect the data by actively participating in the European Union funded project, Ninja Riders (EIT digital-Digital Cities Action Line- Activity 17091) regarding technology driven service design for improved road safety. As part of the project, the authors of this paper were responsible for the business model design. However, all the decisions regarding the business models were shared and discussed with the rest of the partners of the project.

We use Action Research as our methodology. Action Research is an iterative process that involves researchers and practitioners working together for specific activities namely: problem diagnosis, intervention and reflection (Avison et al., 1999). We actively intervene throughout the duration of the project, using available different business model tooling based on the emerging needs related to the BMI process such as Business Model Canvas (Osterwalder and Pigneur, 2010), STOF business model (Bouwman, De Vos, and Haaker, 2008), Value Proposition Canvas (Strategyzer, 2018), business model stresstesting (Haaker, 2017). Additionally, we collected data from: (a) interviews with potential stakeholders; (b) monthly meetings with the project partners; (c) workshops on business models and business model tooling; (d) desk research on the existing market and what the competitors offer; (e) analysis of the e-mails exchanged between the participants of the project. We store all the data in a cloud database that we updated after every new activity.

With this research we aim to contribute to Business Model Innovation (BMI) with a set of recommendations extracted from the learning reflection cycle. These recommendations could inform the design requirements of future business model tooling. Practitioners can use the outcomes, and our approach for different products, problems or industries.
The paper is structured as followed. In section 2, we discuss business model innovation and business model tooling. Section 3 focuses on the action research methodology, and the setting of our research. In section 4 we discuss our action research interventions (how we introduce changes, description of the project we got involved, data collection methods). In section 5 we discuss the results of the action research and the learning reflections. In section 6, we conclude with the final outcomes, limitations and recommendations for future research.

2. Business Model Innovation

Technological developments (e.g the Internet) increased the interest of the academics and practitioners regarding business models. Business models are described as the core logic of how the enterprise creates value (Kallio, Tinnilä, and Tseng, 2006; Linder and Cantrell, 2000). Even though there are different ways to define business models, we adopt the definition given by Osterwalder, Pigneur and Tucci where a business model is defined as *'[…] a conceptual tool containing a set of objects, concepts and their relationships with the objective to express […] what value is provided to customers, how this is done and with which financial consequences'* (2005, p. 3). When the aim of a project is to offer new products to the market, the attention to the business models is necessary. Business models are essential for a successful organisation either is an experienced or newly established player (Magretta, 2002).

Due to changing technologies and market needs, enterprises might need to adjust their business model (Linder and Cantrell, 2000; Hedman and Kalling, 2003). Scholars argue that, in times of change, where both opportunities and threats occur from the internal or/and external environment, it is valuable for enterprises to rethink their Business Model if they want to stay competitive and profitable (Bucherer et al., 2012). De Reuver et al., (2008) argue that organizations might need to reconsider their business model to stay up to date with factors such as socio-economic trends, technological developments, and political and legal changes. Examples of drivers are enterprise's poor performance, innovative use of resources (internal), or the introduction of new services in the market (external). Due to these drivers might need to rethink their position within the market or to target a new target group or to change their suppliers

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(Solaimani, 2014), and innovate their business model (BMI). BMI can be described as '[…] *businesses' change in their logic for creating and capturing value (*Bouwman, et al., 2018, p.15*).* Business model exploration can be important when in the process of BMI.

Business model exploration involves suggesting changes in business models (Cavalcante, Kesting and Ulhøi, 2011), conceptualizing the changes (Sonsa et al., 2010), creating alternative business models, and assessing what could happen under a range of different decision choices and alternatives (Bisbe and Malagueño, 2012; Heikkilä et al., 2016). Existing business models do not take into consideration technology disruption as a separated part of the business model design, (e.g. in business model CANVAS (Osterwalder and Pigneur, 2010) technology is not a separate building block). Even in cases that technology is one of the basic building blocks (e.g. STOF model (Bouwman et al., 2008) how business models can be affected by technology disruption is limited analyzed.

Academics and practitioners are paying specific focus on developing business model tooling (De Reuver et al. 2016). Scholars and practitioners are interesting on developing new business model tooling to contribute to the business model innovation process. However, the benefits of business model tooling are still not sufficient studied (Eppler Hoffmann and Bresciani, 2011). As a result, it is not known in detail what are the benefits of the existing business models and how future business model tooling could be developed.

Available business model tools have different forms. Tools can take the form of a printouts (e.g. Business Model Canvas), printed cards (e.g. Foresight cards, 2012; Haaker, 2017), apps (e.g. Leanstack, 2017; Osterwalder and Pigneur, 2010; SWOT), board games (e.g. Business Innovation Kit, 2012), or a website (e.g. E^3 value, 2017). For the purposes of our study we used the online database of business model tools 'Business Makeover' (available at https://www.businessmakeover.eu/platform/envision/tool-overview), that is freely available and provides business model tooling for all the BMI phases (i.e. explore, design, test, implement, grow) (De Reuver et al., 2016). Table 1 presents the five different BMI phases and their purpose (De Reuver et al., 2016). While for our research we were interesting at the business model exploration, tooling that is related to other phases were needed and thus, used.

Table 1 BMI phases and the purpose of each phase (De Reuver et al., 2016)

BMI	Purpose
Explore	To provide new insights on business and context to discover new business model opportunities.
Design	To define (or redefine) how business creates, captures and delivers value.
Test	To verify and validate new business models.
Implement	To realize business model design in practice.
Grow	To estimate how to grow business through innovation actions

3. Research Setting

3.1 Mobility ecosystem

For our study we focus on an R&D project related to the mobility ecosystem. Mobility ecosystem is interesting, as organisations within it are in the process of transforming their business from product to service oriented enterprises (Dombrowski and Engel 2014). By mobility ecosystem we mean the group of organisations that offer products and services related to personal mobility (from the manufacturing and sell of commercial vehicles to the development of apps for improved mobility experience).

Digital technologies have long being adopted by actors within the mobility ecosystem. (Piccinini, Gregory, Hanelt and Kolbe, 2015). Digital technologies are fundamentally changing the mobility ecosystem and make the affected actors to rethink their position in the market, and explore new opportunities improving their offerings (Viereck et al., 2015).

Concepts such as mobility on demand and shared mobility are rising; car ownership is still a trend that needs closer consideration as concepts within personalization (e.g. adaptation to drivers' preferences) are related. These digital, disruptive, technologies cause radical changes to the business models (Rayna and Striukova, 2017). These challenges are able to create a competitive advantage for the actors within mobility ecosystem (Baden-Fuller and Haefliger, 2013).

Three main challenges regarding business models within the mobility industry are identified: (a) designing the new business models, (b) co-creating valuable offerings, and (c) competing with the offerings of the 'newcomers' (i.e. new participants entering the automotive industry after the technology disruption) (Piccinini et al., 2015). While designing business models for offerings within the mobility ecosystem, the above challenges need to be taken into consideration.

3.2 The project

For our research we focus on a research and innovation project founded by an independent organisation of European Union (EIT digital-Digital Cities Action Line- Activity 17091) that derived by opportunities aimed to create a product and the start-up to offer the created product. The project got approval on July 2016. The research setting involved five organisations: one technical university (The Netherlands), one research and innovation institute (Italy), one digital innovation advisory company (The Netherlands), one research and design studio (Italy), and one consulting company (France). For a period of 12 months (January 2017-December 2017) the consortium project partners participated in various activates (see Table 2).

Table 2. Activities of the consortium of the project

Activities	Details
Consortium meetings	(12) Monthly consortium meetings: (5) face to face consortium meetings (3 in Milan, 1 in Delft, 1 Paris), and (7) skype meetings
Focus group	(1) Target group (potential users)
Interviews	(13) Potential stakeholders
Workshop	4 (1 on potential stakeholders; 1 on business models workshop, 1 on Game design)
Deliverables	Official report describing the process towards the business model development for generic audience (1)

The authors of this paper were actively involved in these activities with at least one of them always present to the consortium activities. The initial purpose of the project was to build a 'digital toolbox' to create participative communities to model young drivers' actual behavior, their perceptions and future visions while at the same time to train young people on road security with the use of gamified/ entertaining feedbacks. However, initially a clear overview of what the final product will be and what problem will solve for the customers was not available. Based on the initial proposal for the funding, the critical success factors for the project to be considered successful were: (1) a product described as a digital toolbox that improves the road behaviour of young people, (2) creation of a start-up that offers the developed product. However, what the product will be, and how the business will be created was not defined. The underlining assumptions, and reasoning behind the initiation of the project, are that mobility behaviour is difficult to catch among young people, because they are more reluctant than adults to be monitored through connected devices. Even when sensing technologies are in place, collected data tells us what happened (e.g. driving style), but not why it happened (e.g. conditions and variables that affects drivers). After iterations the final offerings were designed and developed. The overall purpose of project was to create a start-up that promotes a road safety culture and makes sense of attitudes and choices, thus allowing both young people and mobility stakeholders to get a deeper understanding of the why behind risky decision-making. The final 'toolkit' included (a) a website with the main aim to create a community that will share their ideas and feedback on the topic of driving safety, and (b) an engaging gamefull app that gathers information about decision-making and attitudes in a structured form (data) from young people in an implicit way.

The challenges regarding the business model creation is twofold: first what the project aims to deliver to the users it was not described from the initial phase of the process and that leads to an exploratory approach regarding the business model creation, and second for the whole project an agile approach is followed with teams/partners working on different task at the same time. The deferent teams are working on their activities at the same time. The responsibilities and roles of each partner were clearly defined (see Table 3).

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Table 3. The teams of the project and the assigned tasks

Teams	Leading Tasks
Project coordination	(a) Project management (b) Communication and Dissemination (c) Product user evaluation (d) Start-up creation
Business Model Team *(The authors of this paper)*	(a) Market research, (b) Business Modelling (c) Mock-up business evaluation, (d) Product business evaluation
User research	(a) User engagement, (b) User analysis
Organisation and support to experimentation	(a) Mock-up user evaluation, (b) Mock-up business evaluation, (c) Product user evaluation
Design and Development	(a) Product design, (b) Product implementation

The authors of this paper were responsible to support the project with the business model design, creation, experimentation and innovation. We did so by introducing changes within a specific complex setting and evaluating their effects (Baskerville, 2001). Figure 1 presents the initial division of responsibilities. The red dotted line indicates the activities that the researchers of this paper were responsible.
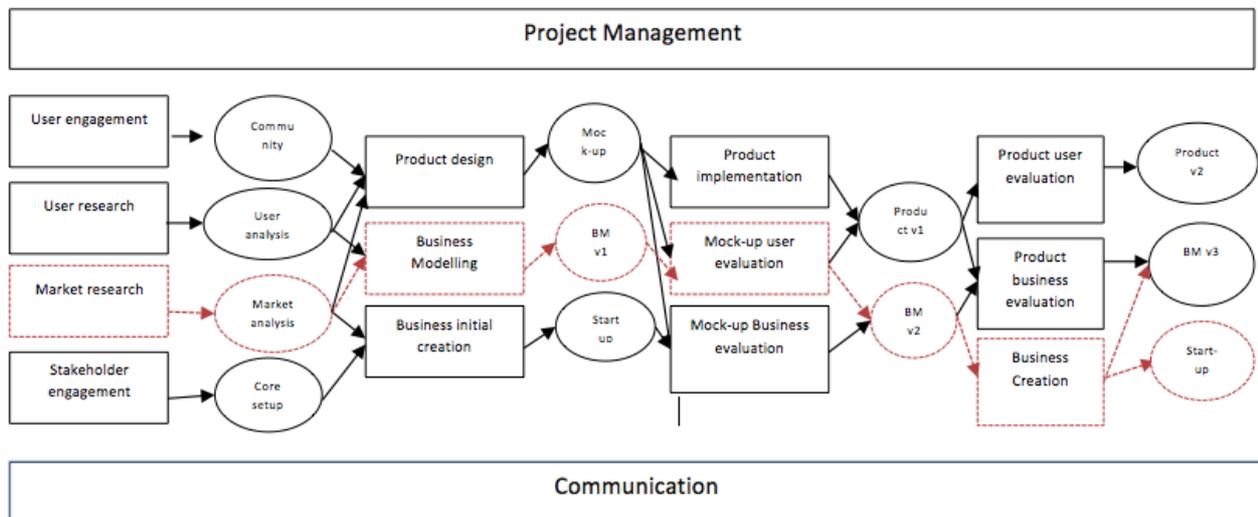

Figure 1. Task division (the red dotted line illustrates the tasks of the business model team)

4. Action Research

The authors of this paper were actively involved on the project. That allowed us to actively intervene, collect data, and feedback. The project partners were meeting monthly in a face-to-face or online setting to discuss updates, and arrange action points for next month. Between the official monthly meetings, bilateral meetings are held between partners when necessary. Other activities include promotion of the project in European level events, focus groups with potential users, workshops evaluating the products and interviews with potential stakeholders.

With this research we wanted to understand how business model exploration is held in a practical setting and make recommendations from our findings. We used action research as our research approach for our study. We used this approach because as Baskerville argues '*Action brings understanding*' (1999). We argue that action research was ideal for this study as it allowed us to be (a) actively involved in the project (as members of the consortium); (b) to obtain knowledge that could be applied immediately, and (c) the research allowed the link of theory and action (Baskerville, 1999).

Berg (2004) points out that there are three types of doing action research: (a) Technical/scientific/collaborative: to test a particular intervention based on pre-specified theories (b) Practical/mutual collaborative/deliberate mode: where researchers and practitioners work together to identify problems and solutions, and (c) Practical/mutual collaborative/deliberate mode: the goal is to empower and promote social change among the practitioners. While the second way of doing action research might receive critics that control is low it was the action design type we followed

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as our aim it was to solve a practical problem with the involvement of participants. Figure 2 presents the action research phases (Baskerville, 1997).

Through the project we repeated the Action Research Phases 14 times. We call each phase an '*action research cycle'*. For each of the action research cycles we 'diagnosed' the problem we 'planned' and 'took' specific actions, we 'evaluate' the outcomes with the project partners and finally we 'formulate' what we learned from this process. Following the Action Research Phase allowed us to structure our research, and reflect on the results (see section 5), while the other activities of the project were in progress.
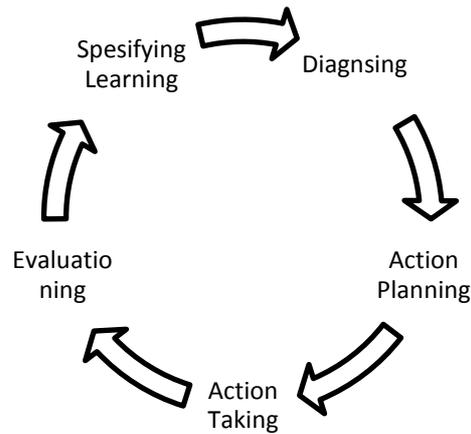

Figure 2. The Action Research Phases (Baskerville, 1997)

Throughout the action research we introduced different business model tools, based on the 'diagnosis', and the planned action. Based on the 'diagnosis' we used business model tooling available at the business makeover database. Regarding the chosen business model tooling, by no means we do not argue that we used all the available business model tooling. We made the decision to only use tooling available from business model database for three reasons: (i) the tooling was freely accessible (ii) this specific database is the outcome of an extensive research (under Horizon 2020), and (iii) sufficiently covered all the business model phases. Regarding the specific tooling we used, based on the identified needs, and the business model phases, we used tooling that were most related to the need. Nonetheless, tooling that is easier to use, and most often used were preferred. The business model tooling we used is: (a) Persona-organisata: (b) Business model Canvas tool; (c) (parts of) STOF Business Model; (d) Value Builder, (e) Focus Group (f) Business Model Cards; (g) Competitors analysis, (g) Thinking Hats (h) Business Model Roadmap (i) Pricing strategy cards, (Business Makeover, 2018). Table 4 presents the business model tooling and the business model phases we used them for. In most cases the authors of this report used the tool and then presented the results to the other project members.

Table 4. The business model tooling we used throughout the business model phases

Business Model tooling we used	BMI phases the business model was used
Persona-organisata	Explore
Business Model Canvas tool	Explore; Design
STOF Business Model	Design
Value Builder	Explore; Design
Focus Group	Test
Business Model Cards	Implement
Competitors analysis	Explore
Thinking Hats	Explore; Test
Business Model Roadmap	Grow
Pricing Strategy Cards	Explore; Grow

Figure 3 presents two of the business model tools we used namely, Value Builder and Business model Canvas tool.

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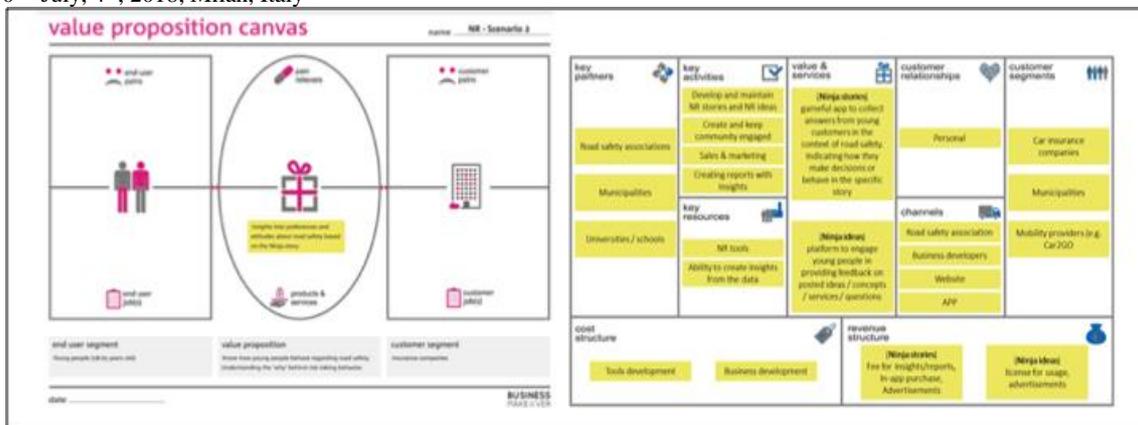June, 30th -July, 4th, 2018, Milan, Italy

Figure 3. Two of the business model tools we used from Business Makeover database

5. Results

5.1 Data Analysis and interpretation

Following recommendations of Action Research scholars, and to increase the validity of our research we document our actions through the process and the ability to explain in practise (Avison et al., 1999). We collected the data in different forms and key informants validated them. Table 5 present the data sources and the quantity of the collected data.

Table 5. Data Sources

Data sources	Amount of produced documents and pages (pages when applicable)
email	365 (related to the business model exploration)
Interviews	13 d documents (19p)
Minutes	12 documents (66p)
Workshops	4 documents
Presentations	9 documents
Official Deliverable regarding business model exploration	1 documents (16p)

In table 6 we present the 14 Action Research Phases we undertook throughout the project. While within the project many activities took part, in the research (and therefore in table 3) we only focus and present the Action Research Cycles that were related to the BMI process. Following the most interesting logs from the logbook regarding the business model innovation process. The action research cycles are described based on out active participation and intervention. The analysis of the minutes, memos, emails, interviews (Baskerville, 1997). The action design cycles combined with the emails database, and the memos and minutes database allowed us to reflect on the Action Research Phase (Baskerville, 1997).

Even though in some cases there were some delays in communicating with other project partners, in general the process was efficient. While our intervention was considered successful for the overall aims of the project, we identify some challenges. Mainly the challenges were related to the fact that the offering was not defined a priori, neither the potential entering market or the stakeholders. These issues required for an exploratory approach from our side on which approaches, or tooling we will use. While the creation of a business without a defined product might be sound an untraditional approach, within the disruptive technologies era, many enterprises find their products outdated and they need to reinvent their offering and thus their business models. For that reason we argue that the identified challenges are generalizable and thus, our learning reflections can contribute to projects dealing with opportunity creation, exploration and business model innovation.

Action Research requires the researchers to define specific explicit criteria before applying the actions in order later to evaluate the results (Avison et al., 1999). Some of our evaluation criteria were 'requested' upon us from the project partners, while other derived after the kick-off meeting. The evaluation criteria were:

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(a)   The partners can understand the business model process we followed
(b)   The partners are able to make decisions and future requests.

The business team and product design team working in parallel with an open communication approach including monthly (virtual) meetings. Findings from the business model exploration steered to some extent the product definition. A challenging part of this project was that the offering was not clearly defined. To conclude to a specific offering a lot of iterations and discussions were made. It is interesting that in a few cases the activities performed by the business team gave a 'push' the other teams to make decisions regarding the offering. For instance the creation of different potential business models provided an overview of potential offerings. When the results were presented to the other project partners a discussion among the teams were made where some of the business models were rejected and others were preferred.

We can argue that we manged to fulfil the criteria and deliver what was requested. We managed to do that by evaluating, revising, exploring and reflecting after every new activity we undertook. Based on the initial requests from the project partners and the revisions we had to make, we contribute to the project by creating potential business models, doing market and competitors research, identifying the value proposition, creating a road mapping for the feature business, and by making the pricing and revenue models.

  We encounter some challenges. One of challenges was that the available tools are more generic and there are not sufficiently technology focused. The used business model tools were useful especially when the business team wanted to communicate them to the other partners or stakeholders. The use of the tooling helped in the business model design becoming more useful (a big challenge when working based on the opportunity creation premise). Developing the product and the business model in parallel resulted sometimes in challenges. The product was not clearly defined in the early stages of the project; hence the initial business model designs do not fully match the final product. Adaptations of the business model design were needed in order to align with the final product definition. Eventually, there were three main business mode cycle iterations. There were many degrees of freedom in defining the business model considering that there was no launching customer defined yet, which created room for creativity but also a wide-ranging set of business model designs. One more challenge is that there is not always a clear distinction between (paying) customers and users. Early in the project, it was clear that these two roles should be separated as users are not willing to pay; however, from the available tools that division is not always clear. Another 'problem' is that the existing business model tools are not made for businesses that are still in an exploratory phase. Multiple versions were needed of alternative business models, value creation etc. A tool that could be more open to more than one potential business model might be useful. From this research we conclude that active and iterative business model experimentation is a necessity when the offering is not clearly defined, when technology gives new opportunities to value offering and when the environment is dynamic.

5.2 Learning reflections

The reflections of each step are presented at the last column (Specifying Learning) of table 6. These step by step reflections derive our lessons learned regarding business model exploration with the use of existing tooling (LL_x) based on them we propose three recommendations (R_x) for the creation of future tooling for supporting the business model experimentation. In the parenthesis we indicate the Action Design Cycles that influence the six learning reflections.

LL_1: Tooling supporting business model exploration is not available and should be developed. Business model exploration is a necessity when there are new business opportunities, and the offering is not clearly defined. Existing business model tooling is useful for the whole BMI process, but they are lacking in supporting the business model exploration, especially when opportunities (or disruptions) make the design of a business model challenging. Additionally, one more issue we identified with the existing business model tooling is that it is not created for the exploratory phase or they do not take into consideration that within a dynamic environment with high uncertainty, alternative business models might be created. Future business model tooling that could be more open to more than one potential business model might be useful. (1;2;3;4;5;6;7;8;9;10;11;12;13;14)

LL_2: Business Model design cycles are an indispensable process when disruptions create opportunities. Revisions and flexibility is important when experimenting with business models. (2;3;5;6;7; 8;10;11;14)

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Table 6. Action Design Cycles regarding business model exploration

Action Design Cycles	Diagnosing	Action Planning	Action Taking	Evaluating	Specifying Learning
(1) What is the project about?	The final offering is not clear. There is not much knowledge regarding business modelling The target group cannot be the same with the paying customers.	Brainstorming on the potential stakeholders.	Business model tooling 'Target the group' was used.	During the brainstorming the project partners firstly identified potential stakeholders that could be interesting in improved mobility behaviour. Then, divided into subgroups the project partners used the business model tooling for a specific stakeholder. With the use of the business model tooling the project partners identified potential 'pains', 'gains' and 'activities' for each of the stakeholders. A detailed document described the whole brainstorming. However, decisions were not made.	When the offering is not clear, the potential stakeholders, customers and target group are not clear either. Brainstorming tools, focus on specific potential stakeholders. At this level specific tooling for business model design can not be used as important details are still missing.
(2) Understand the potential entering market, competitors.	We do not know how the entering market is, and who the potential competitors are.	Market analysis, competitors' analysis.	Desk research and business model tooling 'Competitor analysis' was used.	We present the outcomes to the project partners (i.e. who focus on improved safety mobility offering digital products). That allowed us to understand what the competitors offer and how the market is currently. That allowed the project partners to understand how the market they are entering is and what their offerings are.	An overview of the potential competitors and market is needed. However, the existing tools do not support the exploration.
(3) What is the offering?	Still a specific offering that can add value and compete within the market is not available.	To create some 'scenarios' for the project's potential offering.	We intervene by creating four potential scenarios on what the offering could be and how the paying customers could be.	The scenarios were presented to the other partners' of the project. The partners discussed the possibilities their concerns and finally the excluded one scenario as not fusible and dedicated two others as preferred ones.	When the business offering is not clear, business scenarios alternatives are needed. Exploring the alternatives can give some ideas and reduce the possibilities when one idea is not fusible.

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Table 6. Action Design Cycles regarding business model exploration (continue)

Action Design Cycles	Diagnosing	Action Planning	Action Taking	Evaluating	Specifying Learning
(4) How a potential business model could look?	We realised that the scenarios were not focused enough. So we decided to design potential business models.	A brainstorming session in a face to face meeting with the project partners. In this brainstorming session simple questions will be asked.	Business Model canvas, STOF model. We combined the two approaches and asked the participants, at a workshop setting to think out laud what their ideas are regarding the basic business model questions (who? What? How? What's in?).	The brainstorming helped to answer some questions. The offering was not clear yet. However, this brainstorming derived an important differentiation that it was not clear to the project partners yet. The customers and the target group are different.	Traditional business model are not always detailed and applicable to technology disruption.
(5) Is one business model enough?	The different business scenarios require business models exploration.	We created business model alternatives. It was decided to create four alternative Business Models to be discussed with other members of the project.	The CANVAS Business Model was used. We use printed versions of the tool and we fill out the building blocks.	We communicate the alternative business models made the process of business creation more tangible. The partners welcome the alternative business models and acknowledged that having alternatives helped them to understand what they can do and what not.	We soon realized that one single business model suggestions is not possible. Important decision was made: The 'product' sells insights (information). -We do not need to focus on mobility providers as the only customers. Customers from other fields are possible to be interesting in the product, and not date
(6) How updated version of the product drives business model creation?	The updates from the product development drive an updated version of the Business Model.	The presentation from the product development team and revision of the business models.	Revision on the existing business models, to include the revisions from the product team.	A better understanding of the final offering is made.	Updates and revisions are important when new results are available from other task divisions.

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Table 6. Action Design Cycles regarding business model exploration (continue)

Action Design Cycles	Diagnosing	Action Planning	Action Taking	Evaluating	Specifying Learning
(7) How the users' opinion affects the business model creation?	The offering is at an initial stage. It is not appealing on the users.	We are not responsible for the product development but we were interesting on how potential users find the product. The comments from the potential users made obvious that we need to focus more on how the competitors make their products appealing to their target group.	A new market analysis took place. Now that the product was more focused the previous market analysis was out-dated.	The new market analysis was presented to the project partners. The partners made questions regarding the presentation, while we had a list of specific questions to be answered by the partners. The new market analysis brought potential changes at the business models. -Decisions were made over discussing different possibilities and potential outcomes.	Revision and flexibility is necessary. Some risk taking on the product development can make business model creation more interesting. Business model exploration is again necessity.
(8) How the users' feedback affects the business model design?	The feedback from the users.	To create the value proposition(s) for the offering product.	Value proposition canvas is used.	Based on the latest versions of the business model and the value propositions the management team expressed their opinion regarding the business models. -An order of preference was created.	A decision making tool is useful; for the project partners to create lists of preferences on the value proposition.
(9) What is the value the company can offer?	We still do not know what the value of the product is.	Up to now we created a set of documents that describe what we can offer to the three different types of customers.	New version of business models, -New Value proposition.	Presenting the alternatives to the project partners, trigger discussions and gave then an overview of the potential value propositions.	We had to be flexible and make updates when needed.

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Table 6. Action Design Cycles regarding business model exploration (continue)

Action Design Cycles	Diagnosing	Action Planning	Action Taking	Evaluating
(10) What is the future of the start-up?	Up to now we only have the opinions of potential users. However, we do not have the opinions of potential stakeholder think.	Interviews to validate our assumptions.	We arranged meetings with different type of stakeholders and we present the product and the business model. The main outcome of the interviewees was that the want proofs that the product will be successful. Also they asked for pricing models.	The interviewees provided some comments and suggestions. These comments contributed to the business model exploration process too. From the minutes we create after the interviews we understood that the main request from the interviewees was, that the business model needs, need to be appealing and to be able to prove some potentials for success. The pricing was the other important factor.
(11) Which one to choose? How is the start -up going to make money? What should be the price of the offering? If it's for free we will find customers but no profits. If there is a high price then customers will not buy a newly lunched offering.	Until now we only had as revenue model the white label option. We want to investigate all the options and possibilities, find the gains and the risks of the different models.	To create alternative pricing and revenue models for different business model and for different timings of the start-up (initial, after one year, later).	Revenue model/ pricing models tools to support the actions.	Alternatives to make decisions regarding the pricing and the revenue. The alternatives were presented and discussed with the partners. Making a final decision was challenging.
(12) How the business will look from the initial creation to a long running successful business?	Future estimation is not possible but alternatives and experimentations could contribute to an organised approach.	To create a planning of how the business will look from the start-up creation to a longer team.	Road mapping tool is used	The future steps of the business were suggested. Also it was identified that during different period of the business other type of business models are needed. We suggested a road mapping of the different business models.

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Table 6. Action Design Cycles regarding business model exploration (continue)

Action Design Cycles	Diagnosing	Action Planning	Action Taking	Evaluating	Specifying Learning
(13) What are the final decisions before the start-up creation?	Create a final list of decisions/recommendations	Decisions are made regarding the final suggested business model, value proposition, road mapping, pricing model and revenues.	Presentation to the project partners, official deliverable that involves our recommendations.	Decisions on what business model, value proposition, revenue model and pricing model should be used at the initial face are made. Alternatives for the future are available.	It is challenging and it is asked the business team to make suggestions. Uncertainty is high. Support is needed to make decisions.
(14) Understand the potential entering market, competitors.	We do not know how the entering market is, and who the potential competitors are.	Market analysis, competitors analysis.	Desk research and business model tooling 'Competitor analysis' was used.	We present the outcomes to the project partners (i.e. who focus on improved safety mobility offering digital products). That allowed us to understand what the competitors offer and how the market is currently. That allowed the project partners to understand how the market they are entering is and what their offerings are.	An overview of the potential competitors and market is needed. However, the existing tools do not support the exploration.

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***LL₃**: An initial business model version is needed to have adaptations with each new decision or innovation.* From the whole process we realized that the business model exploration is becoming more focused when there is an initial business model to work upon. The initial business model allowed iterations that provided advantages. For instance, the market and competitor research was instrumental in finding out the competitive edge of the offering, and thereby steered the product development. (3;5;6;9;12)

***LL₄**: The use of business model tooling from an early stage allows the identification of questions that need to be answered and hence, more focus on what the next steps on business model creation should be.* The use of business models tooling from an early stage allowed the identification of unanswered questions. Having alternative business models designs allows the realization of unanswered questions. Due to the active collaboration the questions were, then answered (or processed) by other project partners. Additionally, the use of the business model tooling made the processes easier for the partners that are not experienced with the business model process. In general the existing business model tools were quite easy to use and to be understood. The tools were useful especially when the business team wanted to communicate them to the other partners. However, as it was mentioned before the researchers had experience with the tools so they should not be considered as new users of the tools. Tools helped in the design process to become more focused (a big challenge when working based on the opportunity creation premise). In most of the cases the authors of this paper used the tool and then presented the results to the other project members. The other participants acknowledge that the use of the tools made the process easier and more focused. However, a problem that we occurred with the use of the existing tools was that they are more generic and are not sufficiently technology focused. (4;6;7; 9;11; 12;14)

***LL₅**: Exploring potential solutions, changes and alternatives is important when the business model is not clearly defined like in a case of a new technology.* (2;3;4;6;7;8;9;10;11)

***LL₆**: Existing business model tooling do not sufficiently support decision making regarding BMI.* One of the most asked question when we were presenting new results to the project partners, and at the same time a challenging task for us was what option/alternative we chose. Deciding upon which business model to choose, or even more specific which pricing mode to choose, which product is prefer etc., is a demanding part of the process. Existing tools supported as to create alternative models but supporting the decision making was not possible. However, we do not argue that a single tooling can 'take decisions' for us, but could support us by, for instance create a list of preference. (10;13)

The six lesson reflections derive three recommendations (Rₓ) for the development of future business model exploration. The main recommendation is the need for the design and development of business model tooling supporting business model exploration. *(Derived from LL₁; LL₂; LL₄).* This tooling could be designed based on the recommendation below:

> ***R₁***: Future business model tooling should support the design of business models even when the building blocks are not clearly defined. *(Derived from LL₃)*

> ***R₂***: Future business model tooling should take intro consideration the ability to create alternative business models when new opportunities are available. *(Derived from LL₅)*

> ***R₃***: Future business model tooling should have functions that support the decision-making regarding alterations on the business model. *(Derived from LL₆)*

Figure 4 presents our main recommendations as there were extracted from the lessons learned. Our three main recommendations can drive the creation of business model tooling that could contribute to the business model exploration.
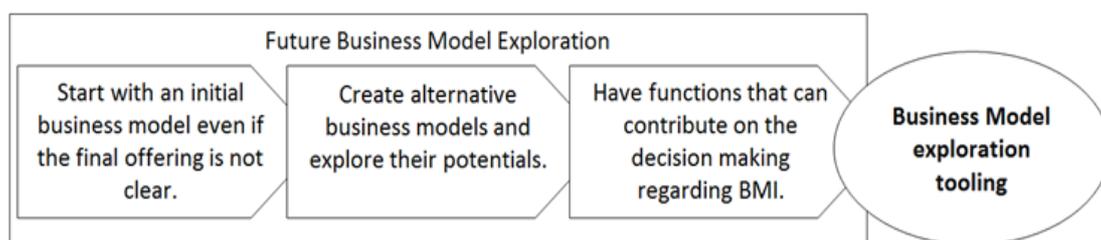

Figure 4. Our main recommendations on Business Model exploration process

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6. Conclusion

In this paper we actively intervene in an R&D project regarding safe mobility. Our task in this project was to support the creation of the business model for the final outcome of the project, that is a start-up. We intervene by introducing existing business model ontologies and tooling to the project partners throughout the project period and collecting feedback on how the existing tooling supports the business model exploration process. This process allowed us to conclude on the activities that some of the existing business model tools contribute, and what it is still missing.

Our initial findings suggest that the use of business model tooling improves the communicability of the business model. Additionally, we observed that business model exploration is an inevitable process when the value offering is not clearly defined, or when there are new business opportunities. Our initial recommendations derived by the obstacles encountered during the process (e.g. the offering not well defined, not a clear view on who are the potential paying customers who were willing to invest on the offering, the project partners asking some examples or possible solutions for inspiration, the need for revisions and evaluation while designing the offering, decision making). Based on the obstacles our recommendations regarding business model exploration are: (a) to start with an initial business model even if the final offering is not clear, (b) to create alternative business models and explore their potentials, and (c) use tools or practices that can contribute on the decision making regarding BMI.

The paper aimed at contributing to the BMI literature by providing the above recommendations for BMI. Our approach could be used for business model exploration for different offerings, industries, and markets. For the practice, the recommendations can be used, within organizations, as a starting point for discussions regarding business model implementation and exploration.

We contribute to the BMI literature by providing the above recommendations for BMI. In future research, we will use these recommendations as functional requirements for the design of business model exploration tooling. Our approach could be used for business model exploration for different offerings, industries, and markets. For the practice, the recommendations can be used, within organizations, as a starting point for discussions regarding business model implementation and exploration.

A limitation of our paper is that the results are based on one single project. While the results were grounded over the logbook, the memos, minutes and emails the active and personal involvement of the authors in this action research could be a source of bias. To increase the validation of our results we communicate and received feedback from the project partners (by given presentations, Skype meetings, face to face meetings) after each activity. Another limitation of our study is the focus on the mobility ecosystem domain. While this domain is appropriate due to the rapid technology disruptions, the newcomers, the amount of start-ups, and the variant business models, future studies in other domains could be done in order to strength the generalizability, and the applicability of our results to other domains.

Up to this moment (6 months after the end of the project) we could analyse the data until the official end of the project and the creation of the start-up. It would be interesting for future studies to follow the start-up as it goes to market, and track the dynamics of the business model design and the implemented business model over a longer period of time. It would be interesting, feature studies to follow the created start-up as it goes to market, and track the dynamics of the business model design and the implemented business model over a longer period of time.

In our study we used and tested in practice existing business model tool towards the exploration and design of business models within an unexpected environment. Our recommendations can be used as requirements as design requirements for designing and developing tooling for business model exploration. Our methodology can be used for future studies in other domains too, and compere the results to understand the differences in the use of business model tooling for the business model exploration process.

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