



A BUSINESS MODEL CANVAS FOR IDECIDE – HOW TO DESIGN A NEW DECISION MAKING APP?

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1. Introduction

As products become increasingly complex and have to be developed in shorter development cycles, product developers have to make decisions effectively and efficiently [Luft et al. 2015]. Decisions are made throughout the development and are crucial for the complete product lifecycle. They are taken in different situations in which multiple conflicting and complementing criteria must be considered. In this context, methods and tools can be used for making appropriate decisions. They shall primarily help to manage the cognitive workload of decision makers [Roy 1993] and improve human decision making in a context in which rising information and requirements on products have to be considered.

1.1 Challenges in decision making

In general, decisions can be taken either consciously or unconsciously. The consciously made decisions can be further differentiated into purely intuitive decisions, improvised decisions and methodically supported decisions. With increasing importance and scope of the decision, a methodological support of the decision situation and the corresponding decision making process (e.g. for the objectification) is important. By using systematic evaluation methods, an objective basis for decision making can be designed to minimize the risks of wrong decisions. This is especially relevant for decisions in the product development process, as wrong decisions often lead to very high subsequent costs. Ehrlenspiel and Meerkamm [2013] state that decisions during product development can have far reaching consequences. While some decision situations are easy because their respective consequences can be identified with precision, other decision situations are characterised by complex steps and consequences which are difficult to predict [Jupp et al. 2009], [Luft et al. 2015]. The basic principle is that with increasing complexity consequences are getting harder to anticipate and this leads to the need to support decision making processes methodically [Bennet and Bennet 2008] and with computer assistance (e.g. an app). Therefore, a decision maker needs not only to make decisions serving his own goals, but to take into consideration the effects a decision has on further steps in the development of the product or on its later use. A “Rubik’s cube” represents a good abstraction of this situation. The aim of gaining homogenous colours on each side of the cube represents a complex goal while the single sides of the cube represent several sub-goals that have to be solved in order to complete the overall task. The process of evaluating which side to twist in which direction as well as the actual twist represents one decision making process. Thereby, one side of the cube represents the perspective of one decision maker, while the other sides represent perspectives of other decision makers. To recognize the decision perspectives of other stakeholders, the regarded decision maker has to turn the cube to take a look onto the other sides. A

remarkable fact is that one side of the cube can be homogenous while the others are still heterogeneous. Consequently, optimizing the own sub-goal (one homogenous side) does not necessarily lead to a solution of the overall goal (all sides are homogenous). Therefore, the consequences resulting from a twist of the cube have to be examined in regard to the other sides of the cube as well, as all sides are interconnected [Luft et al. 2015].

When transferring the model of the Rubik's cube to a development process, the cube is representing the task of developing a complex product, which has to be modified and defined more closely. While a Rubik's cube works relatively simple and follows clear rules, a cube representing the development of a complex product would have numerous sides, while rules, if they are possible to define at all, are far more complicated. In a development environment, layers can be twisted due to outside forces that cannot be controlled (e.g. environmental changes). A twist cannot always be reversed and effects of twists sometimes occur with time delay [Luft et al. 2015]. Moreover, the perspectives of other involved decision makers cannot always be viewed as they might be unknown. The fulfilment of one sub-goal can negatively influence a later goal [Luft et al. 2013c], sometimes due to a lack of knowledge about these goals. While some goals can be fulfilled without negative side-effects onto following goals, others bear consequences that have to be regarded. The challenge is to identify these potentially critical situations. Once identified, the decision situations need to be structured and analysed to understand how negative consequences can be controlled and reduced [Luft et al. 2013c].

A widespread example of the problem is the timewise difference of determination of costs and their actual occurrence. Hence, thoughtful decision making is especially important during product planning and development (compare [Luft et al. 2013b]), due to the fact that in average seventy percent of all costs are determined during these phases of the products lifecycle. Decision making is supposed to be done faster while being exposed to a rising degree of complexity. This complexity can be managed by distributing tasks among an increasing number of decision makers who are experts in their domain. While these tasks represent the stated sub-goals (sides of the Rubik's cube), another problem occurs. In many cases, sub-goals affect and contradict each other. The problem that can be derived is that the apportioned sub-goals can potentially contradict each other and trigger unwanted consequences that might remain unnoticed until they appear.

1.2 Objectives of the Special Interest Group Decision Making and this paper

In order to reach the overall goal, mutually influencing aspects have to be considered and adjusted. Thus, to meet the technical requirements for a product (i.e. engineering perspective), for example, the most exclusive materials and production processes can be used to reach technical sub-goals. However, this contradicts another sub-goal that usually has to be met from an economical perspective. The product has to be produced and sold by obtaining a certain profit margin. In case of this example, the product might get too expensive to be sold. As a result, the developed product fulfilled the technical sub-goals but it did not reached the economical sub-goals and therefore the overall goal of the company is not achieved. That is the reason why the authors have elaborated during the past Special Interest Group Decision Making (SIG DM) workshops the methodological and conceptual foundation for a systematic and interdisciplinary decision making process (section 2). It turned out that the task of the decision making needs to be supported not only methodologically but also through the use of IT tools (e.g. more data and information has to be collected and analyzed) (see [Luft et al. 2013a]). Therefore, the long term goal of the authors is to develop an iDecide App for a computer-aided evaluation and decision making process. This app should support product developers in complex decision making situations (see [Luft et al. 2015]) regarding the aforementioned challenges (section 1.1) during the development process.

The aim of this paper is to describe some possible use cases and business models for an iDecide App with the help of the Business Model Canvas (BMC). The BMC is a method for elaboration and discussion of business models. Some BMCs for an iDecide App have been developed during the last SIG DM workshop. After a short description of some backgrounds and the presentation of the BMC (section 3), some preliminary results and case studies are described (section 4). This should initiate an in-depth discussion on a detailed business model and application area for an iDecide App for decision making in (engineering) design practice.

2. Background information on past workshops

2.1 Context of the project

The SIG DM regularly organizes workshops during conferences endorsed by the Design Society. In these workshops, presentations by researchers alternate with group work and discussions on topics related to decision making in design. The topics in the past four years have been the following:

- At DESIGN 2012, two workshops took place respectively on scientific decision making approaches and on types of decision making and their connection.
- This discussion continued during the workshop in Paris (March 2013) with a focus on uncertainty in decision-making and validation of decision-making approaches.
- At ICED 2013, the subject of interdependencies between strategic and operational design decisions was tackled, as well as the characterization of decision making situations.
- At DESIGN 2014, design methods to reduce decision complexity have been discussed in detail.

The emphasis was also on creativity methods and specific criteria to evaluate results.

The workshop, which is described in in this paper, took place during ICED 2015 in Milano. After methodological issues debated in the previous workshops, the workshop in Milano was more action-oriented. It stems from two facts. First, that decision making is a universal issue. Secondly, that mobile apps are nowadays a common and practical way to implement a wide range of tools. Market analysis from Gartner forecasts 268 billion app downloads in 2017. Some decision making apps are already available, with names such as Choicemap, Decision Buddy and Best Decision. However, the backstage mechanism in these apps, which weighs options or suggests favourable choices, is usually not clearly laid out. Therefore, it is difficult to evaluate these apps scientifically.

Consequently, during the workshop, participants were proposed to work on an app for decision making: the iDecide App. The idea was to start from scratch: a name, and a very broad requirement "an app for decision-making". The aim of the project is twofold. The first objective is on the actual product of the workshop: to come up with an actual concept for an app and to show how scientific knowledge on decision making can be implemented in a practical, user-friendly, universal tool. Besides this objective, there was also great interest in the process: to study the way participants build their proposition as a design project. A design method was provided: the BMC. The use of BMC for early design stages was evaluated after the workshop by the authors.

2.2 Processes and workshop done

In practice, the workshop was organized in the three-hour slot for SIG meetings of ICED 2015. Twelve people participated in the SIG DM workshop. There were four organizers, who intervened as little as possible in the work of the teams (only to precise or reformulate some tasks). The workshop was organized in three parts: an introductory part and two group works each with a presentation and short discussion at the end.

The introductory session lasted 30 minutes. In this first part, the organizers and the participants presented themselves. The objectives of the workshop were explained. Finally, the BMC was presented. At the end of the presentation of the BMC, the participants were asked a few questions to guide their work. The questions and tasks were exactly the following:

- Who will be or could be the users of the iDecide App?
- Examples of decisions which could / should be made with the iDecide App!
- Needs and requirements regarding the iDecide App!
- Collection of information about existing decision making process models!
- Collection of ideas regarding new decision making processes!
- Key and crucial steps within the decision making process!

Then, participants were split in three groups of four people. Each group worked on a BMC template to provide a first concept of an iDecide App for 30 minutes. Then, they presented their proposition to the whole class (60 minutes). In this first part, groups filled the nine dimensions of the BMC. Pictures of the three different BMC were taken for documentation and analysis purposes. In the third part, groups focused on the core of the BMC, the value proposition. They were not given specific instructions or

format. They worked freely for 50 minutes, and 20 minutes were necessary to present the results of the three groups. Here again pictures were taken to record the proposition of each group.

3. Business Model Canvas and Decision Making

3.1 Presentation of the Business Model Canvas

In 2010, Alexander Osterwalder presented the Business Model Canvas, a new method which aimed at helping start-ups to find their business model as fast as possible. It is simply composed of nine boxes organised in a logical way in which hypothesis are laid down [Osterwalder and Pigneur 2010].

The job is then to "go out of the building", as Steve Blank says [2013], and find out if these hypothesis are valid or not. The start-up can then easily adjust, change and pivot around its business model until it finds a product/market fit.

The Business Model Canvas, presented in Figure 1, is centred around its principal box, the Value Proposition (VP), in which is described the problem to be solved, the customer needs satisfied and the value delivered to the customers. The right part of the Business Model Canvas concerns the customers. On the far right, the Customers Segments are described, the most important customers targeted by the VP. Then, between the Customers Segments and the VP is the Customer Relationships box. For a start-up, the different steps are:

- Acquisition: how do customers know about the VP?
- Activation: why do customers have a first experience?
- Retention: why do customers come back?
- Revenue: why do customers want more VP and are willing to pay for it?
- Referral: how do customers tell others about the VP?

Just under the Channels box in which is described how the VP is delivered to the customers. The bottom right box is about the Revenue Streams, in which is described how the customers pays for the VP. The left part of the Business Model Canvas describes how the VP is realized. On top, the Key Activities box describes the skills needed to create the VP and the box below, Key Resources, describes the most important assets with regards to the VP. On the far left, the Key Partners which help the start-up to go faster and to focus on its core activities are listed. The bottom left box mirrors the bottom right one by presenting the Cost Structure generated by the VP creation.

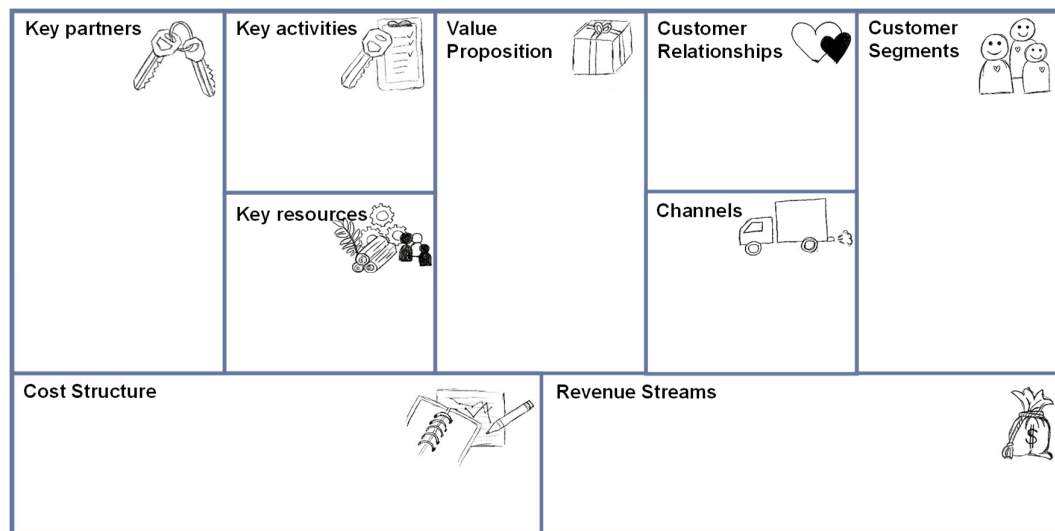


Figure 1. Business Model Canvas from Osterwalder and Pigneur [2010]

3.2 Proposition of a Business Model Canvas for a new application helping decision making

In 2014, Osterwalder et al. [2014] presented the VP Canvas to help start-ups build their VP, which can be the hardest part of the Business Model Canvas. It is composed of a circle representing the customer

(on the right of Figure 2) and of a triangle (on the left), which represent the VP, each of them are divided in three parts. The field "Customer Jobs" includes what the customer wishes to accomplish, independently of the product or service. Those jobs can be functional, social or emotional. On the circle top left, his "Gains" are listed: why the customer wants those jobs to be done, what is he looking for, dreaming about. On the bottom, his "Pains" are described: why his experience of having these jobs done is not going smoothly, the difficulties, fears or risks he encounters. On the left part of the VP triangle, the "Products & Services" are described: what do they do? On the top, the "Gains Creators" present savings that make the customer happy or outcomes that the customer expects or that go beyond his expectations. On the bottom, the "Pain Relievers" present how the products & services eliminate risks the customer fears or put an end to difficulties the customer encounters.

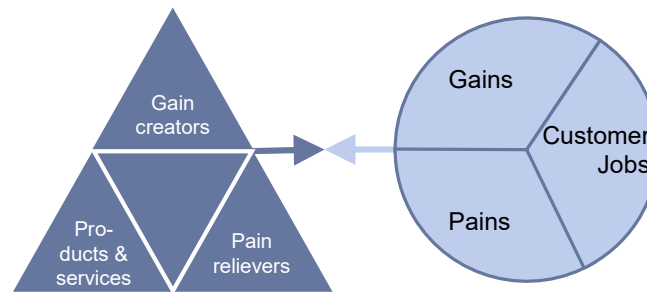


Figure 2. Value Proposition Canvas from Osterwalder et al. [2014]

4. First concepts for the iDecide App

The following section describes some concepts for an iDecide App. These concepts emerged during and after the past SIG DM workshop. In section 4.1, the rough business model for the iDecide App is presented by using the BMC. The next section explains the general possible functionality or the procedure of the iDecide App (section 4.2). Thereafter, we present two industrial use cases for an iDecide App. The first use case sums up the concept decision regarding an electric car (section 4.3) and the second use case explains the concept decision regarding a motor (section 4.4).

4.1 The Business Model Canvas for the iDecide App

Within the workshop, three groups worked on the development of a BMC. The BMC has been used to analyse an iDecide App that will be developed in the future. The following Figure 4 shows how this analysis could look like. In the case of the iDecide App, the value proposition is generated through channels (e.g. websites, app stores) and should help the customers to ask appropriate questions, make the best suited decision or even find the right decision making model. Therefore, within the BMC there could be easily described new or existing business models. This description is used as a basis for decision making processes.

As it could be seen in the business model, the iDecide App should mainly be designed for employees in the industrial sector. Especially for project managers and design engineers within a product development process. The app should help with decision making processes in the product or service design development, so for example the project leader could use it to communicate with his team and it could help to assess the different options and even to analyse the final results.

4.2 Procedure of the iDecide App

Furthermore, in the workshop there came up ideas how the app could work based on decision making models and processes (compare Figure 4). After defining the decision making task, the evaluation team must be set up. An advantage of the app is that the members of the team do not have to stay at the same time at the same place. Instead, they could communicate and share their information by using the iDecide App. For instance, if the project leader has to make a decision on a new product to be developed, it is possible to define the task in the app and send it to the related evaluator.

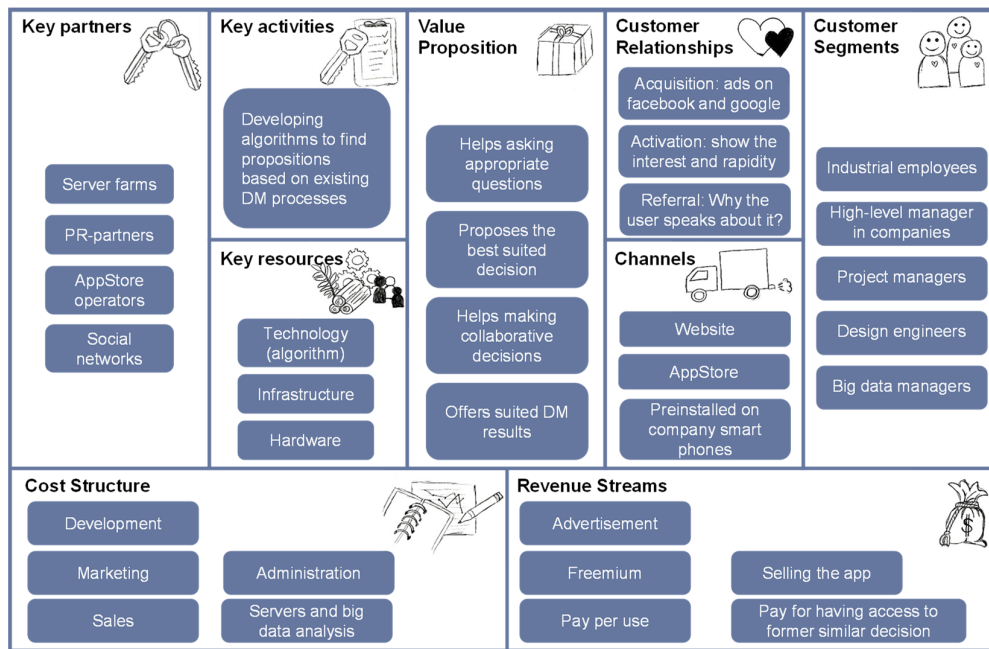


Figure 3. Brief BMC for a generic iDecide App

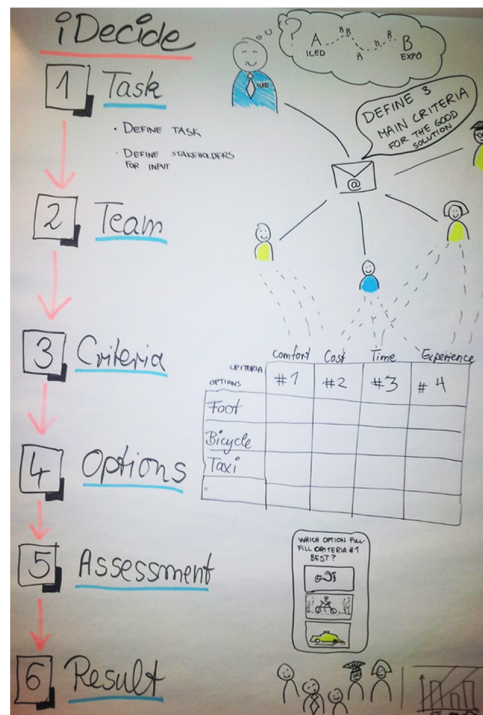


Figure 4. Abstract representation of a decision making process (created in the workshop)

In addition, the app has to give the possibility to define options and criteria for the decision making process. For this, the BMC is used as a basis. The BMC includes information regarding different channels or customer segments, which are defined by the team. In the next step, the team has to evaluate the various options with regard to the previously defined criteria. In the last step, the project team has to analyse and interpret the results. Subsequently, the project leader or the team members have to decide and have to choose one option. The picture (Figure 4) shows the process how the app could probably work.

4.3 Industrial use case: concept decision electric car

The following BMC of the business case "development of an electric car" (Figure 5), which has been created after the workshop, could be the basis of for a decision making process. The task could be the decision between selling the technology and protecting the technology and selling the final product.

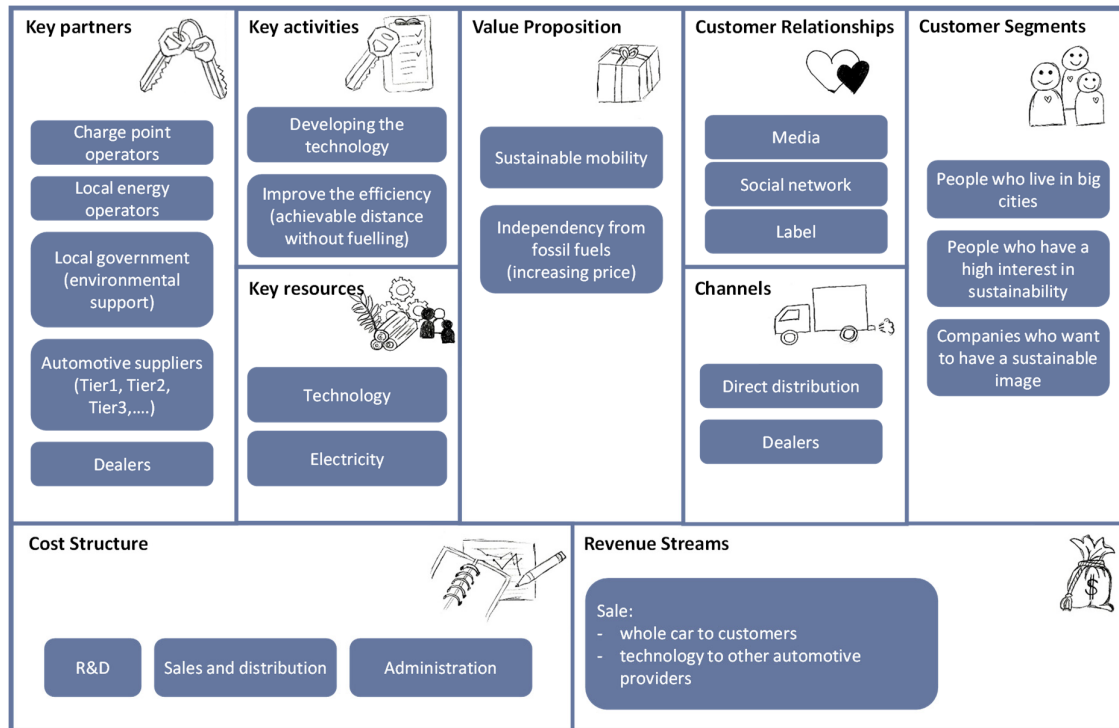


Figure 5. First results from a group for a concept decision regarding an electric car

This concerns the BMC-box "revenue streams". First, the task has to be defined. Two alternative strategies of revenue streams are generally possible: the selling the technology and the protecting the technology and selling the final product.

The next step is the definition of an evaluation team that discusses the two different options regarding several criteria that have to be defined before. These steps could be done without a meeting of the involved persons. The team can communicate and share information by using the iDecide App. The evaluation criteria could be, for example, expected costs, risks, revenue or even market penetration (Figure 6). The iDecide App supports the team in this step by providing a structured platform for communicating, analysing and presenting different options and criteria, for example, in a chart.

The assessment of the different options could be done with a numerical scale or even a pairwise comparison. The iDecide App supports this step by suggesting proper evaluation methods. In this case, the evaluation is done with a numerical scale from 1 to 10, while 1 means "low" and 10 means "high" (see Figure 7). The final step is the analysis and interpretation of this evaluation chart. This process can be run automatically by the iDecide App. Subsequently, the iDecide App presents the analysed data in a graph or another form that could be easily interpreted by decision makers (Figure 7).

Criteria	Expected costs	Expected risks	Expected revenue	Expected market penetration
Options				
Selling	3 points	9 points	6 points	5 points
Protecting	8 points	7 points	8 points	5 points

Figure 6. Different criteria and options

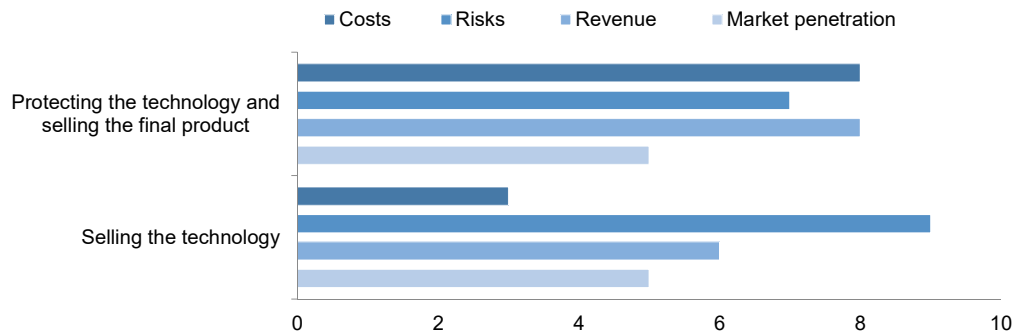


Figure 7. Expected costs, risks, revenue and market penetration

In this case, the decision would be made for protecting the technology because only the costs were assessed worse in comparison to selling the technology. The example shows how the iDecide App could support a team in a decision making process. Indeed, the iDecide App takes not the final decision regarding the options considered.

4.4 Industrial use case: concept decision for motor

The possible application of the iDecide App is now illustrated in an exemplary industrial use case. A company providing products, systems and solutions for construction professionals has started a development project for a new rotary hammer. This rotary hammer is one of many products featuring an electric platform drive. Typical challenges regarding this kind of development setup especially concerning portfolio decision making processes are described in [Ponn 2015].

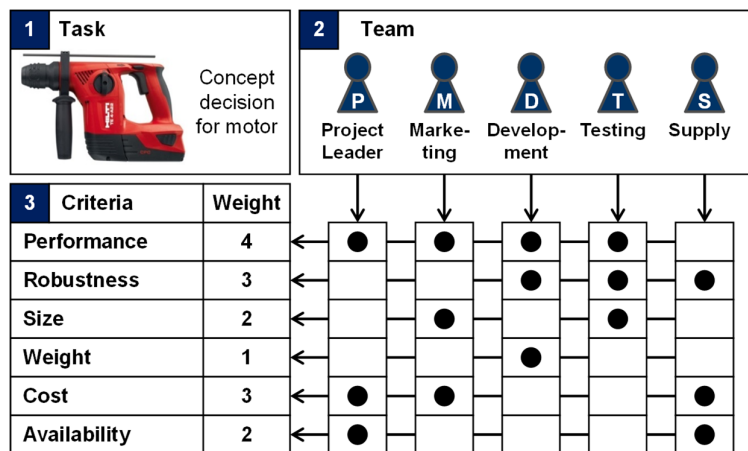


Figure 8. Use case motor concept decision: task, team and criteria

At a certain phase in the project, a concept decision for the motor is needed. The project leader initiates the decision making process by sending a list of relevant decision criteria via the app to the rest of the members of the core team (marketing, development, testing and supply). There are six criteria: performance, robustness, size, weight, cost and availability. Each team member is asked to nominate the three most important criteria from the list. By adding up all points a weighting of the decision criteria can be calculated by the app.

Three different motor concepts are regarded as options in the scope of this decision.

- Concept 1 is based on an existing motor technology that is characterized by its low cost. The technology is used in many other products and is readily available.
- Concept 2 is also based on an existing motor technology. However the motor is a bit more compact and has less weight compared to concept 1 at a slightly higher cost. Some adaptation efforts are necessary, therefore a certain development time is required.

- Concept 3 is based on a new motor technology. It features a significantly higher performance and robustness at higher cost. Due to its novelty, major development efforts are necessary to bring the technology to serial maturity.

The assessment of the considered concepts is carried out by rating each concept (1-4 points for each concept and criterion, whereas 1 means that the criterion is fulfilled poorly and 4 means that the criterion is fulfilled well). The project leader sends messages via the iDecide App to certain team members, which are able to conduct the rating due to their field of expertise in the project. The testing engineer delivers the values for the criteria performance and robustness, based on relevant tests. The development engineer delivers the rating for size and weight. The supply manager gives an estimation on cost and lead time. The iDecide App leads the team through the process and combines all data into a summary of the assessment.

Finally, the team comes together to discuss the results and draw a conclusion. The team recommends pursuing concept 3 further because it provides the highest level of differentiation (high performance to weight and high robustness). The higher cost and long development time are judged as acceptable.

1Task  Concept decision for motor		4Options Concept 1  Concept 2  Concept 3 					
3Criteria Weight		P	P * W	P	P * W	P	P * W
Performance		3	12	3	12	4	16
Robustness		2	6	2	6	4	12
Size		2	4	3	6	3	6
Weight		1	1	2	2	3	3
Cost		3	12	3	9	2	6
Availability		2	8	3	6	1	2
5Assessment		16	43	16	41	17	55

Figure 9. Use case motor concept decision: options and assessment

This use case gives an impression how an iDecide App might support a development team in the decision making process. Major benefits are:

- *Reduction of complexity:* with the help of the App the process is broken down into "digestible" steps. The App guides the team through the process. Results can be displayed in a clearly arranged format that serves as common basis for the discussion in the team.
- *Increase of efficiency:* the App helps to reduce the required effort. The workflow of the decision process is embedded in the app. The collection of data is triggered by messages to the relevant team members. The input from each team member is collected and processed in an efficient way.
- *Increase of motivation:* the App creates an interactive process with a certain "fun aspect" that increases the motivation of the team members to participate in the process.

5. Conclusion

5.1 Contribution and conclusion

Finally, the authors and the participants of the last SIG DM workshop concluded, that an iDecide App is one valuable and user-friendly tool for a systematic and computer-aided support of decision making tasks during product development. Consequently, the long-term goal of the authors is the development of an iDecide App for a computer-aided evaluation and decision making process. This app should support product developers and managers in complex decision making situations (cf. [Luft et al. 2015]).

The main advantages of an iDecide App are the reduction of the complexity, an increase of the efficiency, transparency and objectivity as well as a higher motivation of the user.

5.2 Limits and future work

Some business models for such an iDecide App are described with the help of the BMC method in this paper. We have shown that the BMC is very appropriate for the early steps of the development of the first concepts for an app. However, these concepts need to be further developed and redefined. Thereby, we will also include the current state of the art in the field of expert systems and application of artificial intelligence in decision making processes. In addition, it is also very important to get feedback from industry representatives and potential users. This allows conceptualizing the app right from the start for the needs and requirements of future decision makers. The authors and interested researchers will be working in the future on these tasks.

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