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Developing Design Principles for a for Crowd-Based Business Model Validation System

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Abstract. The high uncertainty of creating business models demands entrepreneurs to re-evaluate and continuously adapt them. Therefore, incubators offer validation services. However, systematic, and scalable information systems to enable interaction with a crowd of potential customers, investors, or other stakeholders and entrepreneurs do not exist. Our aim is thus to develop tentative design principles for crowd-based business model validation (CBMV) systems. Such systems should support entrepreneurs to reduce the uncertainty about the validity of their business model. Thus, we apply a theory-driven design approach based on knowledge drawn from literature and complemented by empirical insights. For developing such information systems, we combine the concept of crowdsourcing with findings from research on decision support systems to propose theory-grounded design principles for a CBMV system. The identified design principles describe a potential solution to a problem that previous research proved as viable.

Keywords: Service; Decision support; Crowdsourcing; Business model; Entrepreneurship

1 Introduction

The rapid digital transformation of businesses and society creates tremendous possibilities for novel business models to create and capture value. Many Internet startups such as Hybris, Snapchat, and Facebook are achieving major successes and quickly disrupting whole industries. Yet, many digital ventures fail. One reason for this is that entrepreneurs face high uncertainties when creating their business models. Consequently, entrepreneurs must constantly re-evaluate and continuously adapt their business models to succeed [1].

One way to deal with uncertainty during the development of business models is the validation of the entrepreneur's assumptions by testing them in the market or with other stakeholders such as suppliers or complementors [2] . Such a validation allows the entrepreneur to gather feedback to test the viability of the current perception of a business model and adapt it, if necessary, before potentially wasting money. For this purpose crowdsourcing has proven to be a valuable mechanism [3] in other contexts.

Literature on business models provides a rich body of knowledge about different components or the initial design [4, 5], however, they do not provide any information systems that support such processes and enable the integration of the diverse voices of stakeholders [6]. Thus, service institutions that create a supportive environment for startups, so-called incubators, function as intermediaries that connect different actors such as consultants, business angels, or venture capitalists with entrepreneurs for the exchange of services. Although business model validation services are a repetitive activity of incubators, systematic and scalable solutions to enable interaction to validate business models do not exist. In this context, IT creates opportunities to design systems that support the entrepreneur in business model validation.

Therefore, the aim of this paper is to develop tentative design principles for crowd-based business model validation (CBMV) systems. Such information systems support entrepreneurs in learning and reducing the uncertainty about the validity of their assumptions. With this aim in view, we develop design principles that guide the design of prototypes for CBMV systems. We refer to design principles as the tentative properties of a generic solution drawn from literature that address the potential solution space of such artifacts. The purpose of this paper is thus to develop design principles for information systems that feature crowd-based business model validation.

To derive our design principles, we follow a design science approach [7, 8] guided by the process of Vaishnavi & Kuechler [9]. This paper follows a theory-driven design approach based on knowledge drawn from literature and complemented by empirical insights. For developing CBMV systems, we combine the concept of crowdsourcing with findings from research on decision support systems to propose tentative design principles. The identified design principles describe the core of a solution to a problem that previous research proved as viable. We therefore ensure theoretical rigor while developing a system to solve a real-world business problem.

Following a design science approach, this paper proceeds as follows: In section 2, we introduce related work. Section 3 provides a brief overview of our research methodology. We then give insights into the problem awareness and our identified design requirements derived from our kernel theory and interviews in sections 4 and 5. Section 6 then reviews design-relevant knowledge to guide the development of design principles that address these requirements. Concluding in section 7, we close with a discussion of our findings and contribution.

2 Related Work

2.1 Business Model Validation in Early-Stage Startups

To formulate the problem for our design research approach, we reviewed current literature on business model development. The concept of business models has gathered substantial attention from both academics and practitioners in recent years [6]. In general, it describes the logic of a firm to create and capture value [4, 10]. Although there is no commonly accepted definition of the term, this concept provides a comprehensive approach toward describing how value is created for all engaged stakeholders, the allocation of activities among them, and the role of information technology [11, 12]. Following Teece [13], a business model reflects the assumptions of an entrepreneur and can therefore be considered as a set of "hypotheses about what customers want, and how an enterprise can best meet those needs, and get paid for doing so".

In the context of early-stage startups, business models become particularly relevant as entrepreneurs define their ideas more precisely in terms of how market needs might be served. In addition to that, it helps the entrepreneur to examine which kind of resources have to be deployed to create value and how that value might be distributed among the stakeholders [14]. Such early conceptualizations of a startup's business model represent an entrepreneur's assumptions about what might be viable and feasible but are mostly myopic in terms of the outcome as entrepreneurs are acting under high levels of uncertainty [15]. Since entrepreneurs are operating under high levels of uncertainty, they start a sense-making process in which they test their initial beliefs about the market through iterative experimentations and learning from successful or failed actions [16]. When the entrepreneurs' assumptions contradict with the reaction of the market, this might lead to a rejection of erroneous hypotheses. This will require a reassessment of the business model to test the market perceptions again. Thus, the business model evolves toward the needs of the market and changes the assumptions of entrepreneurs [15, 17]. The success of startups thus heavily depends on the entrepreneurs' ability to develop and continuously adapt their business models to the reactions of the environment.

2.2 Previous Work on Crowd-Based Validation

Practitioner literature recognizes that many business models fail due to wasting resources before validation [2]. Consequently, entrepreneurs should test the assumptions about their business model with customers, partners, complementors, and suppliers to gather feedback and validate the current version before continuing and possibly wasting money. The feedback from external actors enables entrepreneurs to reflect on the current version. Thus, entrepreneurs may start thinking about the drawbacks of their hypothesized business model and exert effort on resolving these by reassessing, pivoting, or even abandoning elements [18, 19].

One mechanism that has proven to be valuable to gain access to such feedback is crowdsourcing [18–21]. Research on crowdsourcing shows the value of integrating customers and other stakeholders into the evaluation process to support decision making during the development of new products. For instance, crowd voting provides extensive evidence for the suitability of a crowd in evaluation tasks as it is equally capable of identifying viable ideas [22–24]. Therefore, many companies have started to use the collective intelligence of a heterogeneous crowd to evaluate ideas [19]. Thereby, a heterogeneous crowd, most commonly end users of a certain product, rates certain product ideas. Crowd-based online validation of innovation is particular beneficial compared to industry expert evaluation due to time and cost efficiency reasons [21], the reduction of individual biases through averaging the results [18], and the possibility to focus on the demand side perspective of innovation [23] including a much higher number of raters compared to offline approaches. This assessment constitutes a proxy to distinguish between high- and low-quality ideas and the feedback of the crowd is then used as decision support on how to proceed [25–27]. The appropriateness for using a crowd has also been shown for business models [3, 28]. We thus argue that crowd-based validation is also suitable for the highly uncertain context of startup business models and provides a superior approach compared to consultancy feedback or offline approaches such as design thinking, which might force the entrepreneur to follow biased individual feedback or to draw conclusions from small samples.

3 Methodology

For developing design principles for a CBMV system, we conducted a design science research project [7, 29] in the broader context of a research project that attempts to provide crowd-based services for incubators to design a new and innovative artifact grounded in theoretical rigor that helps to solve a real-world problem. Therefore, we followed the design research cycle methodology as introduced by Vaishnavi and Kuechler [9] (Fig. 1).

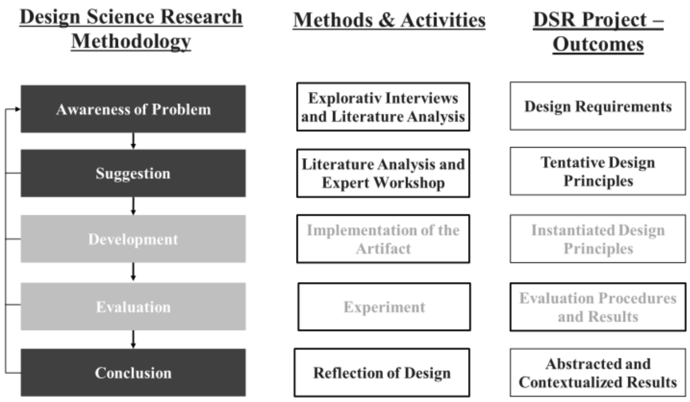

Fig. 1. Research approach

First, we conducted a literature analysis as well as exploratory qualitative interviews. We contacted executives of German business incubators (n=17) that provide business model validation services and decision makers in startups (n=28) to analyze the status quo of business model validation, the limitation of those, and requirements for a solution. For this procedure, we used a semi-structured interview guideline, which followed the theoretical concepts of opportunity creation theory. This theory-guided approach provides two benefits. First, we could justify the design requirements derived from theory. Second, we obtained a deeper understanding of the requirements from the practical problem domain. The requirements identified through the interviews were aggregated and coded. Thus, we could derive four additional design requirements. The interviews lasted between 30 and 45 minutes and were coded by two of the authors. A cross case analysis was conducted to identify common themes. To develop suggestions for a solution, we applied a theory-driven design approach and opportunity creation theory [15–17], which explains how business models are co-created, as general scientific knowledge base that provides theoretical abstraction of the cause and effect of the problem space and informs our design [30, 31]. From this kernel theory, we derived design requirements that were validated and complemented with findings from the interviews. We then used previous work on crowdsourcing evaluation as well as decision support systems as relevant knowledge base that provides us with guidance in the development of the design principles for the CBMV system. Such design principles drawn from literature are tentative properties that may inform the design of a first prototype. Through an expert workshop (n=7) we evaluated the validity of our conceptual tentative design principles. These design principles will then be instantiated into an IT artifact and finally evaluated in an experimental setting of a business model competition. Applying this approach allows us to use theoretical rigorous knowledge for developing an innovative IT artifact, which helps to solve a real-world problem, thus ensuring practical relevance.

4 Awareness of the Problem

The design science research project is motivated by both a gap in IS research on systems that support business model validation services and practical problems of entrepreneurs and incubators. Therefore, we conducted exploratory interviews with incubators (n=17) as well as entrepreneurs (n=28) to include a two-sided perspective on the problem and to create awareness. The interviews were guided by the central question of how incubators as service providers typically conduct the validation of entrepreneurs' business models and the perceived limitations of these approaches. By analyzing the interviews, we gained a deeper understanding of practical business model validation for startups and discovered four key problems:

- **Problem 1:** Incubators do not use structured processes to conduct business model validation services, which represent a repetitive task.
- **Problem 2:** Both incubators and entrepreneurs have only limited access to expertise. Access to demand-side knowledge is especially scarce.
- **Problem 3:** The feedback of consultancy services is frequently perceived as subjective, industry bound, and thus misleading.
- **Problem 4:** Resource constraints make scalable and iterative validations of business models impossible.

Although the validation of business models is one of the most pivotal parts of business model creation [21], to the best of our knowledge, there are no systems that support this service.

5 Theory-Driven Design for CBMV Systems

To define the objectives of the solution for our design science approach, we zoomed in on the entrepreneurial process and identified opportunity creation theory (OCT) [15–17] as a kernel theory [31] that informs us about the requirements of a CBMV. OCT is a theoretical lens to examine business co-creation under uncertainty [32]. This perspective implies that opportunities emerge from the iterative actions undertaken with the social environment [16, 17]. Entrepreneurs create business models based on their individual beliefs and perceptions, imagination, and social interaction with the environment [15, 33]. Entrepreneurial actors then wait for responses from testing their models in the market to understand the perceptions of customers and other stakeholders and then adjust their beliefs accordingly to adapt their business models [34, 35]. During the validation of the entrepreneur's assumptions, a mismatch between the entrepreneurial idea and the opinion of the social environment may become evident [15]. The entrepreneur will therefore need to reassess his assumptions and adapt the business model to the feedback of the market [35]. This integration of customers, suppliers, and other stakeholders into the evolvement of a business model enables the entrepreneur to learn and further develop the initial version of the business model; it also reduces uncertainty about the validity of his assumptions [34].

5.1 Design Requirements from Opportunity Creation Theory

This entrepreneurship theory perfectly fits the context of our research as it explains how entrepreneurs create their businesses under uncertainty and helps to understand the problem domain of business model validation [34]. Using this kernel theory, we developed the design requirements for our artifact.

During the process of business model creation, entrepreneurs should validate their assumptions [35] to validate the initial form of the business model and reassess parts of it if needed [34, 36]. To support this validation process, the CBMV system should consequently be able to support the entrepreneur in engaging in social interaction with potential customers or other stakeholders to validate the assumptions about the business model with the broader environment and make sense of it.

DR1: *Business model validation should be supported by systems that enable social interaction with potential customers or other stakeholders to test an entrepreneur's assumptions and support the sense-making process.*

To capitalize from social interaction, entrepreneurs gather external feedback on the viability of their business model hypothesis to make sense of their assumptions [15]. Therefore, the feedback providers require suitable mechanisms to provide adequate responses [18]. Following this argumentation, CBMV systems should support the entrepreneur in gathering feedback through social interaction and, on the other hand, enable the crowd to provide such.

DR2: *Business model validation should be supported by systems that enable providing and receiving feedback to test an entrepreneur's assumptions and support the sense-making process.*

The creation of an initial version of the business model represents an entrepreneur's individual assumptions and beliefs [37]. To start a sense-making process by interacting with external actors who provide feedback, entrepreneurs must translate their mental model of what is viable into a transferable format to communicate the imagined business model to others [35]. Thus, entrepreneurs need to turn their assumptions regarding their business model into a transferable format to create a shared understanding between themselves and the external environment, which should provide feedback.

DR3: *Business model validation should be supported by systems that enable the entrepreneur to transfer their mental representation of a business model to the external environment for creating a shared understanding.*

Such mental representations of business models are not static but rather emergent assumptions that evolve through the process of social interaction and feedback [15, 38]. Thus, the creation process of a business model is highly iterative as entrepreneurs should start a sense-making process again when their assumptions about a desired business model change [34, 39]. To reduce incongruities in the assumptions of the business model, entrepreneurs incorporate the feedback from external actors [33]. Validating a business model might therefore need multiple iterations. Thus, systems that support business model validation should provide two affordances to enhance the iterative development of an entrepreneur's business model. First, such systems should easily allow for the adaption of the business model representation (see DR3); and second, they should enable the entrepreneur to iterate the process of gathering feedback and adapting the business model.

DR4: *Business model validation should be supported by systems that enable the iterative development and adaption of the business model representation during the sense-making process.*

Finally, entrepreneurs need to learn from the feedback and integrate the learning into the reassessment of their business model [35]. The feedback that actors provide will include specific knowledge or expertise [40] and thus change the information that is available for the entrepreneur during this emergent process [16]. Such feedback serves as a form of formative assessment that alters an entrepreneur's assumptions and accelerates learning [33, 36]. Thus, feedback-based learning might create a mental shift that orients the entrepreneur toward a specific direction. However, to facilitate the process of learning from the supply of extra knowledge through feedback from the social environment, entrepreneurs need guidance on what to do and how to derive actions based on this [41]. Systems for business model validation should therefore support entrepreneurial learning through guidance on how to leverage feedback for the interpretation and update of an entrepreneur's assumptions and finally improve future versions of the business model [34, 38].

DR5: *Business model validation should be supported by systems that enable the entrepreneur to learn from the results of the sense-making process through guidance that instructs future entrepreneurial actions.*

5.2 Practical Requirements

To complement the theoretical design requirements, we gathered practical requirements from the problem domain to balance the artifact's grounding in both theoretical rigor as well as practical relevance. We therefore derived additional design requirements from the qualitative interviews with executives of incubators (n=17) and entrepreneurs (N=28) following the data collection approach stated in chapter 3.

As resource constraints are one of the major problems for early-stage startups, the interviewees agreed on the theme of time and money as the crucial requirements for the usefulness of a CBMV systems. The dynamic and fast-changing environment as well as the limited time that entrepreneurs typically spend within incubators require the collection of feedback as fast as possible. Such rapid feedback was identified as particularly important to reduce the amount of time for each validation iteration.

DR6: *Business model validation should be supported by systems that enable the entrepreneur to obtain rapid feedback.*

Furthermore, limited financial resources are a main reason that hinders entrepreneurs to validate their assumptions as they are typically not able to afford multiple rounds of consultancy, conducting workshops with potential customers, or building a community around their business idea.

DR7: *Business model validation should be supported by systems that enable the entrepreneur to obtain cost-efficient feedback.*

Apart from resource constraints, entrepreneurs are concerned about the competency of their feedback providers. They demand to obtain feedback from multiple sources (e.g., customers, investors, consultants) rather than from a single person who might be biased due to subjective perceptions of the entrepreneur's business model.

DR8: *Business model validation should be supported by systems that enable access to multiple feedback sources to enhance objectivity.*

Finally, one additional requirement derived from the interviews is the heterogeneity of knowledge among the feedback providers. The interviewees agreed that the convergence of traditionally separated industries (e.g., manufacturing and IT) requires novel types of business models that might blur traditional industry standards. CBMV systems should therefore provide access to heterogeneous knowledge to obtain adequate feedback.

DR9: *Business model validation should be supported by systems that enable access to heterogeneous knowledge to enhance the feedback quality.*

Theoretical Design Requirements		Sources	
DR1	Access to social interaction with potential customers or other stakeholders	[18, 19, 36]	Confirmed in Interviews
DR2	Mechanisms for providing and receiving feedback	[15, 20]	Confirmed in Interviews
DR3	Transfer of the mental representation of a business model	[37, 36]	
DR4	Iterative development and adaption of the representation	[15, 19, 35, 38, 39]	Confirmed in Interviews
DR5	Guidance for future entrepreneurial actions	[16, 18, 19, 35, 36, 38, 41]	Confirmed in Interviews
Practical Design Requirements		**Sources**	
DR6	Access to rapid feedback	Identified in Interviews	
DR7	Access to cost-efficient feedback	Identified in Interviews	
DR8	Access to multiple feedback sources to enhance objectivity	Identified in Interviews	
DR9	Access to heterogeneous knowledge to enhance feedback quality	Identified in Interviews	

Fig. 2. Deriving design requirements

6 Translating Design Requirements into Tentative Design Principles

Based on the nine design requirements derived from opportunity creation theory and the qualitative interviews, we continued our research by identifying tentative design principles for a CBMV system (e.g., [42]). First, we identified design principles by analyzing literature to identify design-relevant knowledge from previous work, which helped us to address the identified design requirements. Second, to ground our artifact in practical relevance, we conducted an expert workshop (n=7) to justify the tentative design principles derived from the literature. The participants in the workshop had both expertise in software engineering to evaluate the usability of the design principles (DPs) to be implemented in an IT artifact as well as knowledge of the problem domain (i.e., business model validation) to assess the efficiency of the derived principles to solve the practical problem (see Figure 3).

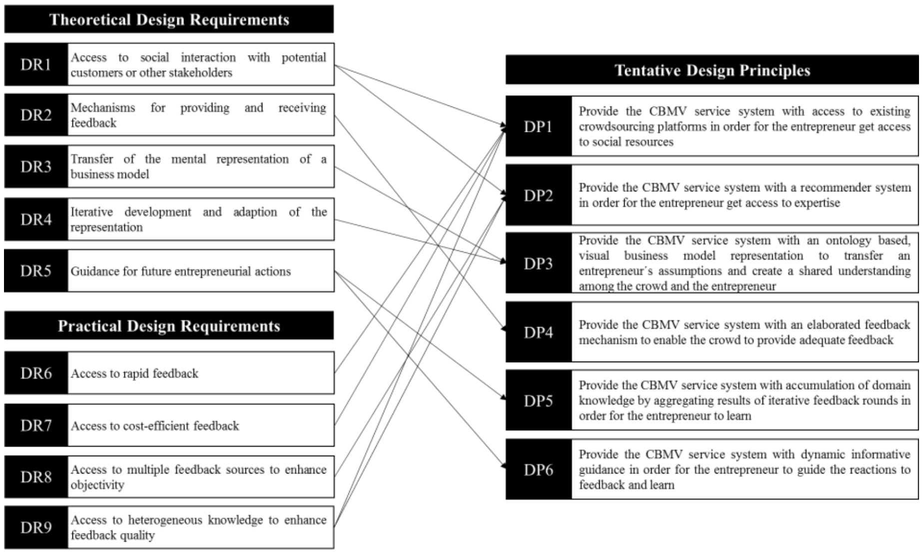

Fig. 3. Design requirements and design principles for a CBMV system

To gain access to social resources that might be used to validate the entrepreneur’s assumptions quickly and iteratively, using a crowdsourcing platform constitutes a suitable approach [43]. This approach is based on the findings of previous studies, which showed that a heterogeneous crowd can assess the value of creative solutions, such as an entrepreneur’s business model, at a level comparable to that of experts, but at substantially lower costs [19, 23]. As neither incubators nor entrepreneurs have so far been able to build a community around their efforts, using existing crowd platforms can be leveraged through APIs (e.g., Amazon Mechanical Turk) to gain access to hundreds of thousands of problem solvers [43]. Thus, CBMV systems allow access to huge crowds to validate an entrepreneur’s business model. This design principle is suitable due to various reasons. First, it provides a scalable and cost-efficient way for tapping social resources to obtain feedback. Second, it enables the entrepreneur to provide monetary incentives to ensure participation [22]. Third, creating tasks and retrieving validation results from individual participators, whose previous ratings by other users cannot be seen, avoids information cascades [18, 27]. Thus, we suggest:

DP1: *Provide the CBMV systems with access to existing crowdsourcing platforms to provide the entrepreneur access to social resources.*

This procedure continues at least until the crowd has the necessary knowledge of the context in which they validate a business model. Past literature shows that a judge who is qualified for validating a business model is also an expert in the respective context [44, 45]. Such appropriateness then results in a higher ability to provide valuable feedback. This enables the prediction of the potential future success of a business model even in highly dynamic contexts [46]. Therefore, a participant in the crowd should have two types of expertise to be suitable as a judge and provide more accurate predictions [45]: demand- and supply-side knowledge. While the first type is necessary to understand users' needs and wants explaining the desirability of a business model, the latter one consists of knowledge on feasibility [47, 48]. Both are necessary for the crowd to accurately validate an entrepreneur's business model, which represents the problem-solution fit. For this purpose, recommender systems that ensure to find a fit between the expertise requirements for being suitable as a judge and the validation task have proven to be a suitable approach in crowdsourcing [49]. In particular, expertise retrieval, which suggests people with relevant expertise for the topic of interest, can be leveraged to find suitable judges on existing crowd platforms [50].

DP2: *Provide the CBMV systems with a recommender system in order that the entrepreneur obtains access to expertise.*

To apply crowd-based business model validation, entrepreneurs must transfer their implicit assumptions to the crowd participants for creating a shared understanding. Business models are mental representations of an entrepreneur's individual beliefs that should be made explicit by transferring them into a digital object [51, 52]. In particular, approaches to transfer such knowledge into a common syntax are required [53]. Therefore, ontologies can be used to leverage knowledge sharing through a system of vocabularies, which is the gold standard in the context of business models [5]. Previous work on human cognition showed that the representation of knowledge in such an object (i.e., digital representation of the business model) should fit the corresponding task (i.e., judging the business model) to enhance the quality of the crowd's feedback [54, 55]. Due to the fact that judging a business model is a complex task, a visual representation is most suitable as it facilitates cognitive procedures to maximize the decision quality [56].

DP3: *Provide the CBMV systems with an ontology-based, visual business model representation to transfer an entrepreneur's assumptions and create a shared understanding among the crowd and the entrepreneur*.

To validate an entrepreneur's business model, the crowd needs adequate feedback mechanisms to evaluate the assumptions [18]. From the perspective of behavioral decision-making, this feedback can be categorized as a judgment task in which a finite set of alternatives (i.e., business models) is evaluated by applying a defined set of criteria by which each alternative is individually assessed by using rating scales [57, 58]. In the context of crowd validation, individual ratings can be aggregated to group decisions [59]. Using rating scales for judging and thus validating an entrepreneur's business model is therefore most suitable for improving the quality of crowd evaluations [18, 26]. In particular, elaborated rating scales with multiple response criteria lead to more consistent results of crowd-based validations [27]. These multi-criteria rating scales should thus cover the viability and probability of success of a business model by assessing dimensions, which are strong predictors for the future success, such as the market, the business opportunity, the entrepreneurial team, and the resources [60].

DP4: *Provide the CBMV systems with an elaborated feedback mechanism to enable the crowd to provide adequate feedback.*

As business model validation is an iterative process of adapting the current version of the business model and validating it again, CBMV systems should aggregate the results of each validation round to transient domain knowledge to show how the crowd feedback changes an entrepreneur's assumptions and how such changes are again evaluated by the crowd [43]. The accumulation of such knowledge can trigger cognitive processes that restructure the entrepreneur's understanding of the domain [61]. Learning can occur when entrepreneurs add new information from the feedback to their existing knowledge and cognitive schemas [62].

DP5: *Provide the CBMV systems with an accumulation of domain knowledge by aggregating the results of the iterative feedback rounds so that the entrepreneur can learn.*

The feedback from the crowd provides extra knowledge about the validity of an entrepreneur's assumptions. To support entrepreneurs in reducing uncertainty and executing their task of adapting and further developing their business model, the CBMV systems should provide guidance to facilitate learning from the system[63]. Such decisional guidance, often studied in the context of decision support systems [64], is a design principle that intends to reduce an entrepreneur's uncertainty and directs an entrepreneur's future actions by structuring decision-making processes under uncertainty [66]. Decisional guidance can either be suggestive (i.e., explicitly recommending what to do) or informative, "providing pertinent information that enlightens the user's choice without suggesting or implying how to act" [64]. This type of guidance provides information that supports the entrepreneur in reaching a conclusion of what to do. As the aim of the guidance of a CBMV system is fostering entrepreneurial learning, informative guidance is most suitable, especially for complex tasks such as adapting business models [59, 67]. Informative guidance outputs are the result of the crowd's judgment and support the entrepreneurs in learning from this additional information by enlightening the understanding of the social environment's reaction to their assumptions, especially when this feedback adds new perspectives, and lead to more reflective and deliberate thinking. Such learning may therefore increase the confidence of the entrepreneurs and develop a greater understanding of the problem domain. The mode of guidance is dynamic as the system should "learn" from the input of the judgment by the crowd and provide the guidance on demand when the entrepreneur decides to iterate the validation process. This mode is particularly effective for improving the decision quality, the entrepreneurial learning, and the decision performance [68].

DP6: *Provide the CBMV systems with dynamic informative guidance so that the entrepreneur can guide the reactions to the provided feedback and learn.*

7 Discussion and Conclusion

In this paper, we investigated tentative design principles for a CBMV systems that supports business model validation services to provide concrete principles that may guide the development of an IT artifact to solve a real-world problem. Therefore, we identified OCT as kernel theory to explain business model creation under uncertainty and derive five design requirements from this theory. These are complemented by four additional requirements identified during interviews. Based on findings from literature, we develop six design principles that match our derived requirements for a CBMV systems and were validated within an expert workshop (see Figure 4).

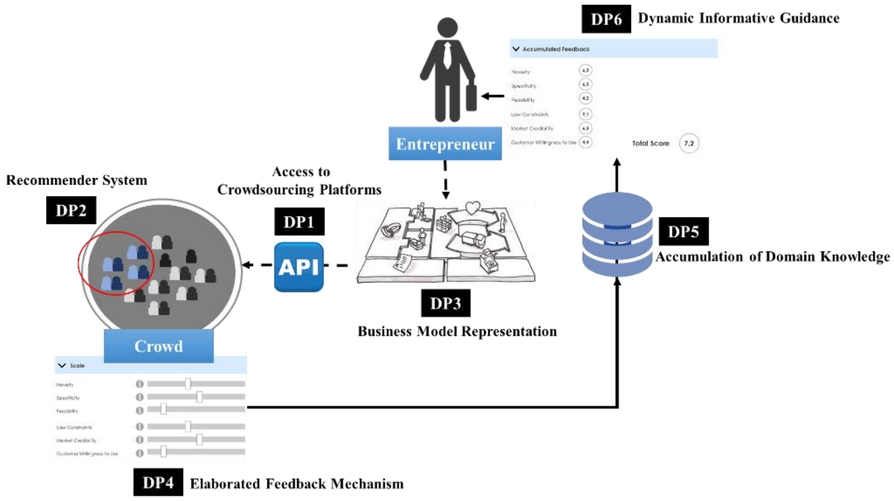

Fig. 4. Visualization of core results

The tentative design principles drawn from literature manifest a potential solution space of tentative properties that may inform the design of a first prototype.

Our findings provide several contributions. First, we contribute to the body of knowledge on crowdsourcing and crowd evaluation [e.g. 18-27] by extending these mechanisms from the evaluation of creative ideas to the uncertain and complex context of startups business models, where we intend to show that the crowd is also able to assess the desirability and feasibility of entrepreneurial opportunities. Second, we provide a design for decision support systems based on collective intelligence. We show that using this approach enables academia and practice to extend decision support services to the context of entrepreneurship and innovation. Finally, our tentative design principles provide practical guidance for providers of business model validation services, such as incubators, to develop information systems as well as a novel, crowd-based approach to conduct such services.

Although our research approach of iteratively integrating theoretical insights from literature and empirical evidence from interviews into the problem domain aims at enhancing both theoretical rigor and practical relevance, our study has several limitations. While each of our principles has proven in prior research to be valuable in addressing the requirements, the instantiation into an IT artifact will reveal how the configuration of these tentative design principles solves a real-world problem. Thus, the selection of relevant theories for deriving our design principles is not conclusive. While we believe that focusing on theories of crowd judgment and evaluation for decision support is most suitable for developing design principles for a CBMV systems, the consideration of other theoretical knowledge may have led to a different collection of design principles. With further research, we will therefore leverage the outlined design principles for instantiating them into an IT artifact. These design principles will then be evaluated in a real-life setting of a business model competition in which we will focus on quasi experimentally evaluating the validity of the crowds' feedback, time and cost efficiency as well as entrepreneurs´ perceived learning effects.

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