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Structuring Framework for Early Validation of Product Ideas

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Abstract: The advancing digitalization leads to new challenges in the development of new product ideas. The systems, which need to be developed, are becoming increasingly complex. As complexity rises, so does the slowness of organizations. In order to remain innovative and be able to react quickly to changes in the market, validation approaches offer great potential. An essential focus is the early, customer-centric and continuous validation of development artefacts. This is the only way to cope with shorter development cycles, and develop products that address a real need. To plan a validation, engineers need to have an idea about the possibilities within a validation. This paper presents a structuring framework for early validation of product ideas, which contains the three tools of Validation Map, Building Block Cards and Validation Canvas. The objective is to enable easier planning of validation experiments.

Keywords: Framework, validation map, development

1. Introduction

The advancing digitization is changing different aspects within the development of new product innovations. The increased use of software components results in higher complexity of the innovation object itself [1]. This in turn leads to a higher organizational complexity, which makes the product engineering more difficult [1]. Furthermore, digitization is causing increased global competitive pressure for industrial companies [2, 3]. In the future, only companies that develop and offer innovations that are precisely tailored to customer needs will be successful in the market. Lack of demand is seen as one of the most common reasons for the failure of product innovations [4-7]. On the other hand, digitization also brings different opportunities within the innovation process. In fact, every person is connected through the internet, making it easy to integrate a critical mass of potential customers very fast by using platforms like Facebook, Instagram or LinkedIn to gather their feedback [8-10]. Other trends like 3D printing, prototyping software or easy-to-implement IoT kits enable the development of possible prototypes and prototypes in short time, which can be tested by potential customers [11]. Basically, companies must increasingly integrate customers, other important stakeholders into their innovation process, and should make use of the potentials, which come up with new technology trends.

Due to these trends, validation has become an important activity in the innovation process, and is a key factor for the market success. Validation is the inspection (e.g. through experiments) of assumptions (e.g. assumptions about the interest, viability) about aspects of an idea through stakeholders (e.g. customer) [12-14].

Through early consideration of stakeholder feedback in the innovation process, companies can achieve a reduced risk of market failure, by creating a higher product-market fit. The importance of early validation can be explained by the Rule of Ten, which describes an increase of change costs by a factor of 10 from one development phase to the next. This means that late recognized mistakes are connected with a large expenditure [15]. The methodical execution of a

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validation includes the definition of the validation goal, the selection of suitable validation environment and the definition of the validation experiment [15].

A validation goal is a superior category of specific aspects of an idea, which are being tested [16]. One example for a validation goal is "desirability". This validation goal focuses customer centric aspects addressing a solution idea. This could be the level of the solution demand (nice to have or must have) or the way a customer interacts with the upcoming business (customer channel, customer relationship). A successful validation of this goal leads to a solution of an existing problem, which is desired as well as demanded by customers [17]. The term "validation-goal" is often used as a structuring basis for the definition of the innovation process. An excerpt from the state of the art is the TAF framework according to Boehmer (Figure 1) [18]. The framework structures the innovation process on the basis of the validation goals of "problem-solution fit", "viability", "desirability" and "feasibility". The validation goals are inspected by using the Plan-Do-Check-Act cycles according to Deming [19].

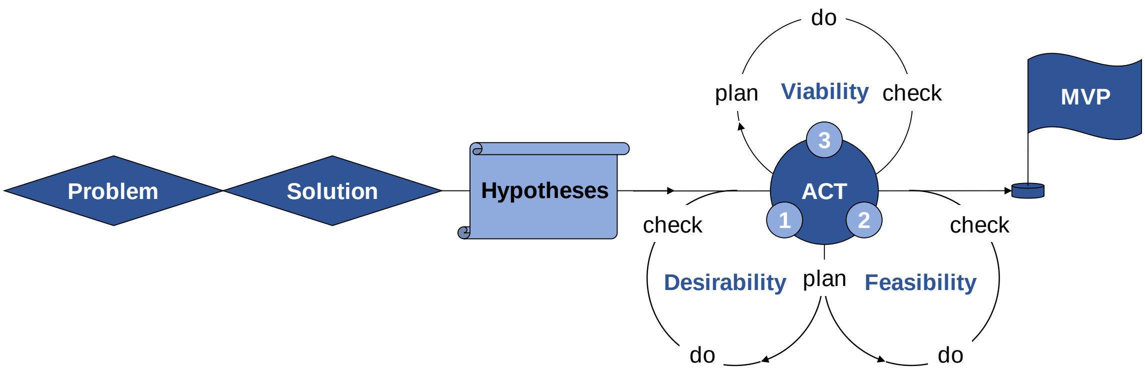

Fig. 1 - TAF Agile Framework for structuring the innovation process through validation goals [18]

Validation goals can be concretized through hypotheses [15]. In this context, a hypothesis is formed on the basis of an assumption about aspects of a product. However, a hypothesis is more concrete than an assumption, since it is often formulated as an "if-then-statement" and allows empirical studies [20, 21]. One example of a formulated hypothesis could be "Customers will be interested in our idea, if 50% of 2000 visitors of our fake landing page, which advertise our idea, will click on the "more information button".

Depending on the validation goal, different hypotheses can be tested within one validation environment. A validation environment describes the resources and methods required to test the validation goal/hypothesis [15]. Resources include organizational resources (e.g. HR) as well as KPIs (e.g. customer satisfaction), tools (e.g. landing page tools) and validation objects (e.g. functional prototype) [15]. A validation experiment consists of the concrete specification of a validation goal through a hypothesis, which will be tested within one specific configured validation environment.

To conduct a validation experiment, companies need an overview of the possibilities within the validation environment and additional planning supporting tools which makes it easy for an engineer to configure company specific experiments for early validation. However, most business decisions regarding validation are only made based on experience. Also, the mentioned aspects of validation are structured differently in the literature and practice, and often do not address the early phases of the innovation process. Also, concrete experiment descriptions (e.g. the mechanical turk), which describe specific experiments are difficult to summarize. In this context, there is a need for a clear structuring framework of validation elements which considers the characteristics of an early validation, and which helps companies to configure their individual validation. For this reason, the goal of this paper is to provide a structuring framework for early validation of product ideas as a basis for validation planning. The approach should structure and describe all necessary elements of a validation and should introduce combinations of these elements as concrete validation experiments.

2. State of The Art

The literature addresses different aspects of the needs described. In the following, current approaches of the state of the art will be listed and evaluated. The section is divided into the areas 1) Holistic approaches for structuring validation and 2) Approaches that consider elements of validation.

2.1 Holistic Approaches for Structuring Validation

The first area describes innovation development methods, which integrate validation as a fixed component. Exemplary approaches are the Lean Startup approach by Ries, the Design Thinking Process by Stanford University or the TAF Agile Framework by Hostettler et al. They are characterized by their iterative approach, and their active involvement of customers in the validation process. They include tools and instructions for validation, which consider different types of validation goals, prototypes, experiment types and KPIs. [13, 22-24]. The Board of Innovation presents a guideline that helps to validate different business ideas [25]. The Lean Startup Machine which is a global movement of entrepreneurs and innovators has developed an experiment board which enables the planning of experiments [26]. However, most of these approaches describe concrete experiments, and do not give the design freedom for a planner to configure an individual experiment for a specific company case. Additionally, they do not characterize single validation elements (e.g. the resource advertising platforms) to conduct an experiment [15, 27]. However, they are mostly limited to IT solutions and neglect engineering aspects [39].

2.2 Approaches that Consider Elements of Validation

The literature also consists of approaches that focus specifically on individual elements of validation, like frameworks for structuring and describing validation goals [23, 28-29]. Chrissis, Konrad and Shrum explicitly deal with elements of a validation environment (e.g. validation tools, software) [30]. Eckertz et al. describe an approach to integrate augmented reality applications into the validation process [31]. Other literature describes possible prototypes (e.g. Mechanical Turk, Minimum Viable Product, 3D Mock-Up) and prototypes (funky prototype, dark horse prototype, functional prototype) [23,28,32,33]. Osterwalder and Pigneur introduce different types of experiments like Ad and Link Tracking, Split Testing and Sales Measurement [28]. The aforementioned approaches refer to individual elements of validation, and do not consider all validation aspects. All in all, they can be integrated in the structuring framework.

2.3 Research Urgency

The outstanding importance of early validation activities is adequately documented in the literature. However, there is a lack of a framework for structuring validation possibilities and showing which combinations between different validation elements are possible in order to configure an individual experiment.

3. Structuring Framework for Early Validation of Product Ideas

With the previously described need in mind, we developed a framework to structure the possibilities of early validation. The objective is to enable easier planning of validation projects. The framework consists of three supporting tools of Validation Map, Building Block Cards and Validation Canvas. Figure 2 gives an overview of the tools, which will be introduced in the following. The content of the tools is extensible and is not claimed towards completeness. Because of constraints, we went through the details of the overall validation planning process.

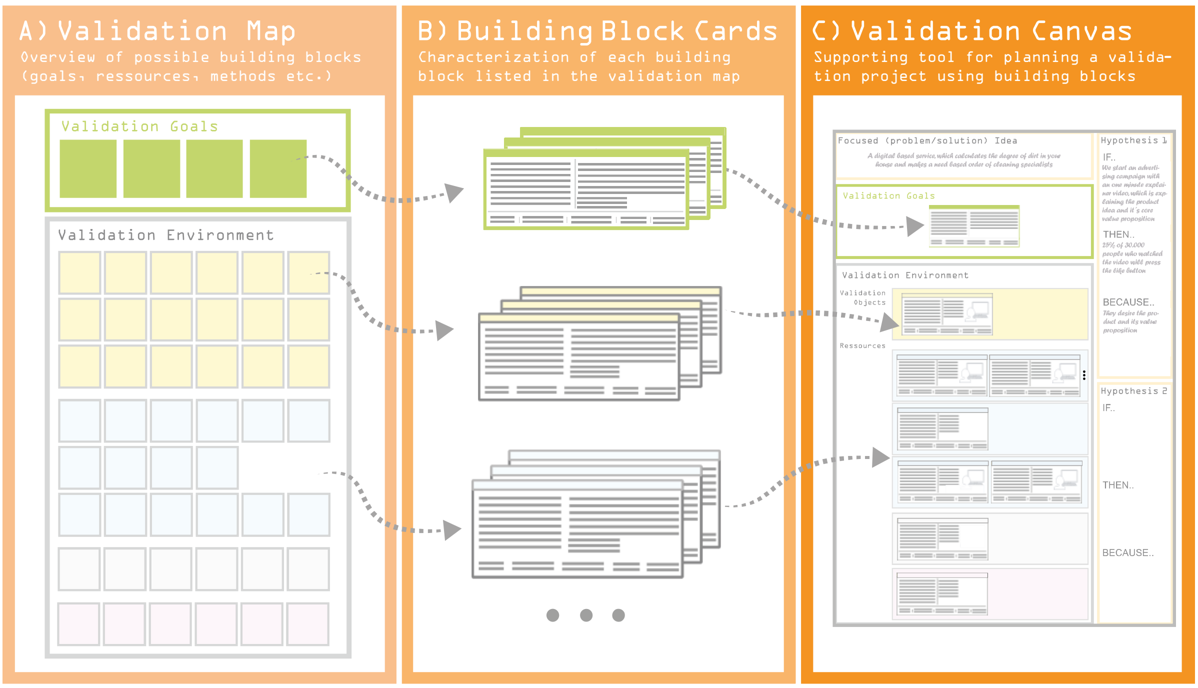

Fig. 2 - Overview of the Framework

3.1 Validation Map

The validation map structures validation elements (in the following building blocks), which need to be considered during validation planning. Engineers, who want to plan a validation, can use the Validation Map as an overview to quickly get an idea of potential elements to be used to execute a validation experiment. The Validation Map consists of two main planning aspects: validation goals and validation environment. The planning aspect of validation goals structures possible validation objectives, which can be achieved within a validation. The aspect validation environment is subdivided into the four sub planning aspects of validation objects, resources, validation methods and KPIs. Figure 3 shows an excerpt of the Validation Map. The individual planning aspects will be explained in the following.

3.1.1 Validation Goals

A validation goal is a superior category of specific aspects of an idea, which is being tested [16]. Defining the validation goal is the starting point of a validation planning process. Depending on which validation goal is focused, different validation environments can be selected for execution. In the following, we will describe the validation goals, which can be addressed during a validation experiment.

Potential: The potential validation has the goal to prove that a certain customer segment has a specific problem or wish within his tasks. The validation goal potential is of high importance, since often product ideas are converted without previously testing whether they represent a real customer problem/wish [33].

Desirability (Human): Based on the validated potential, this goal focuses on customer centric aspects addressing the solution of a problem/wish. This could be a validation of the fit between the solution concept and customer needs (Potential-Solution Fit), the level of the solution demand (nice to have or must have), the quality of the solution from a user perspective (usability), and the way customers interact with the upcoming business (customer channel, customer relationship) [33], [37].

Feasibility (Technical): Within this goal, the technical realization of an idea is being addressed. This includes testing whether necessary resources for implementing the solution are available (internal resources and key partners) if the solution can thus be technically developed (key activities) and the verification of initial requirements [15], [17], [34].

Viability (Business): By considering viability, the economic feasibility and sustainability of the idea are validated. This includes testing whether customers would pay a certain amount of money for an offered value proposition (willingness to pay), the company defines the right way of generating turnover with the product (revenue model), the company knows the costs for developing, producing and marketing the product, and whether the company can increase the output without proportionally increasing the input (Scalability) [17], [35], [36].

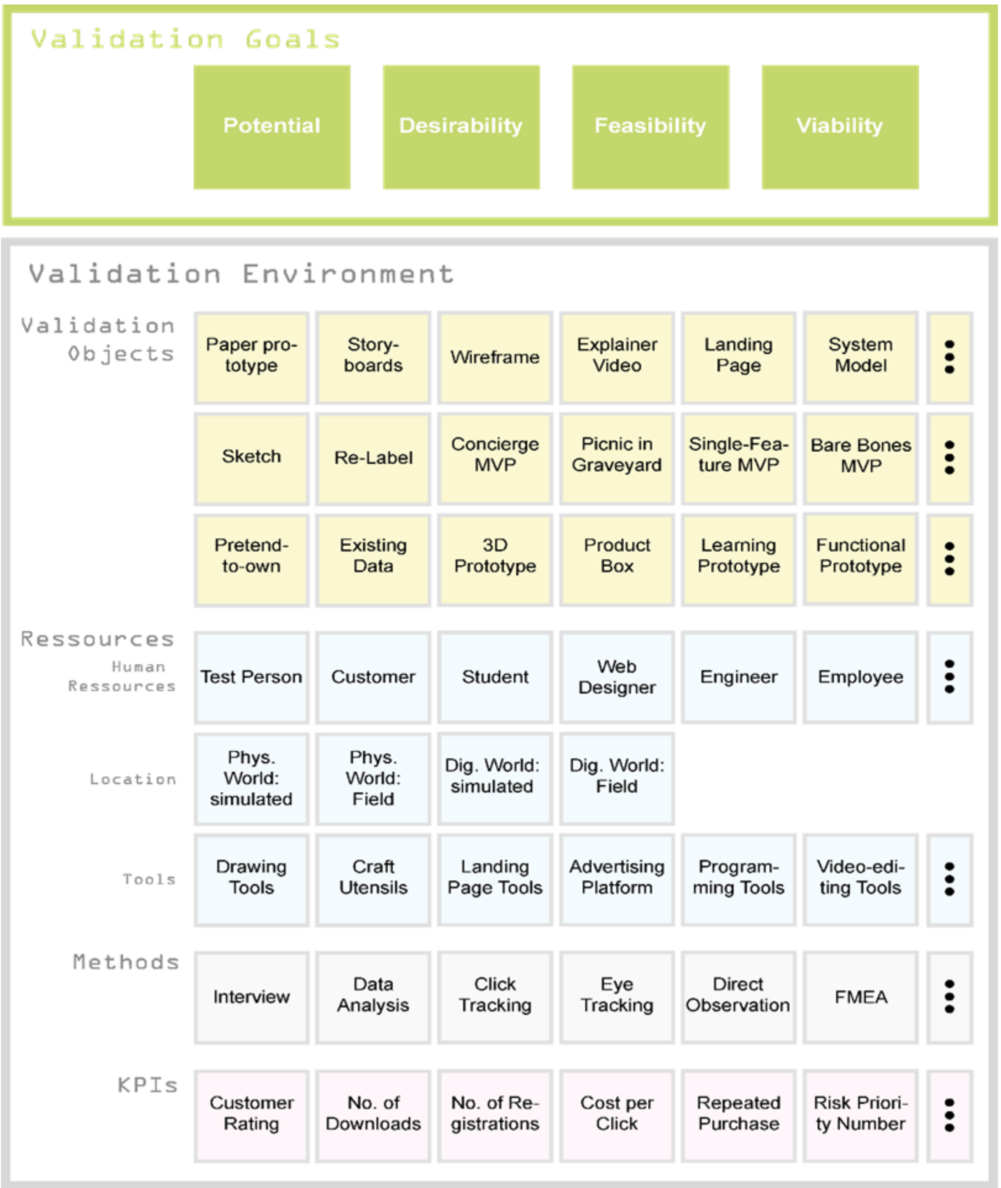

Fig. 3 - Validation Map

3.1.2 Validation Environment

The planning aspect validation environment contains sub aspects that can be considered for validation execution. This includes validation objects, resources, methods and KPIs. The sub aspects will be described in the following.

Validation Objects: Validation Objects are the information carrier of an idea to be validated. They help to build a bridge to relevant stakeholders like customers by making an experienced idea. Depending on the validation goal, different information carriers can be selected as validation objects. Possible non-functional validation objects like product landing pages or explainer videos were used to describe an idea, but also functional prototypes like a single feature prototype, which contained the most critical functions to create a value for customers.

Resources: They describe needed assets to conduct a validation with a specific validation object. Resources within a validation can be structured through the three categories of Human Resources (HR), Location and Tools. HR describes that persons who are necessary to develop a validation environment (e.g. Web-Designer to develop a fake landing page) or who are needed to perform the validation itself (e.g. customer). The second category, Location, describes the local environment in which the validation takes place. Real (e.g. validation execution through Facebook advertising campaign, where an idea is being introduced) but also simulated environments (e.g. Virtual Reality Environment, where customers experience an idea and give feedback) can be considered for this. Supporting Tools for validation are the third category. This could be tools for building up validation objects (e.g. 3D printer to print a hardware mock-up or a video cutting tool to produce an explainer video) or tools which are needed for the execution of a validation (e.g. Facebook Business Manager).

3.1.3 Validation Methods

Validation methods describe generic procedures and mechanisms for executing validation and measuring characteristic values (in this context KPIs) to prove a hypothesis linked to a validation goal. Generally, there are five different types of validation methods. Calculation [analytical or numerical determination of the characteristic values with the help of immaterial, symbolic models of the product and its environment (e.g. Link Tracking)], Inspection [Identification of characteristic values of a product model with human senses or with simple technical systems in a static situation (e.g. site inspection by a reviewer or interview)], Trial [Recording of characteristic values with selected measuring systems during specially designed scenarios that bring a product model into a controlled, operational state with the help of technical equipment (e.g. test drive with specially equipped vehicle)] and Real Test (Recording of characteristic values of a product model according to generally applicable standards with defined technical aids during or according to defined and controlled scenarios). Combinations of the mentioned types are also possible [38].

Key Performance Indicators (KPIs): KPIs are the critical indicators of progress towards an intended result (in this context the validation goal). KPIs provide a focus for strategic and operational improvement within the innovation process. They create an analytical basis for decision making, and help focus attention on what matters most. In this context, KPIs evaluate the success of an experiment in order to achieve a validation goal. Directly connected to the KPIs defines a limit value for a KPI, which defines the goal value to achieve to say, that a validation is a success. Examples for KPIs are the number of downloads of an application or the number of clicks of a fake advertising on Facebook.

3.2 Building Block Cards

To give validation planner a brief description of the building blocks listed in the validation map, the tool Building Block Cards will be introduced in the following. The aim is to support the validation planning process. Depending on the individual planning aspect, every card has a color, name, number, description and useful knowledge of each building block. Possible combinations with other building blocks are also mentioned. In the following, we will show an extract of the different card types, resulted from the planning aspects mentioned in the validation map.

Building Block Cards for the planning aspect of Validation Goals: This card type is structured into three sections. The description includes possible specifications of the validation goal. Answering the key questions help planners to decide which specific aspect of the validation goal needs to be validated. Figure 4 shows the building block card "Validation Goal: Desirability (Human), VG2".

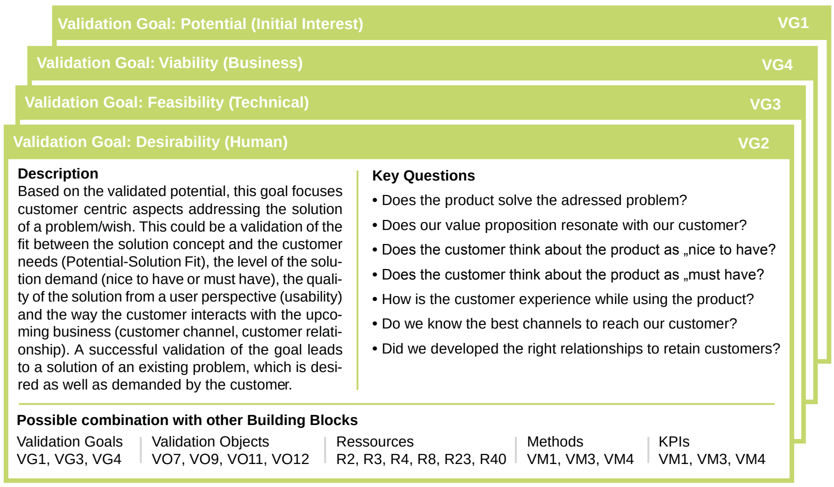

Fig. 4 - Validation Goal Desirability as building block card

Building Block Cards for the planning aspect Validation Objects: The description of this type contains detailed information about individual validation objects and the usage within a validation. To support the understanding of each validation object, examples are visualized, and best practices are listed. The section data for interpretation gives information about the possibilities of gathering data through the validation object during validation. The possibilities are divided into qualitative data (e.g. customer opinion) and quantitative data (e.g. number of clicks). Figure 5 shows the building block card “Validation Object: (Fake) Landing Page, V05”.

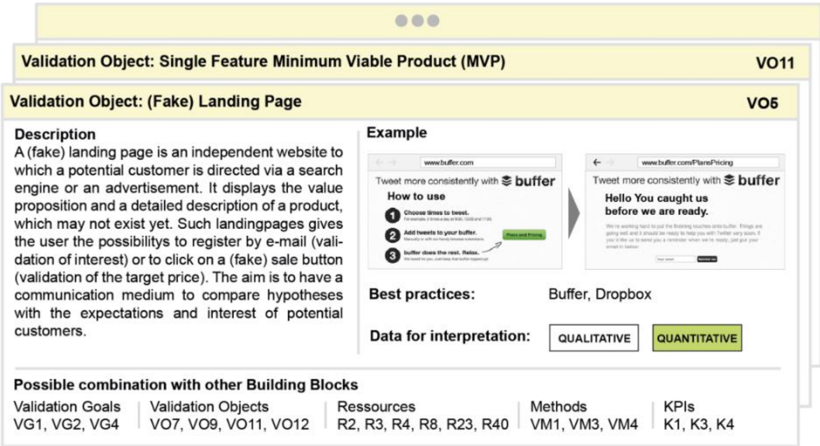

Fig. 5 - Validation Object (Fake) Landing Page as building block card

Building Block Cards for the planning aspect Resources: This type is divided into sub planning aspects of Human Resources, Environment and Tools. Because of constraints, only Tools is described. The description of Tool Building Block Cards contains information of the Tool usage during validation preparation (e.g. the use of video editing tools to build an explainer video) or validation execution (e.g. the use of an advertising platform during validation). Also, real life examples of tool providers are given (e.g. Facebook as advertising platform). Figure 6 shows the building block card “Tool: Advertising Platform, T4”.

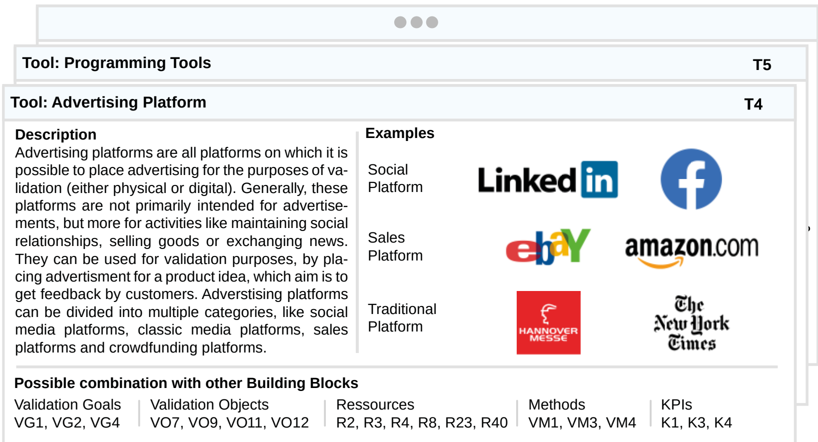

Fig. 6 - Tool Advertising Platform as building block card

Building Block Cards for the planning aspect of Validation Method: The description on these cards contains generic mechanisms of the specific validation method for measuring KPIs, and different subcategories of the individual validation methods are mentioned. The described methods will also be allocated to the method-types calculation, inspection, trial and real test, which are explained in chapter two. The visualization of examples makes a clear impression of the possibilities of the single validation methods. Figure 7 shows the building block card “Validation Method: Click Tracking, VM5”.

Building Block Cards for the planning aspect Key Performance Indicators (KPIs): The description of these cards contains brief information about the single KPIs and further context within validation. The examples shall give planners an idea about the possible expressions one special KPI can have (e.g. The KPI “Number of Clicks, can appear in different expressions like number of purchase button clicks, number of like clicks on Facebook, number of google clicks etc.). To give better understanding, the example of formulated hypothesis is given, which integrates the KPI. Figure 8 shows the building block card “KPI: Number of Clicks, K4”.

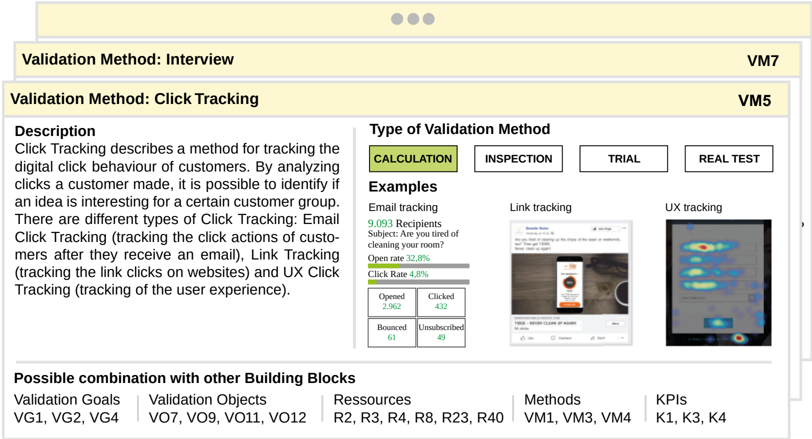

Fig. 7 - Validation Method Click Tracking as building block card

3.3 Validation Canvas

The validation canvas is a framework for the visualization and structuring of validation experiments. The structure considers the most important aspects of validation planning. A planner can use the framework to define an individual experiment. The planner worked with the canvas by hanging up building block cards needed to be integrated into empty linked fields of the frame. The possible fields corresponded to the building block types mentioned above. By filling the template step by step, the validation experiment plan was created. At the end, all building blocks were consolidated into hypothesis, which set the validation goal to be tested and the related environment of the experiment. The template can be used in single work or in workshops to plan a validation experiment. Figure 9 shows the empty validation canvas, which can be printed and used for planning workshops. Figure 10 shows an example of a filled validation canvas.

4. Conclusion and Outlook

In this paper, we introduce a structuring framework for early validation of product ideas. We achieve several outcomes:

i. Validation is a key success factor for creating successful innovations within the innovation process.
ii. There is a need for a clear structuring framework of validation elements which considers the characteristics of validation planning and helps engineers with supporting tools during planning.
iii. Current approaches in the literature and practice do not address the described needs.
iv. The introduced framework addresses the mentioned need in outcome.

Beyond the framework and further tools, there is a need for future research. There are connections/dependencies between the validation goals and the morphology of the elements of the framework, which need to be identified. Furthermore, there is a need for exploration of new validation methods, which are based on cutting edge technologies like Augmented Reality (AR) and Virtual Reality (VR). A concrete procedure is needed, which describes the detailed use of the Validation Map, Building Block Cards and Validation Canvas. Furthermore, there are configurations of validation experiments, which can be extracted to generic solution patterns, which make it easier for engineers to plan a validation experiment.

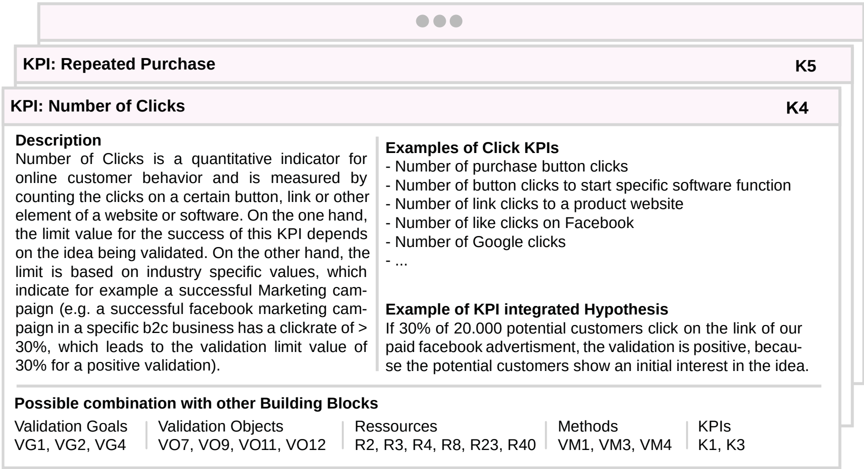

Fig. 8 - KPI Number of Clicks as building block card

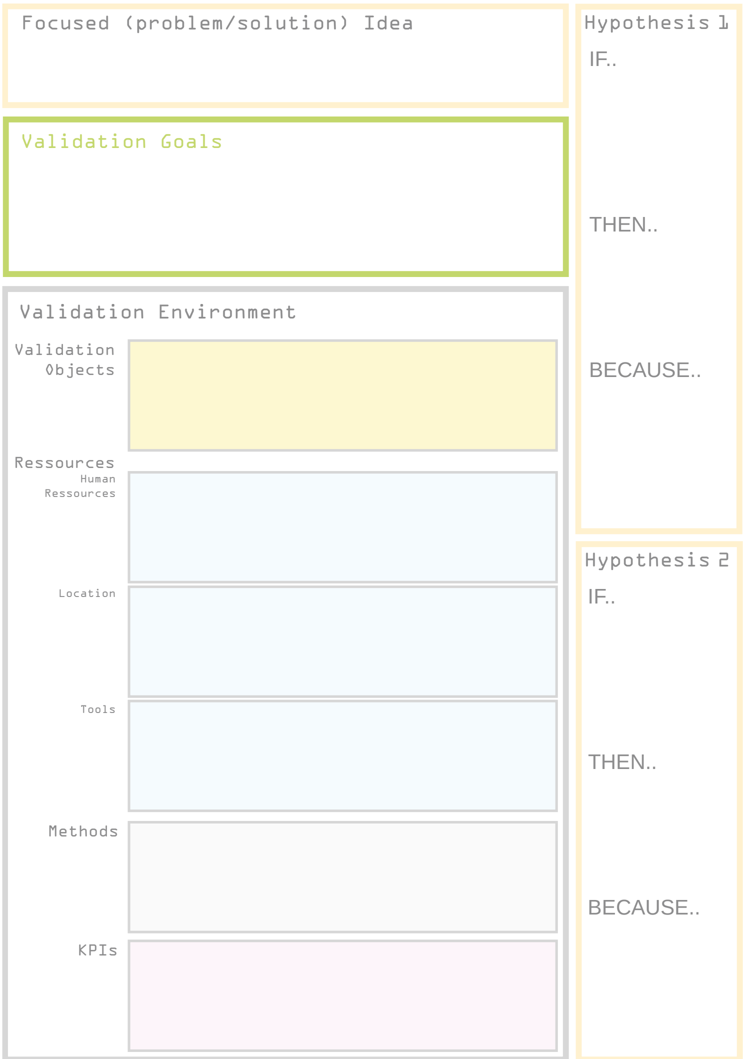

Fig. 9 - Validation Canvas

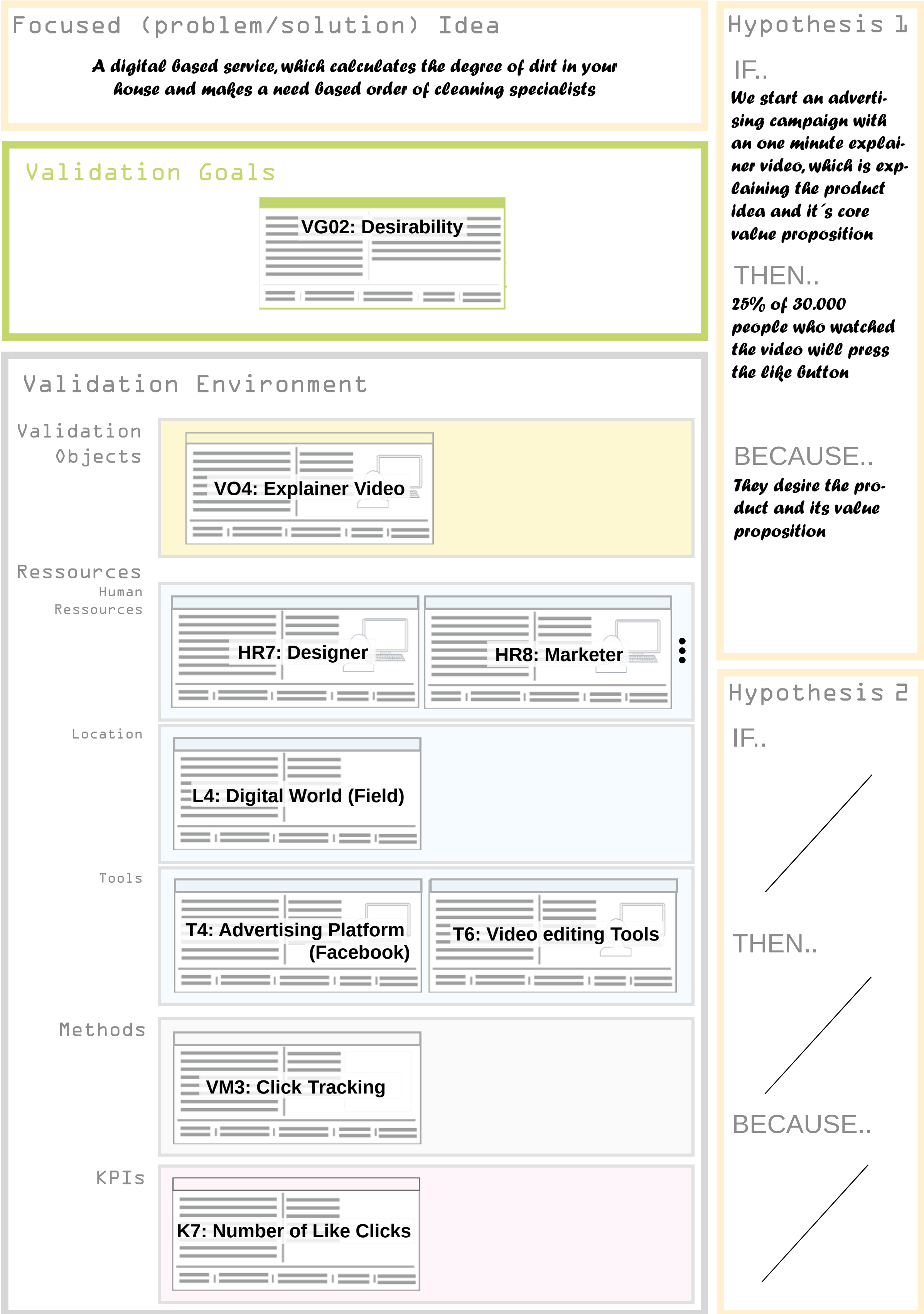

Fig. 10 - Filled Validation Canvas

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