Which effects are claimed with User-Toolkits for Innovation and Design?

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Abstract This study analyses the effects created by so-called toolkits for user innovation and design (TID), a new method of integrating customers into product development and design. Toolkits allow customers to create their own product, which in turn is produced by the manufacturer. User toolkits for innovation are linked to a product or service type and to a specified production system. This study analyses the effects derived from the use of TID. The effects are divided in the effects for the owner of the toolkit and the user. The claimed effects in the literature are tested with a simple toolkit in a user study. Outcome shows that TID has several psychological, functional, social and process effects which are different for customer groups. The effects also change the way for manufacturers.

1 Introduction

New products and services must be responsive to user needs in order to succeed [34]. The flop rate of new products are approximately 70 percentage, which indicate that manufacturers have problems to Figure out customer needs [27]. A new approach to find out customer needs is the use of a User-Toolkit for Innovation and Design (TID) [25]. The customer changes from a traditional consumer to a product-designer and customizes a standard-product for his or her needs [27]. Famous examples show that it is possible to make successful business with such toolkits like designing your own furniture (My-Möbelstück.de), watch (Factory123.de), T-Shirt (Shirtcity.de), shoes (Adidas.de) or mobile phones (designyourhandy.de) [27].

Franke and Piller [8] defines TID as systems that allow the user to design a novel product via trial-and-error experimentation and deliver feedback on the potential outcome of their design ideas. Schreier et al. [27] view TID as the interface between customer and manufacturer. They are virtual, often online design-tools, which allow the customer to design their own product. The feedback function consists of price, design and functionality. The goal is that the customer should get exactly the product he or she want. The customer changes from a traditional customer to a co-designer [7]. Customer co-design describes a process that allows customers to express their product requirements and carry

out product realization processes by mapping the requirements into the physical domain of the product [7]. According to von Hippel [33] the users go through several trial and error cycles which can be compared with a learning by doing. Franke and Schreier [9] identified two different kinds of toolkits. High-end toolkit which allows users to generate new radically products and low-end toolkits which are able to customize standardized products.

The topic of this paper is the effects claimed with TID. An effect is a change which is a result or consequence of an action or other cause [29]. These effects can be positive or negative. According to this general definition it can be seen that an effect can be very flexible and connected to multiple actions.

TIDs have different benefits for manufactures and customers [9]. An example is the easy access to sticky information [9] and for customers the „I designed my-self effect" [11]. Sticky Information are the information that is costly to acquire, transfer, and use in a new location [14]. According to Franke and Schreier [9] the integration of customers via toolkits might be a winning strategy for manufacturers. They also noticed that the measurable value of individualized products in comparison to standard products still constitutes a black box in research at the moment. Therefore Franke and Schreier [9] said that an evaluation of TID and empirical studies is necessary. Franke et al. [11] also has the opinion that empirical data is needed to evaluate the effects of these TID.

This paper investigates if claimed effects by TID can be verified in a user study. In the first step of the research, several benefits with TID are searched in journal papers, books and white papers. The results are categorized and sorted in different categories like process benefits or psychological benefit. To investigate if a specific TID has these benefits, a semi-structured survey is created. A relative simple design-focused toolkit for creation of furniture is tested with a total of 12 participants who use the toolkit and 2 participants who own the toolkit. In this way we can understand the effects for manufactures and customers. After creating their own products the participants complete a survey and evaluate the experienced benefits.

The organization of the paper is as follows. In Section 2 the methodology of the work is explained. Section 3 shows the results of the literature and a suggested framework. Based on this framework, the survey is created in Section 4 and the toolkit is explained. The Section also contain the results of the survey. Limitations of the research and shows the conclusion follow in the last Section.

2   Method

This Section show the methodology of the paper. Figure 1 shows the different steps in the research. As a first step we use several databases to search for journal papers with the keywords „toolkit", „customer-integration" and „effect". The col-
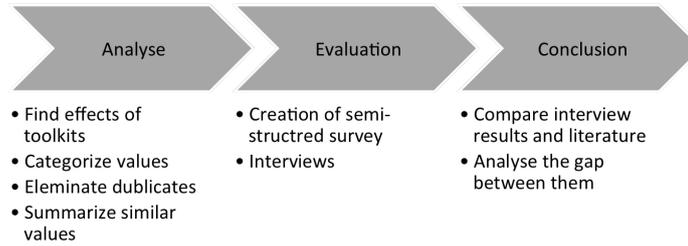
Figure 1. Methodology used in the paper.

lected information are categorized and sorted. Based on this the valueframework is created. After that, a semi-structured survey are created in order to evaluate the valueframework (Figure 3).

Our research is based on the grounded theory. It consists of the systematic charging and analysing of inductive derived data [30]. The grounded theory is the collection of data, the analyse and theory development in iterative cycles [1]. Figure 2 shows the cycle of the grounded theory. After reaching enough data we leave the cycle and evaluate the created valueframework (Figure 3). At this communicative validation we ask the participants and watch them while using the toolkit to make notes [2]. This ensures a valid evaluation of the framework.
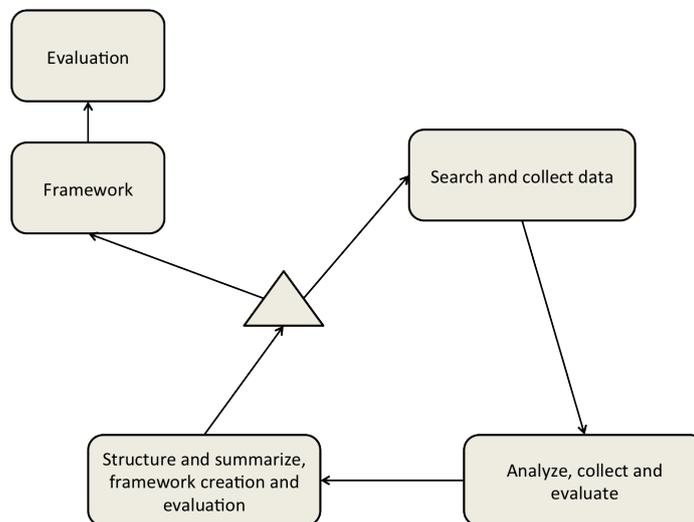
Figure 2. Cycle of the grounded theory [1].

3   Analysis

At the first step we entered the cycle of the grounded theory and search for journal papers, whitepapers and books. To build up the theoretical framework we use several references.
In the process of data collection we use the searchstring explained in Section 2. The result of the analysis is that it was possible to identify several frameworks and success stories of TIDs. From in total, 27 references we identify 191 effects. After these 191 effects the saturation criteria according to Strübing [31] is reached. That means that after one iteration cycle (Figure 1) no more changes in the concept were noticed.

The effects are analysed with several criteria. Similar effects are merged, duplicates are eliminated and effects without enough references are also eliminated. The result is 21 effects with an average of 6,5 references for each factor.

Effect	References
Costs	[5], [10], [12], [22], [25], [32], [34]
Time	[5], [8], [9], [22], [25], [32], [34]
Fit customer needs	[8], [7], [12], [20], [26], [27]
Efficiency	[27], [9], [35], [21], [28], [7]
No change in process	[3], [32], [9]
Sticky Information	[5], [6], [8], [15], [14], [22], [32], [34], [25]
Supportculture	[15], [14], [12], [8], [35]
Marketing	[21], [32], [22], [7], [10]
Without knowledge / Easy	[3], [5], [19], [21], [32], [13], [18], [34], [25], [27]
User Friendly	[5], [19], [21], [25], [27]
Solution Space	[5], [20], [8], [28], [34], [25], [27]
Entertaiment	[10], [11], [12], [19], [21], [20], [26], [28], [34], [27]
Trial and Error	[9], [5], [18], [6], [21], [22], [27]
Satisfaction	[5], [21], [26], [25], [32], [33], [27]
Willingness to Pay	[6], [8], [10], [26], [27]
Pride of Authorship	[8], [9], [26], [34], [25], [27]
Customer Integration	[9], [15], [14], [19], [34]
I designed Myself effect	[11], [16], [26], [34], [25], [27]
Individual Solution/Needs	[5], [14], [19], [21], [20], [22], [32], [27]
Unique	[8], [7], [9], [26], [25], [32] ,[34], [27]
Better Product	[10], [21], [26], [28], [34], [27]

Table 1: Effects and References

Table 1 shows reported effects for a user or a manufacturer when they use a TID. They save costs for the manufacturer and time for the customer because the amount of time to design their own product to try to search it in different stores is normally much lower and the costs of market research decrease for the manufacturers beause they get with the toolkit the specific needs of the

customers. The references in Table 1 show that it is more efficient and fit the customer needs better. It is also not necessary to change existing processes because toolkits are very flexible and can fit with existing processes [3]. The manufacturers have easy access to sticky information. The support culture change from a traditional product consulting to a technical toolkit support [15]. That means that manufacturers not help the customer to choose a specific product because it is his or her task to design it. They just help customers to use the toolkit. Toolkits change the way of marketing from a one-product to a all-in-one solution and makes it easier [21]. Manufacturers should beware how much solution space they offer for the customers because otherwise it will be to complex. TID should be useable without any knowledge and they are user-friendly and entertain the people. So the process of buying is fun and customer enjoy it. They use toolkits with a trial and error mentality. So they xare willing to pay more for these products and the satisfaction is higher. The customer is integrated as a co-designer in the process and is proud of the product. Customized products are unique and individual solutions for individual needs. Normally customized products are regarded as better products.

For the next step we sort the effects in different categories. During the literature analysis we identified several categories, which we use for this.

The first category is „functional". Schreier [26], Schreier at al. [27], Sigala [28], Franke and Piller [8] and Schreier [25] use this category in their papers. Franke and Piller [8] define functional benefit, as adapting a product to suit an individual preference or need. Schreier et al. [27] define it as the customization from technical aspects to the user preferences.

The category „process" is also used by Schreier [26] and Franke and Piller [8]. It is likely that users enjoy the design process due to a „flow" experience and the joy of performing an artistic and creative act [8]. The customer spends time and effort in the products and so the process has to be a good experience.

The „social" category ([9], [21] and [28]) means that these low-end toolkits may well reap the social benefits of individualization (i.e., the demonstration of individuality) [9]. In other words, social value represents effects that users can get from the inter-customer interactions between other customers [10].

The fourth category is „psychological" effects ([9], [21], [28] and [27]). Franke and Schreier [9] recommend that toolkits lead us to conjecture that other factors also have an impact on subjective value creation for user-designers. Specifically, the self-designed product not only has a well-adapted design, it is also an individual design. The fact that the user designed the product by himself has effects on their subjective thinking and is more valuable for him [27].

The last category covers the manufacturer effects of TID. Franke and Schreier

[9] recommends that toolkits are able to support successful business models and have many effects on the manufacturers. Using these categories with the founded factors in Table 1 we received the value framework (Figure 3).
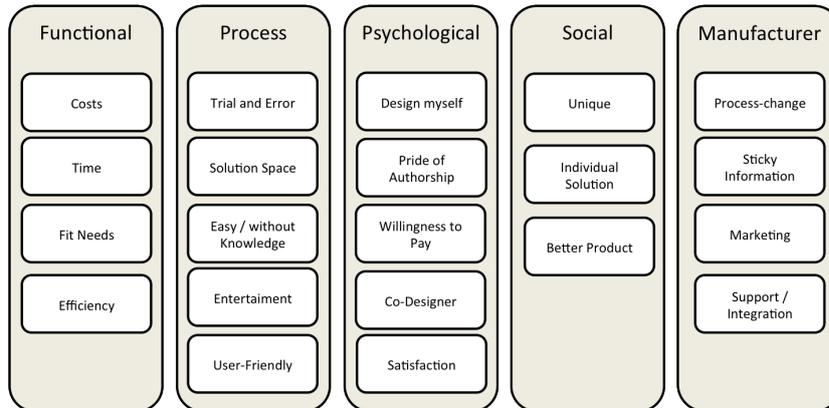
Figure 3. Value Framework.

4 Evaluation

The following Sections describes the evaluation which consist of two parts. First we decribe how we create the survey and the process to evaluate our value framework. Then we explain the TID used to evaluate the framework and the participants. At the end the results are shown. The evaluation is divided into two parts. The first part evaluates the effects for customer with a total of 12 participants. They create furniture with the software and evaluate the feelings and effects after the creation process. The secound part is the interview with manufacturers.

4.1 Design of the Survey

End-User Survey
The questionnaire contains 23 statements. The scale ranges from 1 to 5 (I do not agree to I agree with). We added the question about the knowledge of their own needs because customer with heterogeneous needs are more influenced by the effects of TID [27]. This is because for design your own product it is necesarry to know their own needs to define them in the design. The statements are:

– I know my needs and how my furniture should look like (Knowing my own needs)
– Individualized products are more expensive than standardized (Costs)
– The use of the toolkit save time compared to traditional buying (Time)
– This product fit my needs (Fit needs)
– The invested time, effort and money is justified for a customized product (Efficency)

- During the process I try different things, go back and try it again (Trial and Error)
- The given options are not too much or too less to customize my product (Solution Space)
- I was able to use the toolkit without any problems (Easy)
- The process was funny and I feel comfortable with it (Entertainment)
- The toolkit is user friendly (User-Friendly)
- I like my product more than other comparable products because I designed it (Design Myself)
- I am proud of my product (Pride of Authorship)
- How much are you willing to pay for this product (Willingness to pay)
- I feel like a designer of this company (Co-designer)
- The product and the process are better than traditional buying (Satisfaction)
- My product is unique (Unique)
- This product is an individual solution and fit my individual needs (Individual Solution)
- This product is better than comparable standardized products (Better Product)

The statements were derrived from the effects. For example the effect that customers feels like a co-designer is derrived to „I feel like a designer of this company ". The survey is structured in general data, functional, process, psychological and social effects. According to Eberhart et al. [4] semi-structured evaluation (scale 1 - 5) is good because it is easier, shorter and more objective than traditional interviews. For a better evaluation we convert the statements to key Figures and sort them in the defined categories. Preissler [23] claim key Figures to be a good method to find weaknesses because Figures are honest and realistic. The interviews follow the step and theoretical derived method of the qualitative content analysis [17]. The material is analysed with a strong view on the research question and theories are derived [17]. To guarantee a better evaluation we start the survey with a classification of the customer in the customer-innovation framework (Figure 4). Customers have two main characteristics which are important for the use of TID. Application knowledge refers to practical experience with a product through intensive usage. Professional runners for instance, have a high application knowledge in using (and possibly co-designing) running shoes [24]. Object knowledge focuses not on practical experiences with a product, but on knowledge concerning e.g. the technology, procedure or material of a product (physical conditions of the product and how single components work together coactively) [24]. So Reichwald et al. [24] divide the customers in freshmen, nerd, intuitive and pro. With the help of this framework we have a better understanding of the answers of the participants. A nerd user with a little object knowledge will be not searching for an individual solution and a intuitive user with high object knowledge and low application knowledge will have problems with the process and the use of the toolkit. So we weigh the different effects according to a specific type of customer.
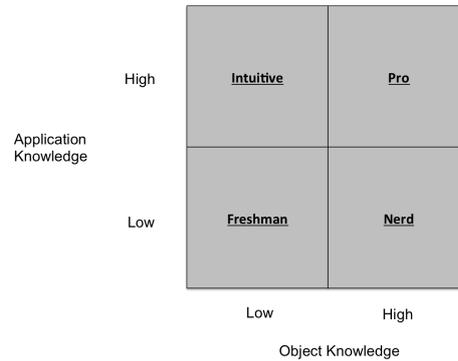
Figure 4. Framework of customers [24]

Manufacturer Survey

The second part is the two interviews with responsibles behind the toolkit. The goal is to evaluate the effects for manufacturers with 5 Interview questions (excluded the general data like age, gender and position):

- Did the process change because of the toolkit or is the toolkit flexible for different processes (Process Change)
- In which way did the traditional Marketing change (Marketing)
- Did the use of the toolkit change your acitivities in customer support (e.g. more technical support) and do you think the customer is more integrated in your product development (Integration/Support)
- Did you have better access to Sticky Information from Customer (Sticky Information)
- Did the use of the toolkit decrease the Market Research (Sticky Information)
- Did the toolkit save costs for the company compared with the traditional process (Costs)

Figure 5. Screenshot of the Toolkit at www.my-moebelstueck.de.

Toolkit for furniture used in the user test
The low-end toolkit allows customers to design their own furniture. The responsible company for the toolkit is the German start up My Möbelstück (www.my-moebelstueck.de) and was founded in 2013. The toolkit allows designing furniture with different elements and they are produced by carpenters. The solution space is very high and the user receives design feedback in the trial and error process. The toolkit has six steps in which the customer can come closer and closer to his or her furniture he or she want.

Participants
The survey is divided in 2 parts. The first part is with potential customers of the toolkit. The 12 people consist of 6 women and 6 men. The average age is 40 and they are from Germany, Sweden and Holland. The participants are current students, graduated people and people with higher education. The customers are divided into the 4 groups shown in Figure 4. From every group we interview 3 people. The participants was choosen in our closer environment according to the four groups of customer. It was very important to be sure that every group is represented by three participants.

The second part is the interview with the manufacturers of the company. Both participants are 24 and they are the founders of the company. The company is in Germany.

4.2   Results

This Section shows the results of the study. They are divided into two different Sections. The first Section show the results for the end-user and the second the results from the manufacturer.

End-User Results

Table 2 shows the different effects with the results divided in the different kinds of customers according to the four different groups described Figure 4. The participants evaluate the effects on a scale from 1 (I do not agree) until 5 (I agree)

All in all the effects for every group with an average of 4,23 are very positive. Every effect exists and is validated by the end-users. The strongest influence has with 4,42 the social and the functional (4,34) effects. But also the process (4,12) and psychological (4,05) effects are confirmed by end-users. So it can be seen that all effects are given. The users are also able to define their needs (3,92) before they use a toolkit.

The freshman is with 4,51 the most addicted user to the effects. He is much influenced by the functional (4,75) and the social (4,5) effects. The process (4,33)

and the psychological (4,4) are also very high. So this group of end-user is very influenced by effects. But they have problems to define his or her needs (2,33).

The intuitive (4,27) end-user is also very addicted to all of the effects. As an expert for furniture he or she knows exactly his or her needs (5). This user group is addicted to the social effects (4.83). The other effects are also given. They think that are also claimed by the functional effects (4,33). The process (4) and the psychological (4,13) are also confirmed by this kind of end-user.
The nerd is the weakest group (3,86). They do not really know their needs (1,67) and so the effects are not strong. They think that social (4,17) and functional (4) effects are given. They are unsure with the process (3,87) and psychological (3,53) effects.

The pro end-user results are very high (4,25), so they confirmed the effects claimed with TID. Especially the social (4,33) and the process (4,27) effects are given. They also rate the psychological (4,13) and the functional (4,27) effects very high. This target group was able to formulate their needs very well (4,33).

All in all the end-users are influenced by the effects claimed with TID. But the effects are different for different user groups. So it has to be separated which kind of end-user uses the toolkit. As an overall view it can be confirmed that the effects exists in general for all kind of end-users.

The statistical significance of the results is very high because the different customer groups represents their logical results. Nerd users for example has low knowledge about furnitures and high knowledge about using the toolkit. Results show that they can handle the toolkit easier but also show their lack with the product themself. This can be seen in every customer group.

Effect	All	Freshman	Intuitive	Nerd	Pro
Heterogeneous Needs	3,33	2,33	5	1,67	4,33
Functional	4,34	4,75	4,33	4	4,25
Costs	4,17	4,67	4,33	4	3,67
Time	4,25	4,67	3,67	4	4,67
Fit needs	4,67	4,67	4,67	4,33	5
Effiency	4,25	5	4,67	3,67	3,67
Process	4,12	4,33	4	3,87	4,27
Trial and Error	3,75	3,67	3,67	4	3,67
Solution Space	3,83	4,33	3,33	4	4
Easy/Knowledge	4,08	4,67	3,33	4,33	4
Entertaiment	4,5	4,67	4,67	3,67	5
User-Friendly	4,42	4,33	4,67	4	4,67
Psychological	4,05	4,40	4,13	3,53	4,13
Design Myself	4,75	4,67	5	4,33	5
Pride of Authorship	4,83	5	5	4,33	5
Willingness to pay	4	4,33	4	4	5
Co-designer	2,75	3	3	2	3
Satisfaction	3,92	5	3,67	3	4
Social	4,42	4,50	4,83	3,17	4,33
Unique	4,83	5	5	4,33	5
Individual Solution	4,67	4,67	5	4,33	4,67
Better Product	4,25	4,33	4,67	4	4
Average	4,23	4,51	4,27	3,86	4,27

Table 2: Results of the study (1 - I do not agree to 5 - I agree)

Manufacturers Results

The interviews with the manufacturers shows that the effects of TID are also valid for them. The process of the production does not change because the toolkit is very flexible and can fit with existing processes. The access to sticky information is according to the manufacturers easy because it is possible to look at the results and functions, which users want to have. In case of marketing, the behavior changes only in the presentation because manufacturers do not advertise for a single product. They advertise with „design it yourself" and „creativity ". But the last effect, that TID saves costs is not valid at the beginning because the implementation of TID is very expensive. But after that implementation it can save costs compared to the traditional selling process. The results are summarized in Table 3.

Factor	Claimed effect
No process change	TID are very flexible and fit with existing processes
Sticky Information	you can see what the customer really want, easy access
Marketing	change from a classical product to creativity and design yourself
Support	change to design and technical support
Costs	high costs and the beginning and than cost decreasing effects

Table 3: Claimed effect for different factors reported by manufacturers

5   Limitations

IIn practice several toolkits from pure product configurators to high-end software [7]. According to Franke and Piller [7] different toolkits can have different effects on users. In this study we only use one toolkit, which is created for the furniture market. Maybe other toolkits have different effects on user. So the study is limited on this low-end toolkit and of the furniture market. The results are only valid for this specific toolkit.

6   Conclusion

TID are systems, which allow the user to design a novel product via trial and error experimentation and deliver feedback on the potential outcome. These systems have different effects for manufacturers and customers. With the method of the grounded theory we searched for different effects and categories. After that we created a valueframework for the different effects and sorted them in categories. Based on this framework a semi-structured survey was created and a total of 12 customers and 2 manufacturers were asked. The 12 customers were divided in 4 kinds of customers. The participants used a simple low-end toolkit to design their own furniture.

The study shows that there are several effects claimed with user toolkits and they are different for different kinds of customers. The effects also influence manufacturers processes and organization.

For a further research the framework should be tested with other kinds of TID. So theories about different markets and toolkits can be made. It is also necessary to interpret the results and find out why a group of customer is more influenced by effects and why not.

7   Acknowledgements

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