

Applicability of Focus Groups in a Design Science Project

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Abstract

Focus groups are a popular qualitative research method often applied to different areas of such as in medical research. The aim of this research paper is to analyse the applicability of focus groups - conducted in compliance with an adopted focus group framework based on Tremblay et al. - in a design science project. Based on classic focus group literature and on the particularities of a design science context, the existing framework by Tremblay et al was adapted and a step-by-step procedure was developed. It includes the most important steps and activities one has to take into consideration when planning, conducting and analysing a focus group study in a design science project. To analyse the applicability of this procedure, it is applied to a current design science based research project. The main findings of this paper confirm that focus groups, conducted in compliance with the adapted framework, can be of great use in design science projects to create, improve and evaluate artifacts and the results gained in such way can provide essential contributions to the knowledge base. The proposed procedure facilitates planning, conducting and result analysis. In addition it can serve as a reference framework in other design science based projects where the application of focus groups is planned.

Keywords: focus groups, focus group procedure, design science, design science research, build-evaluate-cycle

1 Introduction

Design Science is inherently a problem solving process (Hevner et al. 2004) and can be defined as an attempt to create outputs that serve a particular human purpose (March and Smith 1995). There are basically four different kinds of DSR outputs (artifacts): constructs, models, methods and implementations / instantiations (March and Smith 1995; Hevner and Chatterjee 2010). The fundamental principle of DSR is that knowledge of a problem and its solution is created in iterative build-and-evaluate cycles of artifacts. Based on this pattern, Hevner et al. (2004) derived seven guidelines to assist researchers to understand the requirements for effective design science research: (1) Design as an Artifact, (2) Problem Relevance, (3) Design Evaluation, (4) Research Contribution, (5) Research Rigor, (6) Design as a Search Process and (7) Communication of Research (Hevner et al. 2004).

Hence, the core element of Design Science is to develop or build artifacts that are theoretically grounded (rigorous knowledge base) and to justify or evaluate those artifacts for the particular environment (relevance for application environment).

Many different methods and techniques can be found and applied in the context of design science to build, evaluate and improve artifacts, including experimental, observational, testing, descriptive and more recently action research methods (Helfert and Ostrowski 2012; Cole et al. 2005; Hevner et al. 2004; Baskerville and Myers 2004; Lindgren et al. 2004). Such methods range from different kinds of literature reviews, benchmarking, surveys or expert interviews to prototype experiments and simulations (Sonnenberg and Brocke 2012a; Hevner and Chatterjee 2010; Sonnenberg and Brocke 2012b). The current paper concentrates on the use of focus groups in design science based projects. The approach of applying focus groups to build, evaluate and improve design science artifacts is relatively new to the IS field (Smolander et al. 2008; Tremblay et al. 2010). Therefore, in the course of the current paper, a systematic procedure for applying focus groups in design science based projects is proposed, adapted based on one of the few reference frameworks in this context (Tremblay et al., 2010). The research question addressed is the following: Is the developed focus group framework, adopted based on the one of Tremblay et al., applicable in the context of a design science project and does a focus group study conducted in accordance with exactly this procedure deliver project relevant results which contribute to the knowledge base?

In section 2 we present initially the characteristics and general conditions of traditional focus group techniques. Subsequent we present a detailed procedure for applying focus groups for design science projects, adapted based on the existing focus group framework by Tremblay et al. (2010). The adapted procedure is then applied to design and conduct a focus group study as part of a current research project. We conclude our paper by summarising the main findings and contributions in the last section of this paper.

2 Focus groups as research method

Focus groups have long been applied in market and medical research and offer great potential for qualitative research in general (Tracy 2013). The term focus group indicates that this method aims to study a clearly defined area or set of issues (focus) in the context of a group discussion (Stewart et al. 2007). The direct interaction between the group members is the main source to collect information in focus groups which would have been less accessible in simple one-to-one interviews (Morgan 1998).

Usually encouraged by a moderator, a small group of people share ideas and thoughts on open ended but predefined questions. The questions are hereby meant to feel spontaneous, but have to be clearly defined in the so called “questioning route” (Krueger and Casey 2009; Puchta and Potter 1999).

A typical focus group as defined in literature consists of three to 12 participants, depending on the source of the literature (Sim 1998; Krueger and Casey 2009; Tracy 2013). When complex issues or

problems are the focus of the study, smaller groups are advised and the size of the focus group should not exceed seven participants (Krueger and Casey 2009).

Morgan et al. (1988) considers focus groups particularly useful for:
orienting within a new field of study
generating hypotheses based on informants' insights;
evaluating different research sites or study populations;
developing interview schedules and questionnaires;
getting participants' interpretations of results from earlier studies

Additionally, focus groups offer a more economical way of collecting multiple views at one time (Krueger and Casey 2009), provide information on the dynamics of opinions and attitudes by observing group interaction (Morgan 1998), encourage spontaneity and a safe forum for expressing opinions, as participants do not feel obliged to answer every question (Vaughn et al. 1996), and support a feeling of belonging to a group (Peters 1993).

In traditional literature, several key elements of conducting focus groups can be found. The following list provides an overview of the most common points and steps one has to take into consideration when planning to conduct focus group studies (Morgan 1998; Krueger and Casey 2009; Stewart et al. 2007):

- A clear objective and research problem has to be defined
- Carefully select participants in accordance to research objectives
 - E.g. a rather heterogeneous group of “strangers” is more open and doesn’t take knowledge of other participants for granted
- Select an appropriate moderator and a suitable setting
 - A feeling of trust and confidence has to be achieved to talk openly and perceive a comfortable group setting
 - A research assistant should act as an observer and time “coordinator” and should take notes during the focus group to facilitate the final result analysis and to provide the moderator with the possibility to focus on communication and interpersonal attributes.
- Develop a predefined yet flexible questioning route
 - The questioning route should support the moderator in being well prepared, but should also give him enough freedom to address spontaneously arising questions and issues during the focus group
 - Questions should be formulated open-ended and unsuggestive of expected outcome.
 - The moderator should be supported in focussing on asking questions only and not provide answers or inputs that may distort results.
- Define a systematic way to visualize, analyze and interpret results
 - Results gained by one researcher should lead to the same or similar results gained by another one using the same raw data.

In the course of the current project, this list of guidelines and steps as well as one of the few existing frameworks in this context (Tremblay et al., 2010) was used as a starting point to derive concrete steps and measures for developing a procedure on how to apply focus groups in a design science context.

3 A Focus Group Framework for Design Science Projects

Based on the existing focus group framework by Trambley et al. (2010) and derived from section 2, the following paragraphs deal with the methodological steps respectively the procedure how to apply focus groups in a design science context. The sequence of those steps is visualized in figure 1 and the content of each step is explained in more detail in section 3.1. to 3.7.:

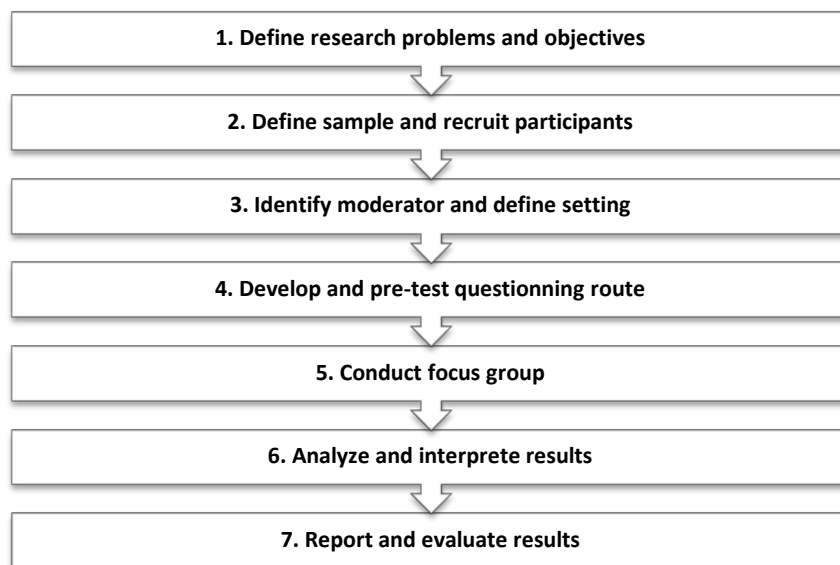


Figure 1. Procedural steps to apply focus groups in a design science project based on Tremblay et al. (2010)

3.1 Define research problem and objectives

As mentioned before, the core element of design science are iterative build-evaluate cycles. When applying focus groups in a design science project, the aim should be to support the build-cycle by gaining the possibility for artifact improvement and to provide a setting for evaluating the artifact in the course of the evaluate-cycle. Hence, when applying focus groups in a design science project, there are basically two types of focus groups: explanatory focus groups and confirmatory focus groups (Tremblay et al. 2010).

The first step when one plans to conduct a focus group is to define which issue or problem respectively which artifact is to be analyzed in the course of the focus group study.

The next step should be to define the objective and purpose of the focus group. We can differentiate between two main goals for a focus group:

- In case the objective is to further define or explain a scientific issue or problem in more detail, practically oriented way, multiple explanatory focus groups should be applied. Findings and results from one focus group can hereby transferred to following one to further increase the quality of their results, e.g. by adapting the questioning route (“rolling interview guide”) or setting (Piercy et al. 2005; Morgan 1998; Dworkin et al. 2003).
- In case the goal of conducting a focus group study is to demonstrate the utility and validity of an artifact in a particular field of application, then confirmatory focus groups should be used. In this case, the results of on focus group must not be transferred to another one and no changes ought to be made concerning questioning route and focus group setting.

3.2 Define sample and recruit participants

The sample and the participants of the focus group should be chosen in accordance to the research problem and the objectives defined in step 1. According to literature, a focus group study should be continued until no new insights and knowledge can be collected (Ivanoff and Hultberg 2006; Henwood and Pidgeon 2006). According to Tremblay et al. (2010), one pilot focus group, two explanatory focus groups and at least two confirmatory focus groups should be conducted. The ideal number of participants also depends on the objective of the focus group study: smaller groups require each participant to be more active while larger groups may lead to social loafing (Morgan 1998).

According to Trambley et al. (2010) larger focus groups exceeding six participants may be tricky to apply in a design science project since the subject matter in such projects is more complex than topics of traditional focus groups.

As mentioned in section 2, participant recruitment is a critical success factor for focus groups. As the subject matter is usually rather complex in design science projects, participants should be familiar with the topic of the focus group. Nevertheless the heterogeneity of the group could lead to new insights as things are not taken for granted and are discussed more deeply. Hence, in our understanding, the ideal focus group sample in a design science project consists of 4 to 6 participants who are familiar with the application environment of the artifact and yet have different backgrounds, e.g. from a different division or company location.

3.3 Identify moderator and define setting

Identifying an appropriate moderator and defining a suitable setting are critical factors for successfully conducting a focus group study. The moderator should not only be chosen in regard to personal skills but also in regard to his abilities to perform well in the focus group setting. As already explained in section 2, several points have to be taken into consideration in regard to the moderator's personality (cf. section 2): his ability to listen, a respectful tone, communication skills, open mindedness, a friendly character and a sense of humor and last but not least the ability to involve and motivate the participants to contribute and actively take part in the focus group (Krueger and Casey 2009).

Compared to traditional focus group topics, design science project artifacts are often more complex. In this context, the moderator should be able to focus on communication and interpersonal skills only. Hence, we suggest providing a second observer who takes notes during the focus group and also acts as a time coordinator. This not only represents a major simplification for the moderator, but also facilitates the final result analysis (Folch-Lyon and Trost 1981; Bradley et al. 2002).

The focus group room itself should be inviting and motivating, appropriate technology based tools (beamers, whiteboards...) and refreshments should be provided in regard to the defined size of the focus group (c.f. to section 3.2.) (Tracy 2013).

3.4 Develop and pre-test questioning route

In a design science design project, evaluation and improvement is a core element. When conducting focus groups in such a context, the questioning route should at least be pre-tested once before applying it in the actual focus group. Additionally we would suggest using a rolling interview guide in explanatory focus groups to further develop and improve the aptitude of the questioning route by collecting and implementing feedback in each conducted focus group (Morgan 1998; Piercy et al. 2005; Stewart et al. 2007; Dworkin et al. 2003). When conducting focus groups with the objective to confirm a developed artifact, a rolling interview guide must not be used as this would distort the results (also cf. section 3.1.)

As mentioned before (cf. section 2), the questioning route itself should allow flexible ways of communication but yet provide a clear framework and structure for the moderator. Questions should be open ended and not suggestive, the moderator should be supported in only asking questions and shouldn't need to indicate possible answers as well as this would distort results.

3.5 Conduct focus group

The fifth step is to conduct the focus group according to the defined setting and the developed questioning route. During the focus group, experience regarding the aptitude of the setting and the questioning route can be gained and transferred into following focus groups for improvements (cf. section 3.1.) In order to make results traceable we suggest using audio or video recording for documentation and evaluation purposes.

Additionally, the moderator should provide some general information on the objectives of the target group, the general rules and the timeline in the course of a short introductory presentation at the beginning of the focus group (Berg 2001).

3.6 Analyze and Interpret Results

After having conducted a focus group, results are analyzed and interpreted. Hereby, the scheme used to analyze the collected data should produce the same or similar results independent from the researcher conducting the analysis (Krueger and Casey 2009). Depending on the research objective and the confidentiality of the artifact, an appropriate scheme has to be chosen. In practice, there are many different approaches to analyze qualitative data, most researcher do not apply one approach only but rather use a mixture of different approaches (Green and Thorogood 2004). In the course of the current project, we applied the framework analysis developed by Krueger (2009), which suggest a continuum of analysis ranging from the accumulation of raw data to deduction of descriptive statements and the interpretation of data.

3.7 Report and Evaluate Results

According to the design science build-evaluate cycles, also focus group results should be reported and evaluated. By that we suggest to conduct a final confirmatory focus group after all explanatory focus groups are finished and the results gained in the course of those are aggregated and ready to be confirmed respectively evaluated. Like approaches to analyze qualitative data, there are also many ways of reporting focus group results (Miles and Huberman 1994) which have to be chosen in regard to the quality and nature of the artifact and the research objectives.

4 Applying focus groups in a Design Science project

To analyse the aptitude of the adapted procedure for conducting focus groups in a design science context, we applied the procedure in the course of the current design science based research project InnoStrategy 2.0, which lays a focus on the early phases of the innovation process (the so called Front End of Innovation). In section 3 we presented the adapted focus group procedure based on the framework of Tremblay et al. (2010). In sections 4.1 to 4.7, the authors describe the application of just this procedure in the context of the previously mentioned design science project.

4.1 Define research problem and objectives

In accordance to the developed procedure, we defined the research problem and the objective of the focus group study. As design science artifact for analysis a theory-based process model for the early stages of innovation was selected. The objective of conducting the focus group study was to improve the artifact by collecting data on current processes and activities at the Front End of Innovation in selected organisations participating in the current project.

The main goal of the focus group study was to enrich and improve the theoretical knowledge with insights and knowledge from business practice. Additionally, the results obtained in such manner also contribute to the underlying knowledge base. In the course of the current research project InnoStrategy 2.0, this means that the main objective of and the reason for conducting a focus group study was to derive a theory-based but also practically relevant process model addressing the early stages of the innovation process, as well as collecting critical success factors, challenges and experiences in this context from practitioners. In this respect, we decided to conduct a pre-test, three explanatory and one confirmatory focus group to validate the artifact adoptions, which were made based on the results of the explanatory focus groups.

4.2 Define sample and recruit participants

As the selected artifact was rather complex in its nature we selected – in accordance to the developed procedure (cf. section 3.2.) - participants who are one the one hand familiar with the topic of innovation management but on the other hand are from different divisions of the respective partner organisation. By that, we assured that participants know what they were talking about but still have different points of views on the artifact under investigation. According to Trambley et al. (2010) we defined a sample size of 4 participants per focus group and recruited them directly through our contact partners in the different organisations. The following table provides an overview of the background and number of the selected focus group participants:

<i>Type of focus group (FG)</i>	<i>Number of Participants</i>	<i>Background Participant 1</i>	<i>Background Participant 2</i>	<i>Background Participant 3</i>	<i>Background Participant 4</i>
Explanatory FG organization 1	4	Innovation Manager	Research & Development	Business Development	Research & Development
Explanatory FG organization 2	4	Product Manager	Project Manager	Research & Development	Innovation Manager
Explanatory FG organization 3	4	Product Lifecycle Management	Marketing	Innovation Manager	Research & Development
Confirmatory FG – one / organization	2-3	Innovation Manager	Product Development	Research & Development	-

Table 1. Sample of the focus group study

Additionally, a short information presentation was provided in the forefield to all participants to inform them about the subject and objectives of the focus group study.

4.3 Identify moderator and define setting

As the role of the moderator plays a key role for the success of focus groups, we specifically selected an experienced practitioner with background in innovation management and the required personal and communication skills (cf. section 3.3.). The setting of the focus group study was defined in regard to availability and aptitude of spatial and technical infrastructure. In the course of a project team meeting, the SprintLab and its technical highly sophisticated infrastructure was selected as the most suitable setting for conducting our focus group study (Perteneder et al. 2013; Gaubinger et al. 2013).

Besides the moderator, a second observer took notes during the focus group to facilitate the final result analysis and to provide the moderator with the possibility to focus on communication and interpersonal attributes (cf. section 3.3.).

4.4 Develop and pre-test questioning route

In accordance to section 3.4 we developed a questioning route with the character of a rolling interview guide. The questioning route consisted of 6 question areas for each of the four process stages at the Front End of Innovation as defined in section 4.1. To provide a high degree of flexibility, the question areas were developed independently from each other, so that various ways of answering the questions and spontaneous inputs and changes were possible.

The pre-test of the questioning route was conducted with 2 participants of each partner organisation with the aim of improving the questioning route itself, addressing requirements and meeting expectations of the partner organisations. The pre-test was an important step to assure the aptitude of the SprintLab and its technical infrastructure for the current focus group study as well.

4.5 Conduct focus group

The focus group was conducted using the Niceboard – a digital whiteboard in the SprintLab (cf. section 4.3) – where the moderator and also the participants themselves were able to take “digital notes”. The following picture (figure 2) was taken during one of the workshops and visualizes the setting and arrangement of the focus group:



Figure 2. Setting and technical infrastructure of the conducted focus group study

At the beginning, a short introduction phase was held, including a presentation about the artifact and the relevant topic, as well as introductory round and a briefing on how to work with the digital NiceBoard.

The whole focus group was also filmed (cf. section 3.5.) in order to make results traceable.

4.6 Analyze and Interpret Results

The results gained by using the NiceBoard and the video recording were analyzed according to the framework analysis developed by Krueger (2009), which suggest a continuum of analysis ranging from the accumulation of raw data to deduction of descriptive statements and the interpretation of data (cf. section 3.6.).

In a first step, the video recordings were transcribed. In a second step, the transcripts were combined with the notes on the NiceBoard (cf. fig. 3) and the protocol of the second observer:

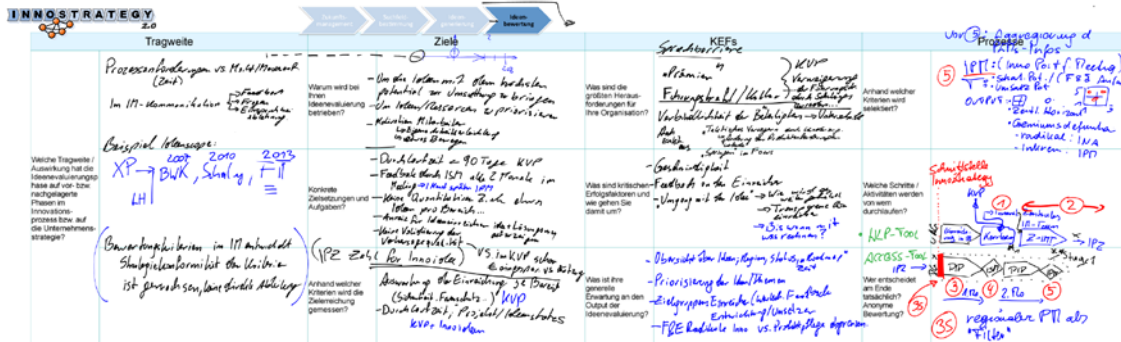


Figure 3. Exemplary overview of notes gained via the Nice Board

Thirdly, descriptive statements were derived. Those statements were summarized in tables using a predefined scheme (cf. fig 4):

Phase	Bereich	Kurzfrage	Ergebnis / Antworten
Zukunftsmanagement	Tragweite	Einfluss Vision/Mission	Zukunftsmanagement bewegt sich innerhalb der Vorgaben der Strategie, diese wird in Zyklen vom Vorstand definiert (aktuell: 2011-2016) und bei Bedarf jahresweise angepasst (Ausrichtung über die Zielfelder der strategischen Vorgaben, meist nur geringe Anpassungen / Bestätigung der Strategie); Overall: Es muss Schallungsfokus haben (ABER: Es werden auch andere Branchen im Sinne von Cross Industry beobachtet) und Ziel: Innovationsführer sein; Strategie ist sehr stark marktorientiert, nicht auf einzelne Produkte bezogen und generell zum Thema Innovation selbst relativ wenig
		Auswirkung auf Vision/Mission?	
	Ziele	Zusammenhang Strategie?	Generell Strategie-getrieben; Trends rechtzeitig erkennen;
		Grund?	
		Ziele?	Konkrete Vorgaben auf dieser Ebene fehlen; Overall-Ziel: Innovationsführer sein
KEFs	Erfolgskriterien?		
	Herausforderungen?	Globaler Markt ist enorm komplex: verschiedene Reifegrade der Länder, versch. Bautraditionen; Kommunikation und Abgrenzung: wie viel Komplexität lasse ich zu?; Durchgängiges Wissen und Commitment; enormer Kosten- und vor allem enormer Preisdruck;	
	Ergebnis?	Monitoren von Gesetzen, Normen, Patenten, Wettbewerb; Einbindung externer Experten; nationale Ausrichtung; Erwartung: Roadmap für Trends (Technologie-, Produkt- und System-Roadmaps für Länder und Konzern); Generieren von "Topic-Clouds" und Abbildung in Strategic Buckets	
Zukunftsmanagement	Prozesse	Initiierung?	Getriggert durch PLM, R&D und Vorstand; Die "Sensoren" (Mitglieder in Netzwerken) adressieren auch gezielt Themen
		Prozess?	Vorgaben durch Strategie; Trends werden durch Kontakte (externe Netzwerke, Kunden, Lieferanten) gesammelt (Marktbeobachtung - was wird gebaut? Welche Methoden? Lassen sich Trends ableiten?); Ideenmanagement kann unabhängig von Suchfeldern passieren
		Rollen?	Zukunftsmanagement passiert in den jeweiligen Fachbereichen (getrennt voneinander, keine zentrale Stelle); Entschieden wird in Forschungskreis und Innovationsausschuss
	Methoden/Tools	Methoden?	Marktbeobachten ("Sensoren" in versch. Netzwerken); Workshops mit Lieferanten (was machen diese? Cross Industry); Trendradar und Zukunftsradar gab es einmal, aber nicht systematisch; Patentmonitoring; Expertenbefragungen; Baustellen-Analyse; R&D-Meilensteine (World-Cafe's für Innovationsmarketing)
		Unternehmensumfeld?	Kontakten zu Experten, Kunden, Lieferanten, Ämtern, Normungsinstituten, Normungsgremien
		Methodenauswahl?	Je nach Aufgabenstellung aus R&D-Sicht ausgewählt
	Input/Output	Inputs	Patente, Gesetze, Trends (zur Verfügung gestellt durch strategisches Marketing -> Abfrage bei Landesgesellschaften); In dieser Phase ist man generell noch sehr offen für verschiedenste Ideen / Inputs; Trends, Anforderungen, Ideen kommen auch aus Tagungen, Messen, Symposien
		Outputs	Trends; Ergonomie-Sicherheit-Wirtschaftlichkeit (Baustellen-Analyse)
		Methodenanwendung?	Fortlaufende Anwendung wäre wünschenswert, momentan nur selten / sporadisch (Bsp.: Trendradar); Häufig leider Methoden-Anwendung durch Druck des Tagesgeschäfts (Dringlichkeit vs. Wichtigkeit -> Ressourcen)

Figure 4. Exemplary table of descriptive statements gained by raw data analysis

The last step was the development of final results, which were summarized in table and visualized graphic form (cf. fig. 5):

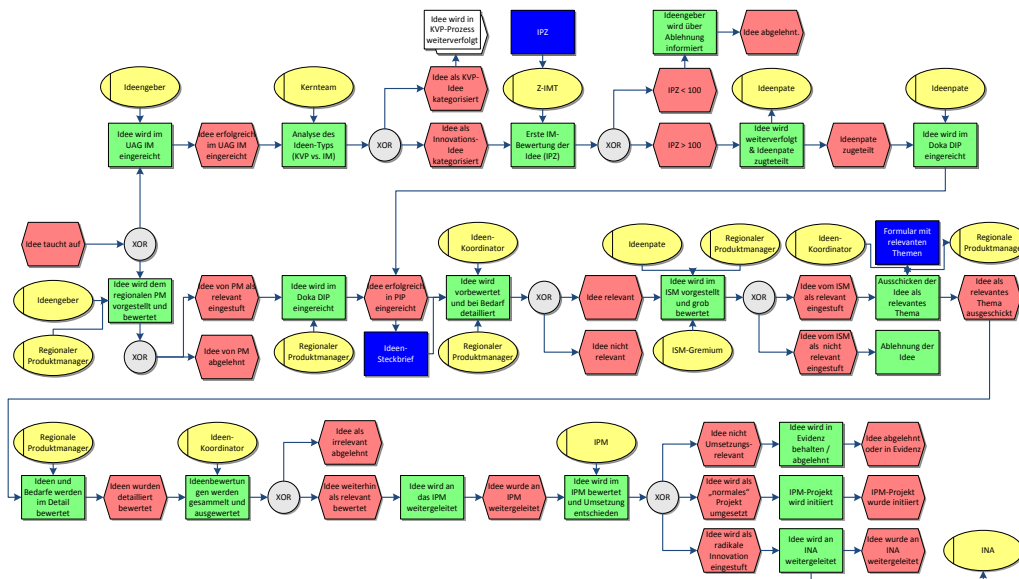


Figure 5. Exemplary process visualization gained by raw data and descriptive statement analysis

4.7 Report and Evaluate Results

After result analysis and interpretation, we decided to report and evaluate respectively confirm the findings in the course of a group discussion similar to a confirmatory focus group. For each organisation, we collected the results and presented them to the innovation manager and the development manager respectively the head of R&D to evaluate our results and improve them if necessary. This additional feedback-loop provided us with new potential for enhancement on the one hand and on the other hand ensured the correctness of the results gained (cf. section 3.7.).

5 Conclusion and Contribution

The aim of the current paper is to analyze how focus groups could be applied in a design science project. Based on the focus group framework by Tremblay et al. and on relevant literature, a step-by-step procedure was adapted respectively developed in section 3. This procedure or framework was in a next step applied in the course of a current design science project to conduct a focus group study (cf. section 4). In total, one pre-test focus group, 3 explanatory and 3 confirmatory focus groups were conducted.

The main findings gained in the course of the current paper are the following:

- The procedure / framework provided a well-structured and clearly defined step-by-step set of actions which fit into our design science based research project.
- By conducting the focus group study according to just this procedure, we were able to enrich our theory based process model for the early stages of innovation (our artifact in this context) in the course of three explanatory focus groups.
- The confirmatory focus group (one per partner organization) provided us with further information and process knowledge on the one hand, and confirmed the changes which were made to the artifact based on the results of the explanatory focus groups on the other hand.
- The results of the focus group provided comprehensive information and valuable additions to the knowledge base in form of the derived descriptive statements and the visualized process stages at the front end of innovation.

The focus group framework by Tremblay et al. provided a good basis for adopting and developing a procedure, which could be found to be of great use to plan and conduct the focus group studies in the current design science project. The results gained in the course of the conducted focus group studies are an important basis for further project steps and an essential contribution to the underlying knowledge base. Of course, this procedure needs further evaluation and improvement, but can serve as a reference framework or at least a good starting point for other researchers who plan to conduct focus groups in a design science context.

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