Design Science Research with Focus Groups – a Pragmatic Meta-model

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Abstract

Purpose *– The purpose of this research paper is to present a pragmatic and systematic approach to conduct and document Design Science Research (DSR) activities with Focus Groups (FG), exploring its continuous usage and providing traceability between problem, requirements, solutions, and artifacts.*

Design/methodology/approach *– To conduct the research and produce the meta-model for DSR with FG, a DSR approach was adopted using a conceptual model for Action Design Research already available. The artifact is the result from a specific literature review to define requirements, a careful design, and a refinement stage where it was widely used and tested in real IS implementation projects.*

Findings *– The main outcome of this research is a specific meta-model for DSR with FG, that delivers new insights and practical guidelines for academics and professionals conducting and documenting real-world research and development initiatives deep-rooted in stakeholders' participation. Rigorous and committed stakeholder engagement is a critical success factor in complex projects. The use of a meta-model enables to increase the process effectiveness, by framing debate and stimulating stakeholders' participation.*

Research limitations/implications *– The meta-model has been endorsed as a practical and useful artifact by the stakeholders participating in the IS projects where it was adopted. However, to fully demonstrate its capabilities and to become more robust, the model must be further used and tested in other application situations and environments.*

Originality/value *– The usage of Focus Groups (FG) in Design Science Research (DSR) has already been proposed as an effective way, either to study artifacts, to propose improvements in its design, or to acknowledge the utility of those artifacts in field use. The paper provides a sound contribution to this line of research by presenting a meta-model that integrates process and data that may be used by researchers and practitioners to conduct their projects.*

Keywords: *Design Science Research; Focus Groups; Stakeholder involvement; Co-creating knowledge; Process Model; Data Model*

1. INTRODUCTION

This paper section presents the problem definition, significance and motivation, introduces key concepts, sets the research objectives, explains the scope of study, provides an overview of methods and findings as well as the theoretical and practical significance, and describes the structure of the paper (Gregor and Hevner, 2013).

1.1. Problem definition

Failures in IS projects have a high cost which is important to minimize (Durmic, 2020). The accomplishment of any socio-technical system depends on the sound contributions from all the key stakeholders involved. Users' participation becomes a critical factor for success (Kujala et al., 2005). When considering information systems, failures include not meeting time, budget, and functional requirements. Users contributions become paramount in all stages of the development process to assess, to specify and to validate functional or usability requirements, or to test and validate the proposed solutions. Fostering people´s involvement is also fundamental to reinforce the individual competences and social skills that are required to promote organizational change and to adopt the technology.

To overcome the above-mentioned issues and to improve the level of success in IS projects, it is important to devise pragmatic models and practical processes able to reinforce the user participation. The DSR paradigm aims to achieve this objective. Additional methods and approaches that contribute to reinforce the DSR capabilities are required and welcome.

1.2. Problem significance and motivation

As a result of a previous research, a Conceptual Model for Action and Design Research has been developed (Henriques & O'Neill, 2019) aiming to provide a general response to "how-to questions". Part of this methodological model describes an integrated set of essential steps and data to be considered when solving multidimensional (knowledge and design) problems.

The conceptual model has been adopted to teach graduate students on the fundamentals of AR and DSR. It was also empirically used to help conducting some MSs thesis research projects that aimed to design and build specific IS applications in distinct business and non-profit organizations domains. The model has demonstrated being a robust tool by helping to characterize the Action and Design Research (ADR) data and processes that are required in IS projects, in a comprehensive and integrated way.

However, the use of the model also enabled to identify that additional support was required in order to handle more practical IS project requirements, namely, to foster stakeholders' involvement in user centric activities when co-creation becomes a key requirement for IS adoption. This need has exposed a relevant didactical research gap and created an opportunity for additional research.

This is the context that motivated the research described in this paper. The possibility to integrate FG with DSR was considered a promising path for enhancing user involvement in IS projects.

1.3. Introduction to key concepts

Design Science Research (DSR) is a research paradigm in which a researcher provides answers which are relevant to address human problems, to create useful artifacts and to provide contributions to knowledge. It has already proven to be a rigorous and relevant research method.

The term artefact, which is a focal aspect of DSR, has been widely used to describe something that is artificial, or constructed by humans, as opposed to something that occurs naturally (Simon, 1996).

Grounded on this perspective, Hevner and Chatterjee (2010) highlighted that a number of disciplines have made design a central element in what they do – including architecture, engineering, computer science, software engineering, media and art design, and also information systems. For these authors, a fundamental principle of DSR is that "knowledge and understanding of a design problem and its solution are acquired through the building and application of an artefact".

Also, Focus Group (FG) research has been widely used for knowledge generation, as an effective instrument to investigate new ideas, based on the collective engagement of problem-solving stakeholders. A focus group is "a special type of group in terms of purpose, size, composition, and procedures", being its main purpose "to better understand how people feel or think about an issue, idea, product, or service", where participants are "selected because they have certain characteristics in common that relate to the topic in analysis" (Krueger & Casey (2015).

Hevner and Chatterjee (2010), emphasizing the "increased attention on the use of FGs in Information Systems Research", highlight several key reasons for using FGs, as an appropriate evaluation technique for DSR projects, recommending its usage "as an effective way to study an artefact in order to propose improvements in its design (Exploratory FGs) as well as to establish its utility in field use (Confirmatory FGs)."

1.4. Research questions/objectives,

Aiming to contribute to IS projects success, the key objective of this research was to produce a process and data meta-model for DSR with FG able to enhance user involvement. To conceive this artefact the research objectives included to identify and understand the essential steps and data components in a DSR approach involving groups of system´s users and how to conduct the support of FG particularly within the IS domain.

1.5. Scope of study

The proposed process and data meta-model for DSR with FG has been used in teaching and supervising IS graduate students on their master thesis and doctoral dissertations. Most of these applied research projects address specific problems in distinct organizational environment, both in business and non-profit organizations.

1.6. Overview of methods and findings

The research itself adopted a DSR approach. Having identified the problem, which is based on real-world constraints, a deep literature research was conducted to identify the requirements to adapt FG to DSR.

The solution comprises a process meta-model, that describes the main activities that must be conducted to manage the FG sessions in the scope of a DSR based process, and a data-component model with the documents that must be produced as a result of those sessions.

The MSc students that contributed to the model development had a double role in this process by helping to validate the requirements that resulted from the literature review, to validate the model and testing the proposed artifact in real DSR with FG meetings. The results of the validation actions done so far suggest the model may be a useful tool in many distinct business environments and in all the IS development phases.

The meta-model has demonstrated to be a useful and practical artefact that fulfils the initial purpose that justified its development. It results from a systematization of knowledge expressed in the DSR paradigm and in the FC approach, already consolidated, which are revisited and integrated in their complementary aspects.

1.7. Theoretical and practical significance

The resulting artefact comprises a comprehensive set of documents to support specific FG sessions that must be held in all the DSR stages. Each one of the documents provides guidelines to prepare and conduct the working sessions, a description of the expected output as well as a checklist of key questions to be addressed and associated documents that are expected from the session.

The artefact is a useful basis to teach graduate students in Organizational Research Methods – providing an overview of its main dimensions, as a basis to further discovery of their own path and main references for contextualized applications.

The artefact has already been used in several FG sessions of the MSc student projects and provided very interesting and valuable results. According to the participants opinion the meetings were very productive, and the data collected was highly valuable. The students also considered that the artefact was very helpful in supporting the tasks they had to perform as session chairs.

1.8. Structure of the paper

The remainder paper starts with a literature review on DSR and FG supported on a set of selected research papers and books that are seminal references in these areas. Next it describes the DSR based methodological approach that was adopted by the research process, followed by a description of the conceptual background and requirements that led to the DSR with FG pragmatic model. The paper presents a session that describes the initiatives that are being taken to evaluate the model, followed by the discussion of the results achieved so far. The last session provides the conclusions and identifies further research opportunities in the DSR with FG domain.

2. RESEARCH GROUNDINGS: A LITERATURE REVIEW

A specific focused literature review has been conducted to identify what are the essential steps, and associated main pieces of data, that must be considered for a DSR approach supported by Focus Groups. It was mainly focused on DSR, FGs, DSR with FGs, and Information Systems' Development User involvement, and Requirements' Traceability.

2.1. Design Science Research

Realizing Simon's (1996) perspective on "*the sciences of the artificial*", several publications highlight the essential aspects of **DSR** and successful application along many years of research and practice (Van Aken, 2004; Reeves, 2006; Peffers et al., 2007; Hevner, 2007; Hevner & Chatterjee, 2010; Vaishinavi & Kuechler, 2015).

Elaborating on the scope of DSR, Peffers et al. (2007) describe DSR as involving "*a rigorous process to design artifacts to solve observed problems, to make research contributions, to evaluate the designs, and to communicate the results to appropriate audiences*". Such artifacts "*may include constructs, models, methods, and instantiations, but might also include social innovations or new properties of technical, social, and/or informational resources*".

Within the DSR process, they consider six major activities, namely: *"(1) Problem identification and motivation, (2) Define the objectives for a solution, (3) Design and development, (4) Demonstration, (5) Evaluation, and (6) Communication*."

Offerman et al. (2009), based on a comparison of DSR activities, propose an outline for the process which includes: *"(1) problem identification, (2) solution design, and (3) evaluation*."

Vaishnavi & Kuechler (2015) propose a process for DSR, including: *"(1) Awareness of Problem, (2) Suggestion, (3) Development, (4) Evaluation and (5) Conclusion.*"

Regarding DSR characteristics, Van Aken (2004) emphasizes that "*research questions are driven by field problem, there is an emphasis on solution-oriented knowledge, linking interventions or systems to outcomes, as the key to solve field problems, and the justification of research products being largely based on pragmatic validity*".

Also, Hevner & Chatterjee (2010) set a widely accepted concept for DSR as "*a research paradigm in which a designer answers questions relevant to human problems via the creation of innovative artifacts, thereby contributing with new knowledge to the body of scientific evidence*".

Hevner (2007), using an elaborated process, envisions Design Science Research as integrating a three-cycle approach and processes, including:

- *"a Relevance Cycle (requirements; field testing) – bridging the contextual environment of the research project with the design science activities;*

- *a Rigor Cycle (build design artifacts and processes; evaluate) – connecting the design science activities with the knowledge base of scientific foundations, experience, and expertise that informs the research project; and*
- *a Design Cycle (grounding; additions to knowledge base) – iterating between the core activities of building and evaluating the design artifacts and processes of the research."*

This model clearly evidences the main objects and actors within the application domain (people, organizational systems, and technical systems, and its problems and opportunities), the associated knowledge base, including scientific theories and methods, experience and expertise, and meta-artifacts (either design products as design processes), and the DSR process itself.

Altogether, these authors have contributed to establish the main DSR foundations, as a rigorous **research paradigm**.

On the other hand, from a **science perspective,** research develops within organizational contexts triggered by a knowledge gap-problem-opportunity. Several major publications (e.g., Saunders, Lewis & Thornhill, 2009; Yin, 2009; Bryman, 2012; Eriksson & Kovalainen, 2008; Creswell, 1994) refer the main steps and data elements to be considered when proposing, designing, planning, developing, evaluating, and disseminating applied research activities.

As a first reference in the field, concerning the research process Saunders, Lewis & Thornhill (2009:10) denote that "*most research textbooks represent research as a multi-stage process that you must follow in order to undertake and complete your research project*".

For this research path, they specifically recommend a set of main activities, namely: " *(1) formulate and clarify your research topic, (2) critically review the literature, (3) understand your philosophy and approach, (4) formulate your research design, (5) negotiate access and address ethical issues, (6) plan your data collection and collect data, (7) analyse your data using qualitative and/or quantitative methods, (8) write your project report and prepare your presentation and (9) submit your project report and give your presentation*."

Yin (2009), focusing on the Case Study Research approach, describes it as a "*linear but iterative process*", including a path starting with a "*thorough literature review and the careful and thoughtful posing of research questions or objectives*".

Particularly, his approach includes six major interrelated steps: *"(1) plan, (2) design, (3) prepare to collect evidence, (4) collect evidence, (5) analyse evidence, and (6) share".*

Concerning the area of Social Research, Bryman (2012:14) summarizes the process in seven essential components: *"(1) literature review, (2) concepts and theories, (3) research questions, (4) sampling cases, (5) data collection, (6) data analysis, and (7) writing up".*

Similar patterns are recognizable in several reference publications within the domain of Research Methods and Research Design (e.g. Eriksson & Kovalainen, 2008; Creswell, 1994).

Using a DSR approach – founded on these perspectives and being based on the results of empirical work, grounded on a major organizational transformation program and involving the design of major IS intervention projects (Henriques, 2015; Henriques & O'Neill , 2014, 2016) – the authors have previously published a Conceptual Model for Action and Design Research (ADR) (Henriques & O'Neill, 2019), using the form of a tri-dimensional perspective (figure 1).

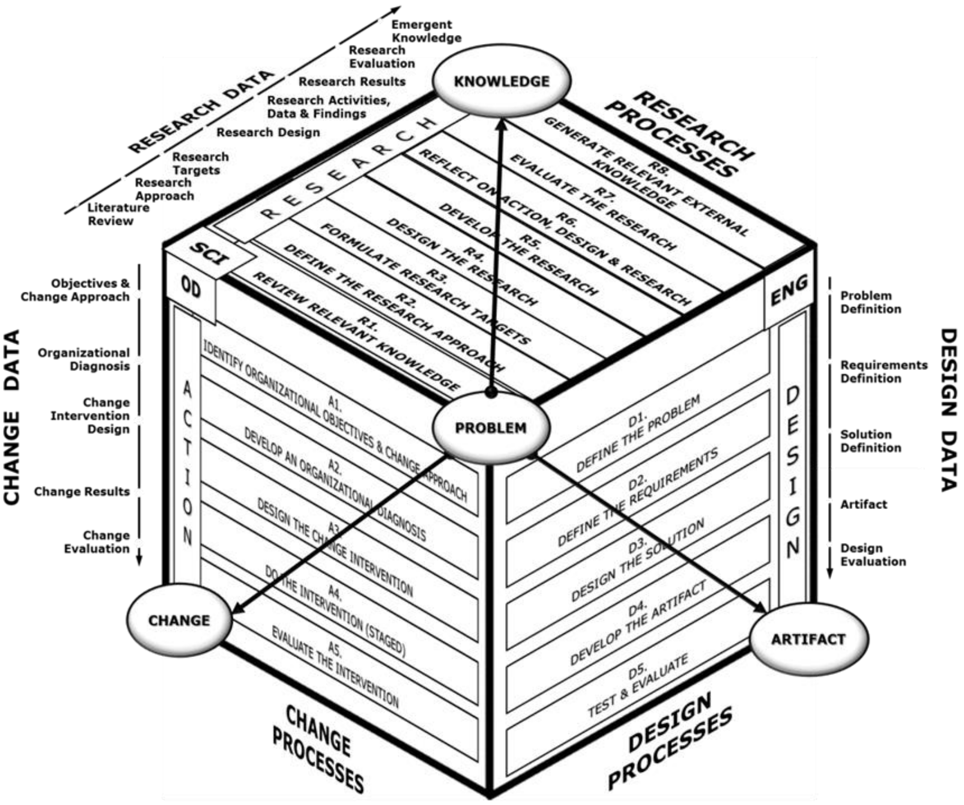

Figure 1 - ADR foundations: the Science, Organizational Development, and Engineering perspectives (source: Henriques & O'Neill, 2019)

This model combines the traditional scientific, engineering, and organization development approaches.

It provides a simple and integrated perspective, showing the main process and data that are parts of an approach which allows organizations, or social communities, to, simultaneously, solve multidimensional problems, while producing actionable knowledge, effective change, and useful artifacts.

Proceeding within this line of research and encompassing the need to progress to a logical level, a detailed process for DSR has been developed (Henriques, 2019) to emphasize its main activities, data components, and dynamic interactions (Henriques & O'Neill, 2020).

2.2. Users' participation in Information Systems' Development

DSR is, essentially, a form of applied research which is grounded to an application context, and involves people, organizational systems, and technical systems (Hevner & Chatterjee, 2010). It is important to understand how people are typically involved in DSR, contributing to its Relevance Cycle, particularly in Information Systems (IS) domains.

Traditionally, IS Development has widely adopted a user-centric approach to support problem specification, requirements assessment and solutions' definition, to engage individuals as main stakeholders in the development and test of software artifacts, and to solve business problems.

This pattern is easily recognisable in early structured systems' "waterfall" approaches (e. g,, Yourdon & Constantine, 1975; Gane & Sarson, 1979; SSADM, 1981), engaging application systems' users on project teams, in order to contribute to problem and requirements' definition; systems' specification; logical data, process, and transactions' design; implementation; user testing, and acceptance.

In more iterative and incremental software development models, such as the Rational Unified Process (RUP) approach (Jacobson, Booch and Rumbaugh, 1999), users' involvement and engagement on dynamic system development phases (inception, elaboration, construction, and transition), through multiple iterations, the user centricity has been also a dominant tonic.

The Agile Manifesto, proclaimed in 2001, declared that" *business people and developers must work together daily throughout the project*". It is a clear example of how agile development approaches strongly advocate (1) intensive engagement of business users, (2) by means of time and effort demanding dynamics, (3) in immersive teams, (4) to deliver specific artifacts which (5) are highly relevant, meaningful, and crucial from a business perspective.

This evolution denotes a global pattern for user empowerment, integrating values, norms, attitudes and behaviours, in order to ensure that (1) problems are adequately identified, (2) requirements are set and properly managed, (3) functionalities and information needs are well defined and (4) incorporated into solutions, which are (5) developed, tested and implemented, using multidisciplinary immersive teams.

In formal organizational contexts this important stakeholders' role has been often performed by business representatives, playing major roles within project teams and decision committees.

2.3. Focus Group Research

Focus Groups (FG) is one important instrument for user engagement, widely used in many application domains.

FG encompass a process aiming to understand how people feel or think about an issue, idea, product, or service, involving participants that have common characteristics that relate to the topic in analysis.

A free-thinking environment, that encourages participants to share perceptions and points of view without pressuring them to vote or reach consensus, enables to gather that kind of knowledge (Krueger & Casey, 2015).

According to these authors, a systematic analysis of the discussions *provides valuable clues and insights as to how the ideas are perceived by members of the group*.

Concerning FGs, Stewart & Shamdasani (2015) refer them, as "*group depth interviews*" and "*focussed interviews*", as emerging in behavioural science research, and being widely applied with success in several research areas. Within this context, these authors emphasize that data collection occurs in, and is facilitated by, a group setting, which becomes a primary difference, and advantage, between focus group research and other types of research – such as surveys, individual interviews, and laboratory experiments.

As Krueger & Casey (2015) add, this implies that the social scientist, as a researcher, assumes a less directive and dominating role, shifting the attention from the interviewer to the respondent, being non directive, and using open-ended questions to allow individuals to respond without setting boundaries providing them an ample opportunity to comment, to explain, and to share experiences and attitudes.

For these authors, FG interviews typically have major distinctive characteristics, by involving a small group of people providing qualitative data in a focused discussion to help understand the topic of interest.

In a congruent and complementary way, Stewart & Shamdasani (2015) recognize a set of powerful advantages emerging from this research instrument, namely: it is a cost effective, flexible and fast way to collect rich data from a group of people; enables direct interaction between the researcher and the participants, allowing to adjust questions, or introduce new ones, to clarify the answers; enables participants to debate distinct points of view, build their viewpoints on the individual contributions and come up with a more sound shared solution.

Concerning the essential activities in the design and use of FGs, Stewart & Shamdasani (2015) consider five major relevant dimensions in the process: *(1) problem definition, (2) identification of the participants, (3) moderator and interview-guide, (4) interview, and (5) analysis and interpretation*.

Similarly, Krueger & Casey (2015) deeply identify and explore six major relevant areas on FGs' conduction: *(1) planning the study, (2) developing a questioning route, (3) participants, (4) moderating skills, (5) analysis of results, and (6) reporting*.

2.4. Design Science Research with Focus Groups

Hevner and Chatterjee (2010), addressing the usage of FG in DSR, consider that it "*poses interesting opportunities and challenges*", underlining that "*traditional focus group methods must be adapted to meet specific goals of design research*".

Following this argument, they propose two essential types of usage for FGs in DSR:

- "Exploratory FGs (EFG) – for the evaluation of an artifact design, studying the artifact to propose improvements in the design, being the results of the evaluation used to refine the design. The cycle of build and evaluate using EFGs continues until the artifact is released for field test in the application environment;
- Confirmatory FGs (CFG) – to establish the utility of the artifact in field use, where rigorous investigation of the artifact requires multiple CFGs to be run with opportunities for quantitative and qualitative data collection and analyses across these multiple CFGs."

The same authors, also summarize the basic steps that are applicable for any research-oriented usage of FGs, exploring main aspects associated with the *(1) formulation of the research question or problem, (2) the identification of sample frame, (3) the number of focus groups, (4) the number of participants, (5) participants' recruitment, (6) identification of a moderator, (7) development and pre-testing of a questioning route, (8) conducting the focus group, (9) analysis and interpretation of data, and (10) reporting of results.*

Trembley, Hevner & Berndt (2010), elaborating on the subject, highlight four key reasons which justify the usage of FGs on DSR projects, namely *"(1) flexibility, (2) direct interaction with respondents, (3) large amount of rich data, and (4) building on other respondent´s comments*".

2.5. Design Requirements and Traceability

As shown by Henriques & O'Neill (2019) Conceptual Model for ADR, particularly considering the Design dimension, there is a set of interlinked steps which, progressively, pave the way to five major interconnected work-products: (1) Problem definition, (2) Requirements definition, (3) Solution definition, (4) Artifacts development, and (5) Design evaluation.

This means that, not only the associated DSR process steps must ensure the production of these main pieces of information (in strict accordance with the focus groups sessions and results), but also that there must exist an adequate traceability between the problem, the requirements, the solution, and the produced artifact.

The PMBOK® Guide identifies requirements as a critical issue in project management and establishes three important outputs from requirements management: requirements documentation, requirements management plan, and requirements traceability matrix (Misch, 2010).

In software engineering the subject of traceability has been widely studied and addressed, particularly in terms of requirements' traceability.

Requirements may be defined as the descriptions of properties, attributes, services, functions, and/or behaviours needed in a product to accomplish the goals and purposes of a system (Carr, 2000). Requirements specification should detail what the system must do, and must incorporate its objectives, life cycle, operational modes, constraints, and interfaces with other systems (Nicholas and Steyn, 2012). The specification also should include the quantified and documented needs and expectations of the project sponsor, customer, and other stakeholders. (PMI, 2017).

This is a foundational concern for the Requirements Engineering discipline, involving a process of discovering the degree to which a software system meets the purpose for which it was intended, by identifying stakeholders and their needs, and documenting these needs in a form that is amenable to analysis, communication, and subsequent implementation (Nuseibeh and Easterbrook, 2000).

This implies that documents created and maintained during requirements' engineering, project development, and throughout the life cycle of the project should be traceable, with links well established (Wieringa, 1995), and that a requirement should be traceable throughout the life of a project with lowest level requirement traceable to higher level requirements (Carr, 2000).

IEEE (1990) defines traceability as "*the degree to which a relationship can be established between two or more work products of the development process, especially work products having a predecessor-successor or master-subordinate relationship to one another*."

In general terms, Requirements Traceability can be defined as "*the ability to describe and follow the life of a requirement, in both a forward and backward direction*" (Gotel and Finkelstein, 1994).

Furthermore, according to Gotel et al. (2012), "*a requirement should be traceable from its origins, through its development and specification, to its subsequent deployment and use, and through periods of ongoing refinement and iteration in any of these phases*" – which involves "*pre-requirement specification traceability*" (those aspects of a requirement's life prior to inclusion in the requirement specification) and "*post-requirement specification traceability*" (aspects of a requirement's life that result from inclusion in the requirement specification).

The PMBOK Guide also states that the implementation of a requirements traceability matrix helps ensure that each requirement adds business value by linking it to the business and project objectives (PMI, 2017).

So, traceability is an essential aspect of "good requirements' management" – being used to ensure that the right products are being built at each phase of the software development life cycle, tracing the progress of that development.

It tracks, not only the relationship between each unique product-level requirement and its source, but also the relationship between each unique product-level requirement and the work products to which that requirement is allocated.

Considering that in DSR there is a set of interlinked "work products" – namely the Problem definition, the Requirements definition, the Solution definition, and the Artifacts – the "vertical" (forward and backward) traceability links between these major design products must be demonstrated and preserved.

Besides this, considering DSR with Focus Groups activities, a "horizontal" traceability link must be also maintained between DSR steps and iterations and the inputs and outputs of the Focus Group sessions that support the design processes.

This will preserve the necessary evidence, by confirming that the findings and outcomes that support the design activities are clearly documented by FG sessions' reports.

Moreover, each FG session must involve confirmatory steps associated with the previous DSR steps (to confirm previously designed work products) before engaging on new exploratory discussions associated with the current DSR step (to study the current work-in-progress product that responds to, and aligns with the previous work products).

These major horizontal and vertical traceability characteristics must be preserved and incorporated, as requirements, in our specific DSR with Focus Groups meta-model.

3. METHOD

According to Gregor & Hevner (2013), the method´s section of a DSR publication *should detail the DSR approach that was employed, with reference to existing authorities.*

The projects that have been developed by our students adopted the Research Processes proposed by the DSR model (Henriques & O'Neill, 2020). The current section summarizes these main aspects, linking the research purpose, problem, and objectives with the main steps of the DSR process which has been used to generate relevant external knowledge

The **purpose** of the current research is (1) to design a pragmatic and systematic meta-model to conduct DSR activities, (2) exploring the usage of FGs to continuously support the process, (3) providing adequate traceability between the problems and the artifacts designed to solve them, and (4) focusing on the essential set of activities, data components, and relationships to be considered along the process.

In line with the research problem and its purpose, five **research objectives** were defined:

O1. To identify and understand the essential steps and data components in a DSR approach involving groups of system´s users;

O2. To identify and understand the essential steps and data components required to prepare and conduct the support FG;

O3. To identify and understand what is already known about FG usage to support DSR, particularly within the Information Systems domain;

O4. To derive the main sub-processes, activities, and data requirements, as well as its articulation, within the context of FG utilization across the several DSR steps;

O5. To produce a process and data meta-model for DSR with FG, as a general approach which could be used to teach and supervise IS graduate students for their master thesis and doctoral dissertations.

To ground, develop, and test such artifacts DSR, itself, becomes the most appropriate approach to conduct this type of research (Hevner, 2007).

To develop the meta-model, it was adopted an approach based on the conceptual model described in figure 1, following the stages identified in the scientific research and engineering design dimensions, with the slight adjustments required by this specific problem domain.

Considering the Science perspective, the following Research Processes were required (table 1).

Research Processes	**Research data**
R1. REVIEW RELEVANT KNOWLEDGE	Based on a literature review the external knowledge needed to support the Research Approach, the Organizational Diagnosis, and the design of the Change Intervention were selected. Four main dimensions for analysis were detailed: (1) the research method, (2) the research domain, (3) organization development and change, (4), and design science and artifact's literature.
R2. DEFINE THE RESEARCH APPROACH	The Research Approach was specified considering the relevant knowledge from the context and the Change and Design requirements.
R3. FORMULATE RESEARCH TARGETS	The Research Targets were defined, including the research questions, research objectives, and research hypothesis or statements, having considered the Organizational Diagnosis and Change Intervention Design, as well as the Problem Definition, the Design Requirements, and the Research Approach
R4. DESIGN THE RESEARCH	The Research Design was defined, which includes the associated steps, the data, and tools to be used along the research development stage.
R5. DEVELOP THE RESEARCH	According to the Research Targets, and following the Research Design definitions (steps, data, and tools), the associated Research Activities were developed, collecting and documenting appropriate data (evidences) and giving testimony of the inherit relevant findings.
R6. REFLECT ON ACTION, DESIGN & RESEARCH	A reflection on the Action and Design was done, based on the Change and Design Results' artifacts and Evaluation, facing them with the Research Targets (questions,

Research Processes	Research data
	objectives, and hypothesis) and evidence, to make explicit the Research Results. This was a preliminary step to Research Evaluation.
R7. EVALUATE THE RESEARCH	A Research Evaluation was produced, based on the explicit Research Results (obtained through reflection) and comparing them with the pre-defined Research Targets.
R8. GENERATE RELEVANT EXTERNAL KNOWLEDGE	Based on the Research Results and on the previously produced Research Evaluation, relevant Knowledge was generated and disseminated (to be used on further research and/or be applied within the same or other organizational contexts).

Table 1 – Research Processes and Data

From the Engineering perspective, the Design Processes required to come up with a sound artifact were (table 2):

Design Processes	Design Data
D1. DEFINE THE PROBLEM	Based on an initial problem definition and on adequate knowledge of its context, a specific Problem Definition was set, as well as the associated goals, the application domain, and the opportunities to be explored.
D2. DEFINE THE REQUIREMENTS	Based on the problem definition and on the internal knowledge of its application context, and considering the results of the literature review, the Requirements for a possible solution, including its acceptance criteria were defined.
D3. DESIGN THE SOLUTION	Based on the Requirement's Definition and considering the Research Targets, an appropriate Solution was defined, including the design alternatives and decisions, as well as, the associated Artifacts to be built, and design processes to be followed.
D4. DEVELOP THE ARTIFACT	The Artifact (meta-model) was developed based on the Problem, the Requirements, and the Solution definition, and using internal knowledge from its usage context.
D5. TEST & EVALUATE	Based on the Requirements' Definition, the Artifact was tested with the relevant stakeholders, producing a field-testing results report and a formal results evaluation report.

Table 2 – Design Processes and Data

These two complementary perspectives were adopted as the main logical foundations to establish the current research work, in order to offer a more specific approach to support all stages of DSR which include the usage of FGs.

Having identified the **problem** – the need to improve the quality of user participation in DSR based development of IS projects – a set of **requirements** were established (table 3). Several alternative approaches and tools were considered to inspire the design of the solution.

The possibility of integrating FG with DSR was considered. Further investigation was carried out during this path.

The resulting **artifact** was the meta-model that integrates DSR with FG that is described in this paper.

The meta-model was **evaluated** in the scope of the development of IS projects by MSc students.

The conceptual model also comprises an action research dimension which was not required in this project, although it may be revisited at a later stage to support the IS platforms implementation.

The paper structure was organized according to the Peffers et al. (2007), Giessmann & Legner (2016) and Gregor & Hevner (2013) recommendations.

The description presented in the next sections enables to clarify the reasons that sustain this methodological choice.

4. ARTIFACT DESCRIPTION

According to Gregor & Hevner (2013), the artefact description´s section of a DSR publication should *provide a concise description of the artefact, at the appropriate level of abstraction, to make a new contribution to the knowledge base.*

This section describes the meta-model for DSR with Focus Groups that, as an artefact, has emerged from this research.

The meta-model considers most of the basic steps that are applicable for any research-oriented usage of FGs, which are compatible with the DSR theory (section 2.4). For instance, the process meta-model considers a Field-Work preparation process that includes specific activities to identify and select potential FG members or to plan the FG sessions. The Session Development process considers activities such as conducting the FG, data analysis and interpretation and reporting of results.

This section provides a previous summary of the meta-model (artifact) main underlying requirements, as well as a detailed description of its main characteristics and components of the solution which answers to those requirements.

4.1. Utilization context and main requirements

The need for a pragmatic and systematic approach to conduct DSR activities, exploring the continuous usage of FGs to support the whole process, has initially emerged from a specific need expressed by IS Management master students, struggling with different DSR approaches, and claiming for a pragmatic process that they could apply within their research projects.

So, the main problem to be addressed by the current research was to fill this gap, using a DSR approach, and achieving a set of five main objectives.

The first three of the already mentioned research objectives have been fulfilled through a deep literature review, which has been presented, and its main results acted as a basis to identify the essential requirements for a solution (summarized at table 3), guiding to a pragmatic and systematic approach to conduct DSR activities exploring the continuous usage of FGs.

Area	**Main Requirements**
Scope	• Find a "pragmatic way" to conduct DSR activities using FGs, routed on the usage of support groups, integrating members from the community of potential system's users; • Must cover the main DSR process stages, being supported by a group of selected stakeholders.
Purpose	• To design a pragmatic and systematic approach to conduct DSR activities demands: • exploring the usage of FGs to continuously support the whole process; • providing adequate traceability, from problems to artifacts; • focusing on the essential set of activities and data to be considered along the process.
Utility	• Support for a user-centric approach to DSR, involving individuals, as main stakeholders, on the design and test of artifacts, which aim to solve their own problems, ensuring that: • problems are identified and • requirements are managed, • functionalities and information needs are defined, • being incorporated into integrated solutions, • which are developed, tested, and implemented, using a team of distinct people. • Deliver a useful basis to teach graduate students in Organizational Research Methods – providing an overview of its main dimensions, as a basis to further discovery of their own path and main references for contextualized applications;
Formalization level	• Meta-model providing a general and pragmatic view of the process, its data, and relationships, to be used (adopted) and tailored (adapted) to specific circumstances.
Support to DSR requirements	• Align with a conceptual view which considers DSR as integrating the main process steps and results that were described in Table 2 – Design Processes and Data
Traceability	• Documents created and maintained during the process should be traceable, with well-established links, involving Pre-requirement and Post-requirement specification traceability • Vertical (forward and backward) traceability links between these major design products must be evidenced and preserved; • Horizontal traceability links must be maintained – between DSR steps and iterations and the FG sessions inputs and outputs that support the design processes;
Coverage for FG data evidence	• Structured information must be collected and produced along the field-work preparation, the meetings, and the reporting activities. • This includes, for each DSR stage, the documentation of the sessions, information about the involved members, and support data aggregated in FG session.

Table 3 – DSR with FGs – main requirements for a process meta-model

The meta-model also provides coverage for FG activities which include the formation of the group as well as the planning, preparation, discussion activities, reporting of results and evaluation of the working sessions. Additionally, the meta-model facilitates the synchronization between DSR activities and FG activities which include preparation, problem and requirements definition, solution design, and artifact development teste and evaluation.

4.2. A pragmatic model for DSR with Focus Groups

In line with these DSR requirements an initial process meta-model has been designed to support the inherit solution. It includes the main activities (figure 2) directly related with the FG sessions, which are associated with the Field-work Preparation and the FG Session Development processes.

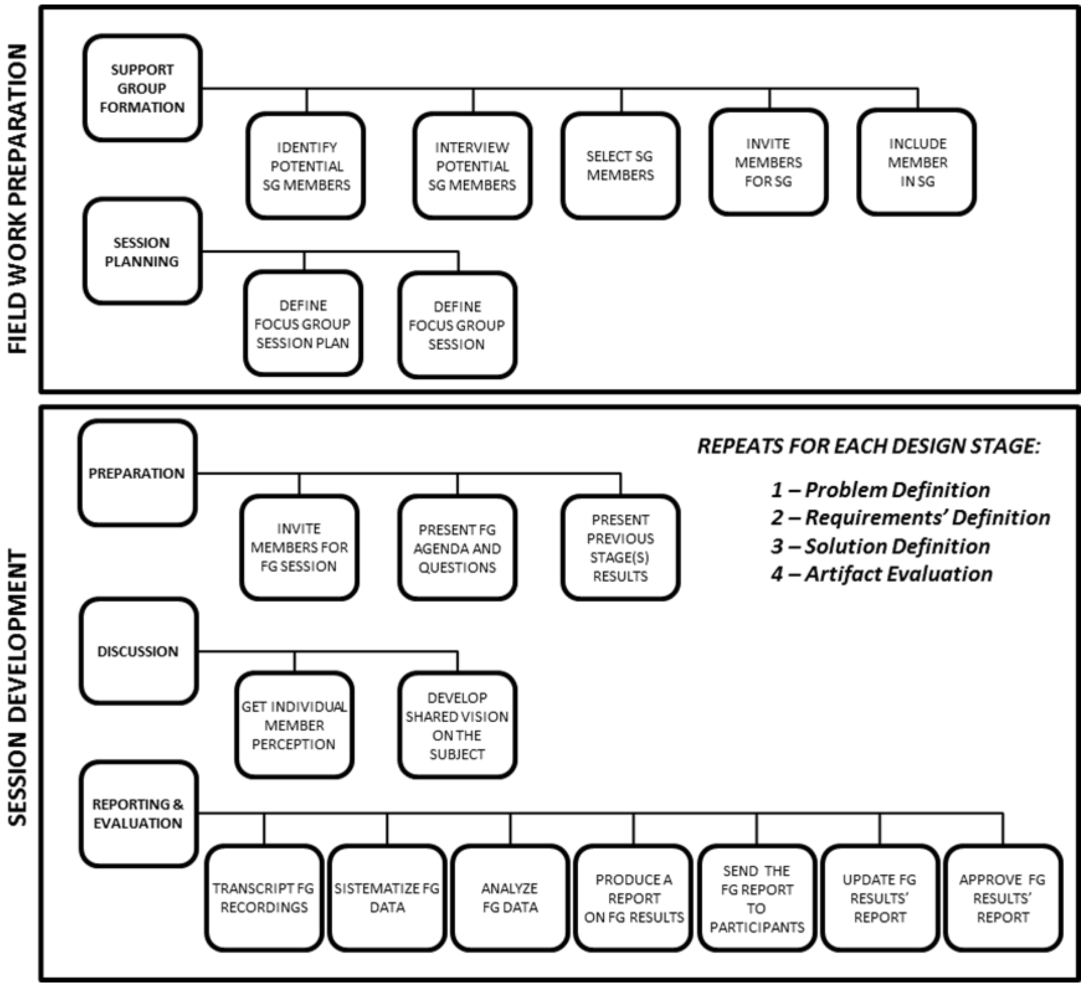

Figure 2 – DSR with Focus Group – main FG-related sub-processes and activities

To support the whole DSR process, these FG-related activities must be planned and developed – fulfilling the specific DSR-related needs – thus synchronizing Focus Group sessions' agendas with DSR stages input and outputs. For each DSR stage has been identified the main activities that must be conducted, thus showing the associated FG sessions and its main purpose, as well as the associated DSR data components (figure in appendix 1).

For each DSR stage it not only implies the appropriate documentation of the sessions, but also gathering information about the involved members, and, not less important, of the support data links which are aggregated in the FG session reports.

By assembling all these elements it is possible to provide an integrated overview of the activities and main data components that are used and produced along the whole process, on a dynamic and collaborative process which involves, together, the researcher and the support group members (figure in appendix 2).

The meta-model for DSR with FGs, emerging from this research, can now be presented as integrating four main perspectives:

- FG-related sub-processes and activities (figure 2),
- Interface between DSR stages and FG sessions (figure in appendix 1),
- FG-related data components and relationships and
- Integrated perspective of FG activities and data (figure in appendix 2).

Complementarily, to apply the model to real DSR with FG research projects, a set of templates (not included in the present paper) has been developed to facilitate its operationalization.

Particularly, in order to ensure appropriate traceability between the main DSR steps and FG Sessions' outcomes, a set of main tables has been developed to support progression across those main steps (figure 3).

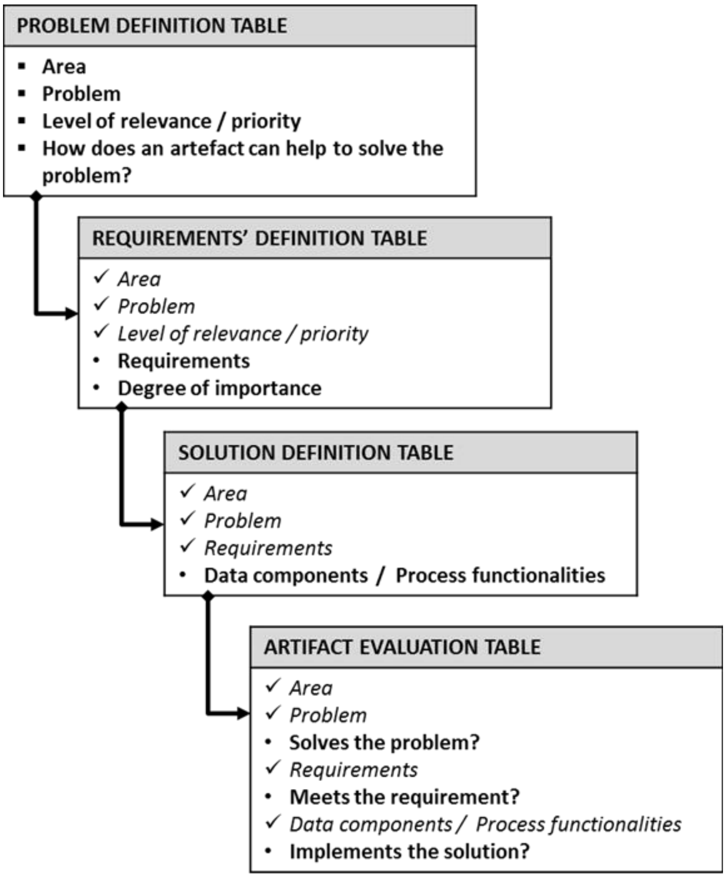

Figure 3 – DSR with FGs – traceability tables used in FG sessions

5. MODEL EVALUATION

According to Gregor & Hevner (2013), the artefacts' evaluation section of a DSR publication should *provide evidence that the artefact is useful.* This is the main purpose of the current section.

The model has been very useful to teach Masters' and DBA students on Qualitative Research Methods. It is currently being used by Information Systems masters students, on developing their research thesis projects, aiming to build up or to evaluate software platforms for specific social application contexts.

One of the research projects aims to contribute to solve common problems that immigrants face on their integration in a host country, making accessible information that is usually dispersed or unavailable. To address this issue the project has to design and implement a platform to support immigrants in Portugal, able to satisfy their information requirements and communication needs, in several areas of concern: citizenship, education, law and justice, social affairs and integration. The DSR with FG model presented in this paper has been used during the different stages of the project to manage the project requirements with distinct project stakeholders in the co-creation of the platform, including the immigrant's representatives.

Another master student's applied research project aimed to assess a previously developed healthcare platform which supports rehabilitation techniques and cognitive training using virtual reality, in order to identify the main user requirements for its evolution, and to plan and implement an improved solution. To develop this artifact the participation of key users, like healthcare professionals, a system analyst and several programmers was required.

In both projects the DSR with FG approach was adopted. The stepwise approach proposed by the DSR with FG meta-model was followed providing a common sense of direction for all the project participants. The focus group support documents were used throughout the several sessions in a systematic way, providing valuable information about the key aspect of project development: problem definition, requirements definition, solution definition and artifact evaluation.

The results and outcomes have provided great satisfaction to the project team members, facilitating the process of gathering user requirements, their understanding by the technical staff, the validation by the user representatives and an easier development of the new platforms.

Particularly, the second above mentioned project – which aimed to assess a previously developed healthcare platform, supporting rehabilitation techniques and cognitive training, and using virtual reality – has provided good evidence of the present model's effectiveness and has contributed to its consolidation and improvement. Due to the current pandemic situation, limitations have been imposed to FGs presential sessions. However, the model has proved to be sufficiently robust to be applied in a virtual meetings' environment, benefitting from virtual real-time intragroup interactions.

Furthermore, supplementary findings have been reached concerning intergroup dynamics – where, spontaneously, the two groups which have been set-up (users' group and domain specialists' group) have required that, before progressing to a new design stage, some consolidation should be done in order to aggregate and synchronize the results of each DSR stage. These main results have been reported in the associated Master Thesis (Abril, 2020) and are currently being object of further publication.

The use of the artifact in real project situation enables to show that it meets the Goal (efficacy) assessment criteria (Prats et al., 2014). Although being of a qualitative nature, the encouraging feedback from the projects' practitioners when questioned about the utility of the artifact, is another assessment criterion that sustains the positive contribution of the proposed model.

6. DISCUSSION

According to Gregor & Hevner (2013), the discussion section of a DSR publication should provide *"an interpretation of the results, highlighting what the results mean and how they relate back to the objectives stated in the introduction section"* and can include *"a summary of what was learned, its* *comparison with prior work, limitations, theoretical significance, practical significance, and areas requiring further work".*

This is the main objective of this section, which also discusses the broad implications of the current research results to further research and practice.

The full research process, an in particular the insights obtained from the FG sessions, enable to confirm Hevner and Chatterjee (2010) statement that the use of FG in DSR poses interesting opportunities and challenges. However, the use of the proposed meta-model also enables to achieve the specific goals of the design research (session 2.4). For instance, the artifact provided a flexible approach to FG usage, fostering and facilitating the direct interaction with respondents, enabling to collect an important amount of rich data, and providing a significant level of participation. The comprehensive set of forms also facilitate the FG moderator to collect a significant set of information, improving the requirements assessment and traceability.

The authors claim that the key research objectives were fulfilled and that the proposed artifact contributes to research, practise and society.

The **aim behind the meta-model** for DSR with Focus Groups is to provide researchers and practitioners with a workable artifact, and a set of organized knowledge, taking advantage of a DSR based approach when addressing complex human problems.

The **collaboration of stakeholders** is paramount to find the best solutions for socio-technical problems. The use of the proper support tools determines the quality and effectiveness of the problem-solving process and enable to reinforce the commitment of all those involved to attain the best solution outcome. By bringing together DSR and FG in a systematic and orderly way, **the research contributes to** better tackle multidimensional problems while fulfilling the recommendations set by Hevner and Chatterjee (2010) on the use FG as a technique for DSR projects.

By developing the meta-model **it was possible to clarify**: (1) What are the essential steps and associated data that must be considered for a DSR approach supported by FG; (2) For each step, what are the main FG activities required to support the DSR process - including Support Group formation, Session planning, and Session development; (3) What is the overall data structure which serves the whole process; (4) How do the activities fit together to offer a dynamic and integrated process-data perspective.

The proposed meta-model has a strong **theoretical foundation** based on the literature review and aims to become a contribution to further consolidate DSR as a research method.

From a **practical viewpoint** the meta-model proved to be a valuable tool to guide participants in research meetings as confirmed by the users involved. Moreover, the model also incorporates the experience obtained from being used in two master thesis projects that helped refining requirements and provided assessment conditions which are close to reality. This enabled to come up with a robust "proof-of-concept", where distinct stakeholders were able to use, assess and confirm the model effectiveness.

This result is an important step forward in a long-term research program the authors are committed on the subject of Action and Design Research (ADR), that is fostered by pragmatic problems and projects but sustained by concerns of theoretical, conceptual and methodological nature.

The conceptual process-data meta-model, and the support documents that may be used for the focus group sessions, are the most recent key results of this program. A **challenge** is set to the readers to analyse, use, assess and, if helpful, to adapt and adopt in their DSR projects.

However, the proposed meta-model and the approach must be **further used and assessed** to confirm the promising results obtained so far and consolidate the meta-model characteristics. We expect that the formal assessments that are being done concerning the model usage will enable to refine the model. However, the model must also be used in more demanding IS project development contexts. For instance, we expect to apply the model in projects following agile approaches. This experiment will enable to understand how the model will behave in stress situation and identify its application boundaries. We hope this test to the model it will provide valuable insights to develop a slimmer version.

7. CONCLUSIONS, IMPLICATIONS AND FURTHER RESEARCH OPPORTUNITIES

Considering the main goals of DSR and the need to support its different stages in the field, an applied research gap was addressed by combining DSR with a FG approach, providing an opportunity to produce a pragmatic meta-model for DSR with FGs. The model enables to align both approaches, providing adequate traceability between DSR and FG activities and results.

As a result of previous research activities developed by the authors (Henriques, 2015; Henriques & O'Neill, 2014; Henriques & O'Neill, 2016), a Conceptual Model for Action and Design Research had been formerly produced and published (Henriques & O'Neill, 2019). It has focused on providing a general overview of ADR's main processes and data.

However, a need has been identified in order to provide a pragmatic model to conduct DSR activities using FGs, routed on the usage of appropriate support groups integrating, as stakeholders, a community of potential systems' users.

In line with the problem and purpose of this research, a DSR approach was proposed grounded on a comprehensive literature review (section 2) and a set of main objectives was set (section 3). It enabled to define the main requirements for a process meta-model (table 1) and to design a solution, as a pragmatic model for DSR with Focus Groups (section 4).

Considering the level of artifacts which can be produced by a DSR initiative, Gregor & Hevner (2013) have defined a three-level classification – ranging from “specific instantiations” (Level 1) in the form of products and processes, to more “general and abstract contributions” (Level 2) in the form of “nascent design theory”, to “well-developed design theories about the phenomena under study” (Level 3).

Within this classification terms, our model corresponds to a level-2 contribution (a process model for DSR with Focus Groups, including methods and rules) which has been developed in order to be applied to specific instantiations.

Within this application context, the main contribution of the current research assumes the form of a pragmatic “route map” with solid theoretical foundations – which has proven to be effective, either as a didactical instrument, as well as a tool being applied in practice by master students on their research projects – modelling a specific DSR approach supported by FGs.

The usage of the model does not exempt, either the necessary readings concerning the relevant literature in the specific field of application, or the use of complementary case studies to support students’ learning and progression to its real-world application on their own research projects.

Also, like any model, it is a simplified and restricted representation of the reality, which means that it must be intensively tested, improved, and, not less important, properly adapted to each real application scenario.

The artifact itself will benefit if being supported by a software platform that will enable a project team to better handle the overall DSR with FG process, including collecting data that may be used to assess the model benefits by benchmarking performance and outcomes among distinct projects.

These limitations represent an opportunity for further research and development in the field, particularly in terms of model (re)testing, refinement, and improvement, benefiting from its application to other contexts and situations.

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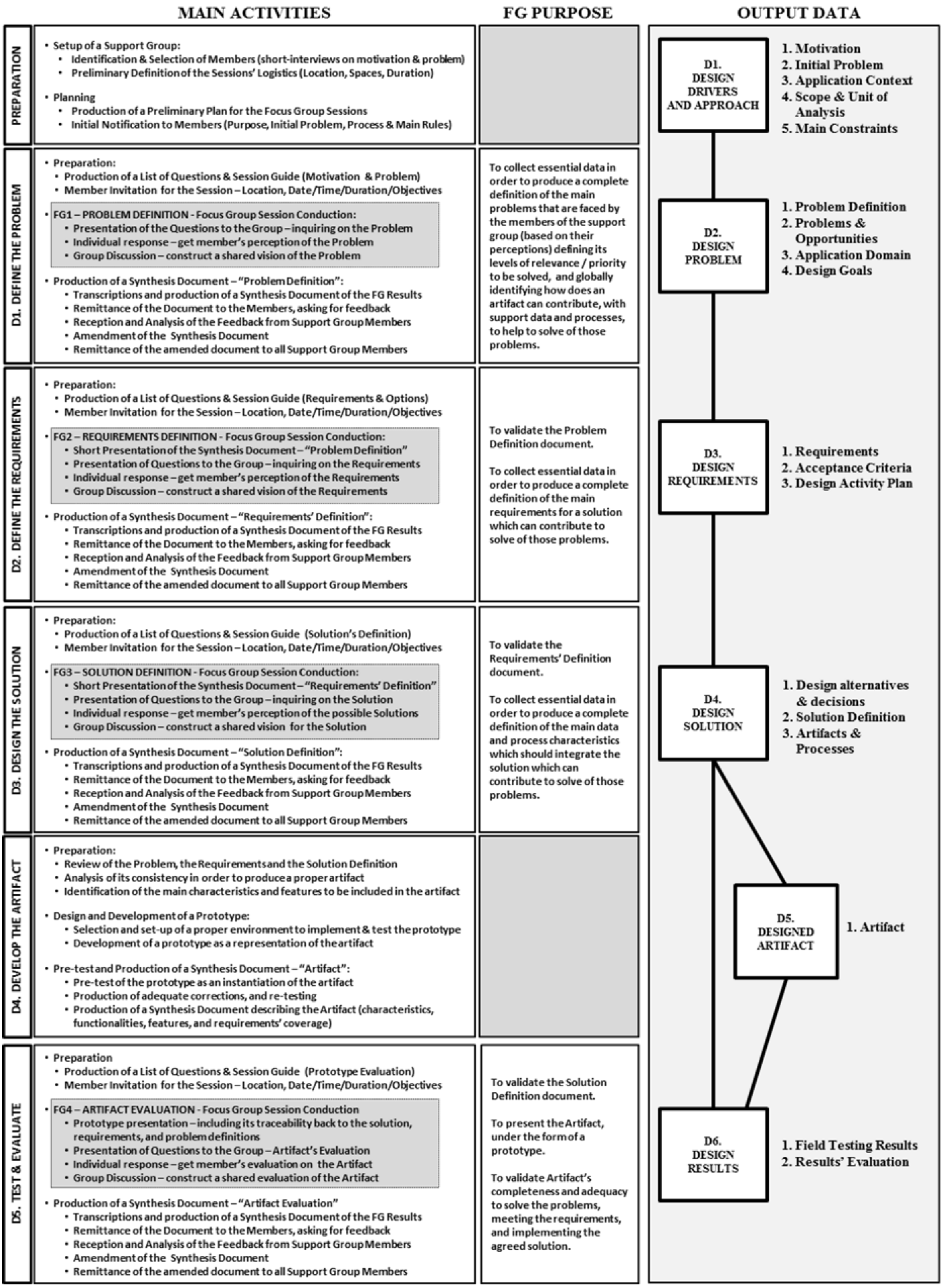
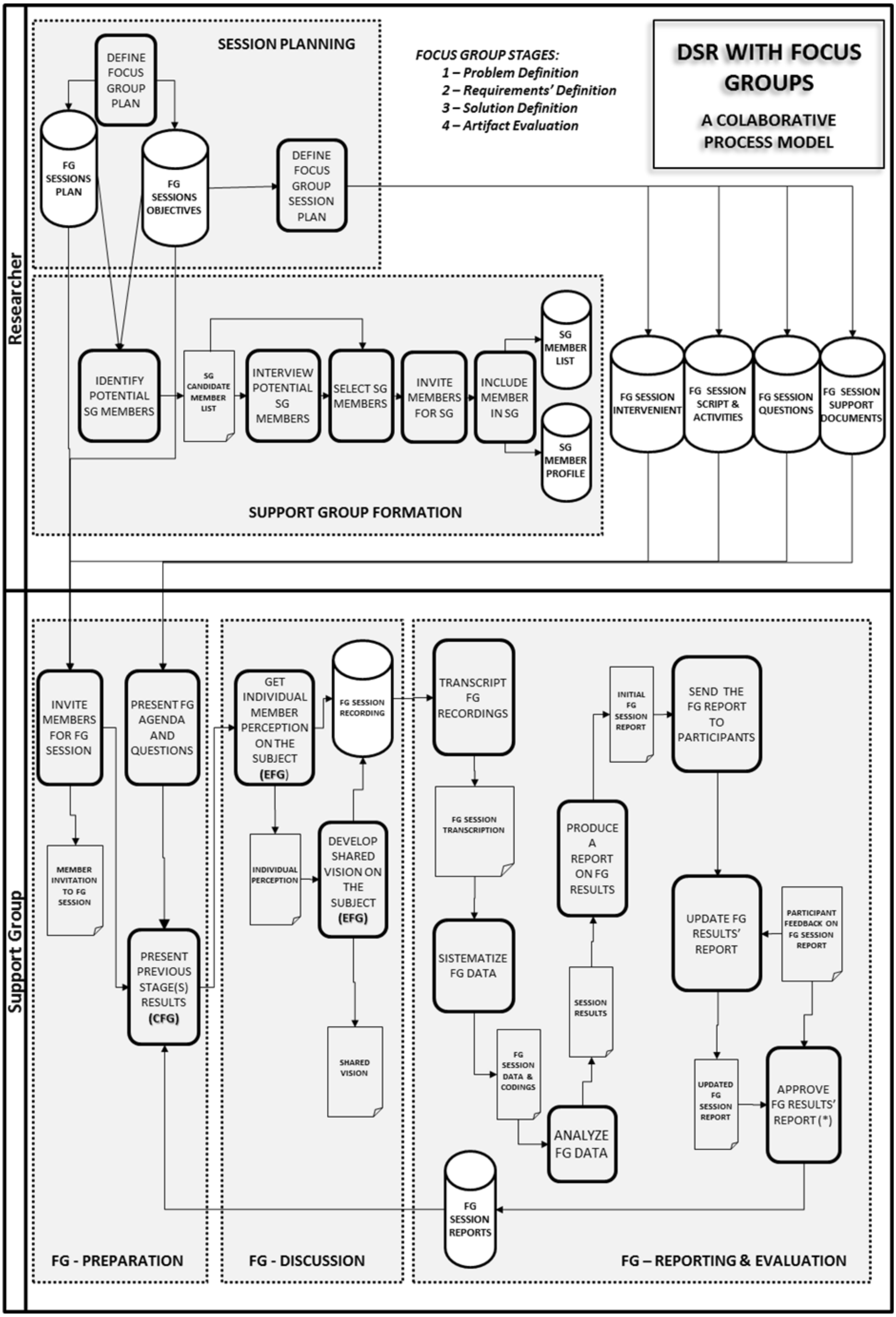
APPENDICES



Appendix 1 – DSR with Focus Group – DSR stages, FG sessions, and associated DSR data



Appendix 2 – DSR with Focus Group – integrated perspective of FG process & data