Trust-Building Mechanisms for Enhancing Collaboration in Design Science Research Projects

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Abstract. In Design Science Research (DSR) knowledge accumulation and evolution across projects are rarely considered. As the world faces increasingly complex challenges that are difficult to solve only relying on the researcher's own domain knowledge, transdisciplinary (TD) collaboration among researchers from different disciplines is becoming essential. TD projects involve partners with different backgrounds working together to understand and solve problems, making trust a critical factor for success. However, building trust is highly contextual and requires different interventions depending on the setting. To address this situation, this study focuses on trust-building in DSR collaborative projects. We adopt a deductive research approach that involves a literature review to identify trust-building mechanisms in DSR-like contexts, followed by a survey of DSR researchers (n=20) to assess the effectiveness of these mechanisms. Our results show that researchers' attitudes, communication, and rigid project management are crucial for trust-building in DSR projects. DSR researchers can get great mileage out of the identified trust-building mechanisms to enhance trust and improve the success of DSR collaborative projects.

1 Introduction

Vom Brocke et al. [62] reported that the limited knowledge accumulation and evolution of Design Knowledge (DK) in Design Science Research (DSR) is problematic, therefore, more cumulative knowledge creation practices need to gain attention [52, 13]. Current DSR studies are typically stand-alone and do not progress over time by applying the solution to different domains (*projectability*), improving the solution to the problem (*fitness*), or providing more robust evaluations (*confidence*). Depending solely on a researcher's own domain knowledge is inadequate to achieve innovation in projects. As such, the migration and combination of knowledge from different domains or disciplines are necessary to design artifacts for complex and interdisciplinary problems. This emphasizes the need for more attention towards cumulative knowledge creation practices in DSR to facilitate the combination of knowledge from various fields for innovative solutions.[42, 23].

DSR researchers are not isolated individuals; they belong to social systems and can only realize their potential through interaction with others. This necessitates the involvement of DSR community researchers from a variety of disciplines in transdisciplinary (TD) projects [26]. The nature of DSR, which involves a combination of creative designs, rigorous scientific inquiry, and novel solutions, provides an ideal framework for TD research projects [58]. TD research aims to address complex and multifaceted problems that require the integration of diverse disciplinary approaches, highlighting the importance of collaborations [64]. In fact, there is a growing number of interdisciplinary DSR projects that bring together researchers from different fields such as law, psychology, and education to collaboratively develop artifacts for multiple application domains [23, 38, 53]. This situation emphasizes the need for collaboration to achieve innovative solutions for complex problems.

Collaboration rests at the core of TD. It implies that the research requires a group of individuals from a range of different disciplines with different backgrounds to come together to cooperate in understanding the problem and coming up with a solution [64]. In fact, collaboration is defined as "the situation of two or more people working together to create or achieve the same thing". DSR-wise, we can rephrase this definition as *"the situation of two or more people working together to create knowledge and artifacts with the goal of solving practical problems"*.

Collaboration allows for access to complementary knowledge, resources, and skills required for success. However, in order to transfer knowledge and learn, actors must be able to connect with each other [11]. While collaboration is undoubtedly more effective than individual action in achieving goals, working in interdisciplinary project teams can present additional challenges. One such challenge, as identified by Morse et al. [49], is the preference for traditional disciplinary work, which can act as a barrier in interdisciplinary team projects. Team members tend to stay within their own disciplines and are not always receptive to new views, making it difficult to share ideas and achieve common goals. Furthermore, team members often lack experience in working within interdisciplinary team constellations, which can further impede effective collaboration.

Interdisciplinary teams need a satisfactory organization based on confidence [2]. Trust is widely recognized as a critical component that influences the success of collaborations [11], as it creates confidence, reduces uncertainty, and encourages shared problem-solving and knowledge sharing [16]. As such, trust-building is a key ingredient of effective collaboration i.e., the activity of developing trust between people so that they can work more effectively, where 'trust' is conceived as *"a psychological state comprising the intention to accept vulnerability based upon positive expectations of the intentions or behaviors of another"* [54]. The decision to trust can be motivated by another party's trust-building mechanism [45]. However, trust-building is highly contextual, and hence, trust-building mechanisms vary among the different settings where the issue is being tackled: organizations [24], education [12], teams [14] and the like. The bottom line is that DSR collaborative projects often require trust-building mechanisms. Hence, the

question arises about which are the specifics that DSR practices bring about, and on this basis, to what extent existing mechanisms can be projected to DSR practices. Specifically, we introduce the following research questions, where each one is built upon the previous one:

RQ1: *Which DSR-like contexts have been active on trust-building?*
RQ2: *Which sort of trust-building mechanisms have been proposed in these contexts?*
RQ3: *Which trust-building mechanisms can be projected to DSR collaborations?*

To address the first two research questions, we conducted a literature review to identify existing trust-building mechanisms used in various collaborative contexts. Our approach involved searching a digital library for relevant literature, analyzing the identified trust-building contexts to determine their similarities with our target context, and extracting the proposed trust-building mechanisms for each context. We then associated these mechanisms with Design Science Research (DSR) collaborative projects. However, we can not take it for granted that interventions (i.e., trust-building mechanisms) that have been successfully applied in some contexts (e.g., asymmetric partnerships) can project their utility (i.e., build trust) to other settings (i.e., DSR collaborations). Finally, to answer the third research question, we administered a survey to members of the DSR community using a questionnaire to evaluate the suitability of previously retrieved mechanisms for DSR collaborations.

We expect our contributions to

- a visualization of the DSR-like contexts that have been active in trust-building.
- provide a collection of trust-building mechanisms used in collaborations for evaluation in other contexts.
- insights of DSR researchers about the utility of these mechanisms for DSR collaborations.

The rest of the paper is structured as follows. First, Section 2 characterizes DSR collaborations, and Section 3 introduces the notions about trust. After that, section 4 provides details on methodological aspects. Then, Section 5, 6, and 7 present the results and discusses them. Finally, Section 8 presents the threats to validity, and Section 9 draws the conclusions.

2 DSR as a collaborative endeavor

In a DSR setting, Vom Brocke et al. [63] point out that the accumulation and evolution of DK require collaborative participation, which provides a helpful means of fostering knowledge reuse and accumulation within research. However, there are different types of collaborations and strategies for conducting DSR [56]. To clarify our inquiry, we believe it is necessary to define research scenarios along

three distinct dimensions: actors (practitioners vs. researchers), intervention (IT artifact vs. non-IT artifact), and aim. Drawing from [63] we consider three potential aims for collaboration: projectability, fitness, and confidence. *Projectability* involves expanding upon the artifact's context, actors, or behavior to address complex and interdisciplinary problems, which may require collaborations with researchers from other domains. *Fitness* entails modifying the artifact to better fit specific contexts, drawing on expertise from the context domain. *Confidence* involves enhancing the rigor and quality of evaluations by replicating existing evaluations. To improve projectability and promote the diffusion of DK to new contexts, we emphasize the importance of TD collaborations involving individuals from different disciplines. Moreover, according to the review conducted by Dickhaut et al. [23] on interdisciplinary DSR collaborations, DSR papers focusing on interdisciplinary projects indicate that the foundation of completed DSR projects often involves multiple design cycles, where knowledge is frequently codified through IT artifacts. Therefore, contributions in interdisciplinary DSR projects are less abstract and focus more on tangible solutions. In our work, we focus on DSR collaborations involving the development of IT software artifacts, between researchers seeking to enhance projectability.

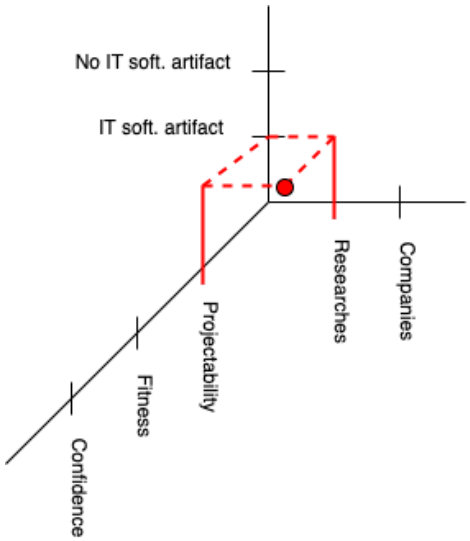

Fig. 1. Our work is focused on projectability of DSR processes that involved IT artifact development in research environments.

We define collaboration as the action of working with someone to produce something or exchange knowledge. However, collaborations are highly contextual in nature, making it difficult to compare different collaboration contexts outside of DSR. To address this, we have identified three dimensions for char-

acterizing collaborations: Partnership, Goal, and Context. Partnership describes the type of relationship between parties involved, Goal represents the aims of the collaboration, and Context outlines the contextual elements of the collaboration, including environment, culture, and location. Table 1 shows the identified elements for each dimension with their description [1].

Partnership characterization of DSR collaborations. The presence of asymmetry between external partners in Design Science and Research (DSR) collaborations gives rise to differing viewpoints and access to unique competencies, skills, and resources [56]. To address such asymmetries, it is effective to establish inter-organizational relationships or ties with other researchers or research teams. Such ties allow for the pooling of diverse skillsets and resources, leading to more well-rounded perspectives and the development of more robust solutions.

While organizations often prioritize safeguarding their worth, investments, and confidentiality through measures such as protectionism and contractual agreements, the exigencies of DSR do not mandate such stringent protocols. In fact, in the realm of research, there is a growing acknowledgment of the principle of openness, which includes the use of open-source technologies and data sharing [25]. As a result, transparency is increasingly perceived as more advantageous than protectionism in the context of DSR.

Goal characterization of DSR collaborations. The Design Science Research (DSR) paradigm advocates a practical research approach that involves the development of innovative artifacts aimed at solving real-world problems of general interest. [30]. This collaborative research process is not motivated by financial gain; rather, it aims to derive prescriptive knowledge to guide the creation of useful artifacts.

In DSR collaborations, there are two key objectives. The first is to exchange knowledge to foster innovation and generate new design insights. The second objective is to apply this knowledge to the development or reuse of artifacts, thereby facilitating their practical application. By focusing on these goals, DSR offers a valuable framework for creating innovative solutions to complex problems.

Context characterization of DSR collaborations. Collaborative research initiatives aimed at promoting knowledge sharing are prevalent in academic contexts. Such partnerships often entail communication and coordination between researchers from different universities or research groups, which may be geographically dispersed. Cultural diversity also plays a significant role in shaping the research style, methodology, and discipline-specific practices, further underscoring the importance of effective collaboration.

[1] The characterization of collaborations was developed progressively during the literature review process. The papers reviewed were instrumental in identifying and comprehending the fundamental elements that distinguish various types of collaborations.

Table 1. Collaborations contextual elements

Facets	**Definition**
Partnership	
Asymmetry	Asymmetry between collaborators involve that the parties involved have different skills, resources, and knowledge [31].
Inter-organizational	This refers to the relation created when two or more legally independent organizations engage in when coming together to deal with their inter-dependencies [47].
Shared leadership	It is defined as "a team process where leadership is carried out by the participants as a whole, rather than solely by a single designated individual" [27]. In contrast, conventional leadership considers one main leader that influences a team or organization [7].
Uncertainty	If complete information about the partner is unavailable or unknown, which can involve some risks.
Contract-based	Collaborations can ensure protectionism by contracts or documented agreements. The contract is here understood as a "formal, written contract between two or more competent parties, which creates obligations, whereby one party becomes bound to another to do or omit to do certain acts that are the subject of that contract" [10].
Goal	
Knowledge based	It involves changing and sharing complementary information with each other [32].
Artifact based	Joined collaboration for developing product or service solutions (e.g, software artifacts) [22].
Financial based	Collaborations aimed to be profitable reduce costs, improve efficiency, mitigate risks, or enhance security [28].
Context	
Geographically spread	During the collaboration, participants can share the same location (i.e., co-location) or be geographically spread (i.e., distributed location). In co-location include face-to-face interactions, while in distributed location require tools for effective collaboration including video conferencing, messaging, chats, shared screens, and so on [1].
Cultural difference	Separate cultures of participants involving the way of work, background or personality. cultural differences may play a role [19].
Academic environment	Involves joined participation to research [43].
Industrial environment	They are created to produce something and achieve business common goals [22].
Community environment	The participants share an interest and aim to share knowledge and learn [28].

In the subsequent section, we will delve into the concept of trust and its relevance in collaborative research settings. By doing so, we aim to provide a comprehensive overview of the crucial role of trust in facilitating successful collaborations.

3 Trust as a collaboration enabler

The convergence of information technology, telecommunications, and media industries has created numerous opportunities that require the complementary knowledge and expertise of different players [11]. However, creating external associations presents challenges due to differences in values, goals, decision-making processes, time horizons, and culture, which can hinder collaboration. However, such obstacles can be surmounted by fostering *trust* among collaborators.

Trust is conceived as *"a psychological state comprising the intention to accept vulnerability based upon positive expectations of the intentions or behaviors of another"* [54]. Collaboration and trust are mutually reinforcing, with each being dependent on and contributing to the other. To build a collaborative relationship, establishing trust is crucial, which is further strengthened by effective collaboration [60]. Collaboration necessitates significant investments of time and effort, as well as the sharing of resources, responsibilities, and rewards; in fact, the establishment of trust is essential for building the requisite confidence needed to engage in such commitments [44]. Furthermore, trust influences knowledge sharing [48], for knowledge creation [18] and is essential for innovative collaboration [36]. This becomes trust-building (i.e., the activity of developing trust between people) a key ingredient of collaboration.

3.1 Trust-building

Trusting refers to the relationship between a Truster and a Trustee, which implies some degree of alignment between both parties [9]. The decision to trust can be intentionally motivated and supported by employing *trust-building mechanism* [45, 29]. Prior research has identified specific social mechanisms that can create a context where trustworthiness can be perceived [8]. These mechanisms facilitate the establishment of environments where trust can take root and grow by providing individuals with the information necessary to determine when trust in another party is warranted [8, 41].

However, trust-building is highly contextual, and hence, trust-building mechanisms vary across the different settings where the issue is being tackled: organizations [24], education [12], teams [14] and the like. For example, within organizational contexts where opportunism is possible, implementing mechanisms like establishing norms or ensuring confidentiality can engender greater trust than more transparent settings like those found in educational environments. It is essential to identify and implement trust-building mechanisms that are tailored to the specific context in which they are applied, as this enhances the likelihood of developing a successful collaboration that fosters trust and promotes effective knowledge sharing.

3.2 Trust-building levels

Researchers have proposed a sequential iteration of different trust mechanisms, in which achieving trust at one level enables the development of trust at the next

level [41]. This classification assumes that two parties are entering into a new collaborative relationship without prior knowledge of each other. Three levels of trust are distinguished [41, 57]:

- ***Calculation-based trust*** is based on an individual's subjective assessment of the costs and benefits of establishing and maintaining a relationship, trust emerges when one party believes the other will contribute beneficially to the collaboration.
- ***Knowledge-based trust*** is developed over time through repeated interactions and observations, it is based on predictability developed by knowing the other party well enough to anticipate their behavior. This trust relies on information.
- ***Identification-Based trust*** is based on a deep sense of shared identity between individuals or groups, trust exists because the parties effectively understand and appreciate each other's wants to the extent that each can act effectively for the other.

Certain trust-building mechanisms are considered to be more appropriate and therefore more likely to be used during certain stages. Calculus-based trust can be developed through mechanisms that support initial interactions, laying the foundation to start the collaboration [57]. Communication is an effective mechanism to improve understanding and predictability, thereby enhancing knowledge-based trust [57]. Finally, at the point of identification-based trust, trust mechanisms can help to strengthen the relationship by allowing each party to act effectively for the other [57]. In our research, we classified the identified trust-building mechanisms into these three levels of trust.

3.3 Trust-building mechanisms' elicitation methods

Trust-building mechanisms are essential for successful collaboration, and they usually have been derived using two different research approaches [4]:

- *Inductive*: A field study (e.g., case study, phenomenology) is conducted with a collaboration among the stakeholders of the collaboration context, and then trust-building mechanisms are derived from the qualitative data retrieved by questionnaires or interviews of participants who share their perceptions (e.g., [37]).
- *Deductive*: A preliminary set of trust-building mechanisms is gathered from the literature or personal expertise, and then they are validated with stakeholders of the collaboration context (e.g., [20]).

Our research follows the latter approach to identify trust-building mechanisms for DSR collaborative projects. We reviewed the literature (as described in Sections 5 and 6) to gather a preliminary set of mechanisms and then validated them through a survey conducted with DSR researchers (as described in Section 7). It is crucial to consider the stakeholders' perspectives on the utility of trust-building mechanisms to ensure their effectiveness in the specific collaboration context.

4 Methodology

The primary aim of this study is to identify trust-building mechanisms for DSR collaborations by reviewing mechanisms proposed in similar contexts. To achieve this goal, we followed a similar approach to that used by Babar et al. to analyze trust-building in software outsourcing relationships [5].

We conducted a literature review according to the guidelines presented in [39] to identify existing trust-building mechanisms in various collaboration settings and then assess their projection to a DSR collaboration setting. As far as we know, there are currently no works proposing trust-building mechanisms in DSR collaborations, so we sought to identify relevant mechanisms from analogous contexts. The study consisted of four phases: (1) identifying trust-building models, (2) characterizing the target contexts of the identified papers to determine whether the mechanisms are relevant to DSR collaborations, (3) extracting the proposed trust-building mechanisms and grouping them into more manageable constructs, and (4) verifying the views of DSR researchers on the mechanisms that affect trust relationships. This section presents the plan for each step of the study, including the data sources and search strategy, as well as the classification and inclusion/exclusion criteria.

4.1 Search Strategy

Search String Along the lines of [39], we broke down the question into individual facets, namely, a model, mechanisms, processes, or frameworks to build trust between organizations to achieve goals (see Fig 2). We searched for synonyms for the act of developing trust following Petersen et al.'s guidelines [51]. We noticed that the development of trust can be expressed in different ways such as "trust-building" or "building trust" or "trust development". This resulted in the following search string:

("trust-building" OR "building trust" OR "trust development") AND ("model" OR "framework" OR "mechanisms" OR "process" OR "intervention").

Academic Databases Primary sources were obtained by querying the Scopus[2] digital library, which returned 81 articles. Scopus was selected as the scientific database for extracting documents, as it contained a large bibliographic index of academic literature from relevant conferences and journals.

Search Scope First, the title and abstract of all the retrieved papers were carefully read to include only the papers that target trust-building in collaborations that are similar to research collaborations. Then, the full text was read to see whether it proposed trust-building mechanisms.

[2] https://www.scopus.com/

4.2 Protocol

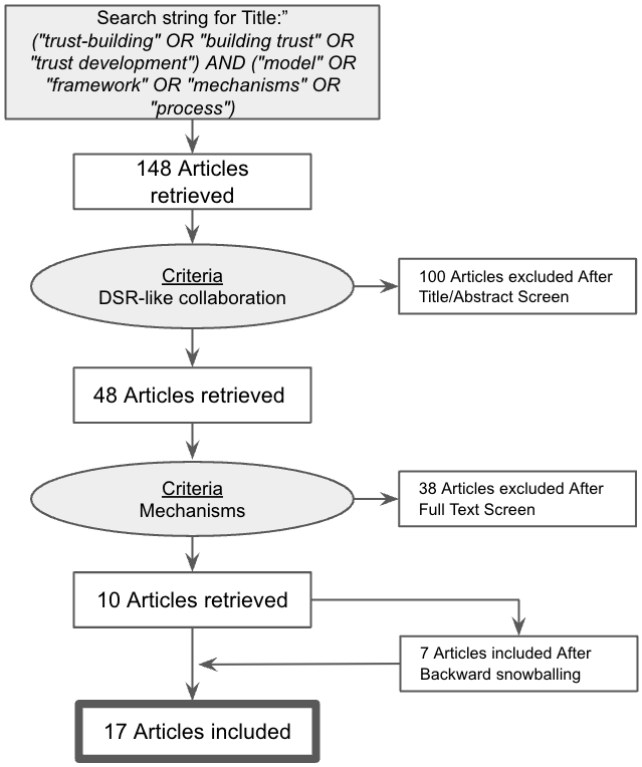

Fig. 2. Trust-building studies selection process: papers retrieved from the search and details of the filtering process.

Fig. 2 outlines the process. We ran the query in March of 2022 in the Scopus digital library. The search was conducted only in the title and we obtained an initial set of 148 papers. Each paper was filtered based on the inclusion and exclusion criteria (see Table 2). In the first stage, we excluded 100 papers that include trust-building in contexts that were not collaborations similar to research, e.g., trust on e-commerce or social media among others. Next, we focused on reading the full paper to select the papers that provide trust-building mechanisms for the target context. This second stage excluded 38 articles, which results in a set of 10 papers. In order to retrieve seminal papers on trust-building, we conducted backward snowballing over the remaining papers to retrieve 7 papers more. This resulted in 17 articles with different collaboration settings and their respective trust-building mechanisms.

4.3 Data Extraction & Paper Classification

During the data extraction phase, we characterized the target context of each paper to determine whether its mechanisms could be applied to DSR collaborations. We compared the characteristics of the collaborations' relationships against those of DSR collaborative participation, as outlined in Table 4). In Section 5, we describe the contexts we found, highlight their main differences from our target context, and emphasize the role of trust in those contexts.

Table 2. Exclusion and inclusion criteria

Type	Criteria
Inclusion criteria: DSR-like collaboration	**The study focuses on trust between humans.** Trust development has to be from individual/organization to individual/organization.
	The study is focused on collaborations. The aim of developing trust is to establish a collaboration. We see collaboration as the action of working with someone to produce something or exchange knowledge.
Inclusion criteria: Mechanisms	**The study presents trust-building mechanisms**
Exclusion criteria: Type of paper	**The study is in a language other than English**
	The study is a previous version of another study in the review
Exclusion criteria: No DSR-like context	**No human collaboration.** We do not consider not focused on trust in collaborations between humans (e.g., trust in a platform, service, or system) and in buy-sell environments.
	No trust-building mechanisms. We left out papers whose contributions are not trust-building mechanisms.

Next, we extracted the trust-building mechanisms proposed in the included articles. To classify the mechanisms, we followed the approach of [40] and grouped them into three types: calculus-based trust, knowledge-based trust, and identification-based trust [41]. We eliminated redundancies and grouped similar mechanisms into a smaller, more manageable set of overarching constructs, guided by arguments and themes presented in the papers. We included each mechanism mentioned in the papers in a group, except for those that were clearly not applicable to research collaborations due to their specificity for the given context.

This phase resulted in a primary research model of trust-building mechanisms for DSR collaborative participation, and it created a hypothesis that we

can validate with stakeholders who have previous experience in research collaborations. In Section 6, we describe the contexts we found, highlight their main differences from our target context, and underline the relevance of trust in those contexts.

4.4 Data validation

n the final phase of our research, we evaluated the trust-building mechanisms developed for DSR collaborations by sending a questionnaire to researchers who have experience in such collaborations. The purpose of the questionnaire was to assess the applicability and suitability of each trust-building mechanism in a DSR context. Further details about the questionnaire and its results are presented in Section 7.

The following sections outline the outcomes of our study, beginning with an introduction to DSR-like contexts, followed by a description of the trust-building mechanisms extracted, and concluding with the evaluation of these mechanisms.

5 DSR-like contexts active in trust building

We identified 10 distinct collaboration settings that met our inclusion and exclusion criteria and shared similarities with DSR collaborations. These settings range from inter-organizational teams to virtual collaborations, and others in between. In this section, we will examine each of these collaboration settings in detail, exploring their similarities with DSR collaborations (see Table 4), highlighting the challenges they present, and emphasizing the importance of trust in each of these settings.

Table 3. DSR-like contexts and the associated primary studies

DSR-like context	**Primary studies**
Asymmetric partnerships	[11, 55]
Construction contracting	[37, 17]
Coopetition relationship	[34, 20, 3]
Distributed agile teams	[61]
Global virtual teams	[33]
Researchers and School Personnel	[6]
Software outsourcing relationship	[40, 5, 50]
Strategic alliance	[21, 46]
Swift starting action teams	[65]
Virtual Communities	[15]

Table 4. Characterization of the contextual elements for the identified collaboration contexts. The characterization is based on the context described in the primary studies

	Design Science Research	Asymmetric partnerships	Construction contracting	Coopetition relationship	Distributed agile teams	Global virtual teams	Researchers and School Personnel	Software outsourcing relationship	Strategic alliance	Swift starting action teams	Virtual Communities
Partnership											
Asymmetry	**X**	X	X			X	X	X	X		
Inter-organizational structure	**X**	X	X	X			X	X	X		X
Shared leadership	**X**	X		X	X	X	X		X	X	X
Uncertainty		X	X	X			X	X	X		
Contract-based		X	X	X				X	X		
Goal											
Knowledge based	**X**	X		X	X	X	X		X		X
Artifact based	**X**	X	X	X	X	X	X	X	X	X	
Financial based		X	X	X	X	X		X	X		
Context											
Geographically spread	**X**	X	X	X	X	X		X	X		X
Cultural difference	**X**	X	X	X	X	X		X	X		
Academic environment	**X**					X	X				
Industrial environment		X	X	X	X			X	X	X	
Community environment											X

Asymmetric partnership collaborations [11, 55]: An asymmetric partnership is a relationship between two parties where the balance of power, resources, and benefits is unequal. In such a partnership, one party may have more influence, control, or resources than the other. In order to foster innovation and be able to access external resources, complementary knowledge is needed. This involves the collaboration between partners that have different skills, resources, and knowledge.

As well as research collaborations, they aim to exchange ideas and develop innovations. However, in the industrial context, there is a risk of the partner's opportunistic behavior and the fear of losing confidential information. Therefore, there is a high need for security and the development of contracts with safety regulations between partners.

In this context, building trust is important to overcome the barriers of perceived dissimilarities between both partners. Trust can also help to reduce opportunistic behavior and minimize the risks associated with information disclosure.

Construction contracting [37, 17]: A construction contracting relationship refers to the agreement between two or more parties involved in a construction project, such as a contractor, subcontractor, owner, and/or architect. The primary goal of this type of collaboration is to construct, renovate, refurbish, or otherwise develop a project, such as a building, structure, or infrastructure.

Collaboration in construction contracting involves developing a project according to a set of pre-agreed requirements, typically expressed in formal contracts. In this context, the contractor manages the collaboration and selects the personnel involved in the construction. One significant difference between construction contracting and DSR collaborations is the economic interest that drives these collaborations. As with the previous context, there is a high potential for opportunism in construction contracting.

Trust is crucial for the success of construction projects. It has been identified as one of the most effective means to suppress opportunism and a key factor in reducing the cost of negotiation, decreasing monitoring costs, and increasing the possibility of mutually beneficial agreements. Trust is essential in overcoming the potential for conflicts of interest and misunderstandings that arise in construction contracting relationships.

Coopetition relationships [34, 20, 3]: Coopetition relationships involve collaborations between entities that compete with each other. Despite having divergent or competing individual goals, this type of relationship can be mutually beneficial by enabling companies to reduce costs and increase innovation while retaining their independence and competitiveness.

Organizations adopt these relationships to exchange knowledge or develop innovations to achieve strategic goals such as lowering costs, increasing market share, accessing external resources, gaining tacit knowledge, and enhancing innovation capabilities. However, this competitive context involves uncertainty and formalization of contracts.

Establishing a successful coopetition relationship can be challenging due to the delicate balance required between cooperation and competition. Competitive pressures and the risk of opportunism make trust-building a fundamental factor in coopetition relationships. Trust can help resolve conflicts, alleviate tensions between partners, and deter opportunistic behaviors, thereby improving collaboration performance.

Distributed agile teams [61]: Software organizations increasingly adopt agile development methods to facilitate the creation of high-quality software products and to remain competitive in the market. In a distributed software environment, agile development provides the advantage of reduced cost, faster time to market, and economical labor.

The collaboration between team members in agile development involves knowledge sharing, effective communication, and cooperation to develop high-quality software projects. However, the distributed nature of agile teams poses several challenges such as communication barriers, time zone differences, and cultural differences. To address these challenges, team members rely on digital technologies to facilitate project delivery.

In this context, interpersonal trust among team members is critical for project success. Trust enables team members to collaborate and work in a self-organizing manner despite the physical distance and cultural differences. Trust also encourages effective communication and knowledge sharing, which helps overcome communication barriers and build a shared understanding of project goals and requirements.

Global virtual teams [33]: Virtual teams are a new form of network organization that has been enabled by advancements in information and communication technologies. These teams consist of individuals who are geographically dispersed and communicate and collaborate mainly through digital technologies. Virtual teams offer numerous benefits, including flexibility, responsiveness, lower costs, and improved resource utilization, making them an ideal option for meeting the ever-changing requirements of modern businesses. Although virtual teams are becoming more common in today's global business, the primary study [33] focuses on an academic setting where virtual teams of globally distributed students collaborate on a collaborative project.

The concept of virtual teams implies permeable interfaces and boundaries, which allows project teams to form, reorganize, and dissolve rapidly as per changing requirements. It also involves individuals with different competencies who are located across different time zones, cultures, and geographical locations. Despite the benefits, virtual teams can face significant challenges such as communication barriers, lack of trust, and differences in culture and time zones.

In this context, trust can keep geographical and organizational distances between global team members from becoming psychological distances, allowing people to participate in risky activities over which they have no control or monitoring. As such, virtual teams must work towards establishing a culture of trust that fosters open communication, respect, and accountability among team members.

Researchers and School Personnel [6]: Collaboration between university researchers and classroom-based teachers is crucial for improving education research and enhancing student outcomes. This researcher-practitioner relationship aims to bridge the gap between research and practice by promoting the practical application of educational research in schools

Unlike DSR collaborations, these partnerships are typically developed in person in an academic context, which is not affected by geographical or cultural differences. They involve the sharing of resources, responsibilities, and rewards to conduct research that can improve educational practices.

However, building trust between researchers and school personnel is crucial for developing a successful partnership. The initial interactions are critical in laying a solid foundation for trust, which is essential for long-term collaboration. Teachers are often hesitant to trust researchers until they demonstrate that they are open, honest, and genuinely interested in helping their students. Developing a successful partnership requires a significant investment of time and energy. Therefore, researchers must work hard to build trust and establish a positive relationship with school personnel.

Software outsourcing relationship [5, 40, 50]: Software outsourcing is the practice of hiring an external company, known as a vendor, to perform software development activities on behalf of a client. This arrangement typically involves a written contract that defines the scope of work, the responsibilities of each party, and the terms and conditions of the relationship. By outsourcing software development, companies can leverage specialized skills, achieve cost savings, and increase efficiency.

The success of a software outsourcing relationship depends on several factors, including effective communication, trust, and mutual understanding between the parties. Trust in software outsourcing relationships is important because it is expected to enable a more open exchange of information and cooperative behavior, a reduction in conflicts and transaction costs, and improved responses to crises.

Strategic alliance [21, 46]: A strategic alliance is a collaborative partnership between two or more organizations with the shared aim of achieving common goals. Unlike asymmetric relationships, strategic alliance partners have a relatively equal footing, with risks, rewards, and decision-making power shared among them. These partnerships can take various forms, such as joint ventures, minority equity stakes, co-production, and joint research and development

The success of strategic alliances hinges on effective coordination and cooperation among partners. Trust is a critical factor in ensuring smooth and productive partnerships. It is a key driver of alliance performance, enabling partners to secure cooperation and prevent opportunistic behavior. Additionally, strategic alliances can involve significant risks, especially when partners come from different industries or have different business models. Trust can help mitigate these risks by fostering a sense of shared responsibility and reducing the likelihood of unexpected conflicts or disagreements.

Swift starting action teams [65]: Swift-starting action teams, or STARTs, are so-named because of their quickly-paced formation. In today's fast-changing world of work, organizations must be flexible and adaptable, often relying on interdependent teams of skilled individuals to complete demanding, complex, time-sensitive projects.

STARTs are commonly used in businesses, organizations, and government agencies to respond to immediate needs or opportunities. They are also instru-

mental in driving innovation and problem-solving, working collaboratively to achieve goals and objective

The rapid formation of STARTs necessitates a need for trust-building among team members. Trust is crucial to the effectiveness of work teams, and without it, low trust can lead to conflicts, while high trust can result in complacency and a reduction in necessary monitoring behavior.

Virtual Communities [15]: Virtual communities (VCs) refer to online groups of individuals who interact through the Internet using various digital communication platforms such as social media, messaging apps, forums, and more. Participants in these communities often share a common interest, and the main goal is to share knowledge and learn from each other, rather than complete a task together.

In VC collaborations, knowledge exchange is a key feature, similar to DSR collaborations. Members can give and receive knowledge from other members. Effective IT support is critical for communication outcomes in virtual communities.

However, trust is a crucial factor in fostering voluntary cooperation among strangers in virtual communities, particularly in a cyber environment where social cues are notably absent. Building trust requires intentional effort, such as open communication, transparency, and shared values. In the absence of trust, individuals may be hesitant to share information or collaborate with others, hindering the community's overall effectiveness.

The following section introduces and describes the various trust-building mechanisms proposed for these contexts.

6 Potential trust-building mechanisms for DSR collaborations

This section discusses potential DSR collaboration trust-building mechanisms. The following mechanisms have been extracted from the ones proposed for the contexts presented above Once we got the list of all the mechanisms, we performed a thematic analysis to remove redundancies and group similar mechanisms. Those focused on the industrial setting are reformulated to adapt them to the context of DSR collaborations. In total, we extracted 32 different mechanisms, divided into 8 different groups of trust-building mechanisms.

Finally, we classified the mechanisms into the three levels of trust distinguished by [41], where the achievement of trust at one level enables the development of trust at the next level. Next, we present the extracted mechanisms:

6.1 Calculus-based trust

Calculus-based trust is based on one's subjective assessment of the costs and benefits of creating and sustaining a relationship. The mechanisms associated with calculus-based trust have been grouped into three different themes: initial interaction, attitude, and predictability.

Initial interaction Establishing trust among project participants is crucial for project success, and it can be achieved through effective and rapid initial interactions. Positive interactions between team members can enhance trust, and increasing the frequency and richness of these interactions can lead to higher levels of initial trust. Several factors can contribute to building initial trust, including:

- ***Strong reputation*** [11, 55, 34, 3, 20, 6, 5, 46]: Team members' previous achievements, certifications, and the financial position of their organization can influence perceptions of their competence and reliability.
- ***Getting acquainted*** [11, 34, 5, 40, 50, 65]: Getting to know and developing familiarity with stakeholders before project initiation can help form an initial understanding of their abilities and willingness to collaborate. This can be achieved through personal visits, conference meetings, and other forms of communication.
- ***Third-party involvement*** [17, 20]: Involving a trusted third party, such as a funding agency or university board, can establish and provide legitimacy to the project at its initial stages.

Attitude Attitude is a critical component in building trust, as it helps to establish initial impressions and sets the tone for the relationship. Here are some key attitudes that can facilitate the development of trust:

- ***Honesty*** [11, 37, 34, 40, 50, 65]: Being truthful and forthright in interactions and communication with others is essential for building trust. This includes fulfilling promises and being transparent in your intentions.
- ***Willingness to contribute*** [11, 61, 65, 15]: Convey a growth mindset and willingness to contribute useful knowledge and learn (e.g., prompt to act or respond by lending a willing hand).
- ***Risk-taking*** [11, 55, 33, 21]: Trust often involves some degree of risk, such as the risk of being taken advantage of. A willingness to take calculated risks and demonstrate a level of vulnerability can help build trust in the relationship.
- ***Team-working*** [11, 61]: A team-oriented attitude that emphasizes collaboration and proactive behavior in helping and working can foster a sense of mutual support and trust among team members.

Predictability Projects can have unpredictable costs and schedules. Although many of the factors that drive this unpredictability are systemic (e.g. rapidly evolving technological markets, scope creep, and poorly defined requirements), others are linked to individual attributes.

- ***Confidence*** [37, 34, 50, 46]: Demonstrating and encouraging confidence in the project's success can help build trust among team members and stakeholders.
- ***Consistency*** [11, 40, 50]: Individuals should be consistent in their words and actions. Consistency builds trust and reliability among team members.

- ***Appreciation of complementary*** [11, 37, 3, 6, 40, 65, 15]: Clear appreciation that the parties involved depend on each other for their individual gains to increase by demonstrating an appreciation of partners' complementary knowledge and skills (i.e., partners are different in ways that enable them to fit or work together well) to ensure that the project runs smoothly.
- ***Norms*** [11, 34, 5, 21, 15]: Establishing norms or principles of right action can make team members believe that they are in proper order and feel safe.

6.2 Knowledge-based trust

Knowledge-based trust is built on predictability, which is established over time through interactions between parties. This predictability creates a generalized expectation that the other party will act trustworthy. We found two themes related to the mechanisms of knowledge-based trust: communication and adaptation.

Communication Communication is a critical factor in developing trust between parties. Research indicates that frequent and face-to-face interactions are essential for establishing a shared understanding and reducing the risk of misinterpretation. To build knowledge-based trust, the following communication mechanisms have been identified:

- ***Encouraging communication*** [55, 17, 61, 33, 40, 50, 46, 15]: Regular team meetings and opportunities for frequent interactions (e.g., schedule weekly team meetings) enable individuals to get to know each other and develop a common understanding. Existing research indicates strongly that face-to-face interaction is critical in the development of trust because it reduces the risk of misinterpreting actions on the part of individuals and provides an efficient environment.
- ***Provision of timely feedback*** [34, 33, 40, 21]: Transparency in information flow and accessibility to resources fosters trust by demonstrating that you have nothing to hide and are committed to working collaboratively
- ***Sharing knowledge and appropriate information*** [17, 34, 3, 6, 40, 50, 21]: The sharing of relevant information and knowledge (e.g., keeping the information flow transparent and making resources easily accessible for all).
- ***Created shared vision*** [11, 17, 34, 6, 40, 21, 15]: Developing an action plan and setting common goals are effective ways of establishing expectations and promoting a sense of purpose and belonging.
- ***Handling expectations*** [11, 17, 34, 5, 40]: Raise fulfillable expectations aids to maintain trust over time(i.e., preventing disappointment by establishing in advance what can realistically be achieved in a regular basis).
- ***Foster open and clear communication*** [11, 34, 61, 5, 40, 21]: Avoiding ambiguity and misinterpretation by offering explanations for decisions and being transparent in your communication promotes a sense of trust.
- ***Show receptivity*** [33, 40, 15]: Demonstrating enthusiasm and responsiveness in communication helps build a positive rapport and promotes trust between parties.

Adaptation Adaptation is a crucial aspect of collaborating with other groups, as it helps to overcome challenges arising from cultural differences, work styles, and processes. The formation of a relationship requires mutual adjustment, resulting in a more harmonious and effective collaboration.

- ***Cultural blending*** [55, 17, 34, 3, 5, 40, 46, 21]: Achieving a sense of cohesion by fostering mutual understanding, creating a common language, and internalizing and integrating each other's values.
- ***Organization blending*** [11, 55, 61, 21]: Making necessary adaptations to accommodate the needs of the partnership, and willingness to adjust to the partner organization's requirements. This involves striving for coordinated interaction with the partner organization by adapting activities to align with the focal organization's common understanding. For example, bridging time zone gaps, and being aware of language limitations for non-native speakers.

6.3 Identification-based trust

The development of identification-based trust occurs as individuals gain an understanding of each other's needs, choices, and preferences, allowing them to effectively appreciate and anticipate each other's wants. There are four main mechanisms that are associated with identification-based trust: equity preservation, concern for others, commitment, and management.

Equity preservation Equity is a fundamental component of trust. Perceptions of control and influence in decision-making processes are closely tied to the perception of one's ability to protect their own interests. The following are mechanisms associated with equity preservation in a trust-based relationship:

- ***Fairness in responsibilities*** [17, 61, 33, 40]: Ensuring the fairness of decision-making processes and sharing control in decision-making. Shared leadership, rotating leadership roles, and allowing partners to freely choose how they fulfill their obligations are examples of equitable practices.
- ***Fairness in rewards*** [37, 6, 40, 21]: A win-win relationship where both parties benefit equitably. The party that contributes the most resources to the alliance should receive the most benefits. Profit distribution must be equitable, ensuring that all parties feel they are receiving fair rewards for their work in the project

Concern for others Concern for others is a crucial factor in building trust within a team. Showing genuine care and interest in the well-being of other team members is essential in fostering trust.

- ***Demonstrate care*** [37, 40]: Displaying respect and concern for team members, especially during difficult situations, can have a significant impact on trust (e.g., promptly apologizing for mistakes and showing empathy towards stakeholders).
- ***Long-term interests*** [37, 6, 40, 46]: Demonstrated interest in the long-term interests of members has been shown to positively contribute to trust.

Commitment Commitment generally is viewed as a strong indicator of an individual's intent to continue participation in an organization or team. Shared commitment can strengthen trust among participants, making it crucial to develop and maintain a commitment to achieving common goals. Research shows that commitment is instrumental in ensuring that team members accept decisions and work cooperatively in carrying out those decisions.

- ***Achieving early results*** [37, 34, 40, 50]: Trust can be established based on the achievement of pre-established project milestones. These milestones serve as important indicators of shared vision and effective and faithful collaborative work.
- ***Good follower*** [37, 3, 61, 33, 40, 50]: Group members' readiness to participate meaningfully, such as agreeing to what the group decides and fulfilling delegated commitments, is crucial for building trust.
- ***Confidentiality*** [34, 50]: Confidentiality and security issues must be addressed, including abstaining from sharing personal or potentially sensitive information.
- ***Familiarization*** [55, 34, 33, 5, 50, 65]: Being familiar with the processes and milestones is essential. By understanding the development processes, team members can present their progression in a way that is understandable to others.
- ***Performance of participants*** [11, 5, 40, 65, 15]: The implication and ability to perform, both individually and as a group, is an important determinant of trust. Competence is necessary for building trust within a team.

Management In addition to the trust-building mechanisms discussed thus far, project management has opportunities to foster trust amongst participants. Such opportunities include the provision of loose schedules with soft deadlines, a good management style, and the support of information systems.

- ***Loose schedules with soft deadlines*** [37, 34, 3]: Strict deadlines can hinder efficiency and may even create a perception of distrust between team members. Loose schedules with soft deadlines can help promote trust by allowing participants to work at a comfortable pace while still meeting project objectives.
- ***Good management style***[17, 61, 40]: Participants view the organizational structure and management style as crucial factors in building team trust. This includes practices such as active listening, task delegation, or partner appreciation.
- ***Information systems support*** [61, 15]: The use of information systems can significantly influence trust within a team. These tools can facilitate communication and planning, which can help build trust and foster collaboration among team members. It's important to carefully consider the characteristics of the information systems used to ensure they meet the needs of the team and promote trust.

The upcoming section evaluates the effectiveness of the aforementioned trust-building mechanisms in DSR collaborations as perceived by the DSR community.

7 Projection of Trust-building mechanisms in DSR collaborations

This study proposes trust-building mechanisms as interventions to foster trust in DSR collaborations with the ultimate goal of increasing knowledge accumulation opportunities. To this end, we gathered trust-building mechanisms from DSR-like collaboration contexts. However, we can not take it for granted that interventions (i.e., trust-building mechanisms) that have been successfully applied in some settings (e.g., asymmetric partnerships) can project their utility (i.e., build trust) to other settings (i.e., DSR collaborations). Thus, a critical question arises: do these trust-building mechanisms prove useful in DSR collaborations? To address this question, this section presents a formative evaluation conducted with DSR practitioners.

Participants To conduct our evaluation, we targeted the Design Science Research Community. Our goal was to gather their opinions on the trust-building mechanisms we identified and assess their potential for use in DSR collaborations, therefore, we sent a questionnaire to the participants and authors of the last International Conference on Design Science Research in Information Systems and Technology (DESRIST).

To this end, we collected 142 email addresses from participants or authors involved in the last DESRIST conference in 2022. The topic of this conference was 'The Transdisciplinary Reach of Design Science Research', which was focused on the three key characteristics [64]: problem focus, emerging research methods, and collaboration. Given this focus, we believe the opinions of these conference attendees will provide valuable insights into assessing the mechanisms based on their experience and expertise.

Method We employed a survey methodology in this study. To ensure the quality of our questionnaire, first, we created a first version of a questionnaire that was improved by conducting a pilot study with the members of our research group, who are experienced in DSR collaborations. The feedback from this pilot study helped us to improve the comprehension of the questions and to detect possible erroneous interpretations.

The final version of the questionnaire was distributed to DESRIST 2022 participants through mail. The first part of the questionnaire collected demographic information and experience using Likert-scale rated questions. The questions were grouped into three categories, with Q1-Q2 focusing on experience in DSR and DSR collaborations, Q4-Q5 assessing the goal of the collaboration, and Q6-Q8 examining the rationales for collaboration from three perspectives: projectability, fitness, and confidence. The results of these questions can be found in Fig 3.

Then, the second part of the questionnaire consisted of questions related to the trust-building mechanisms identified in the literature for each level of trust. Therefore, the questionnaire was divided into three different sections based on

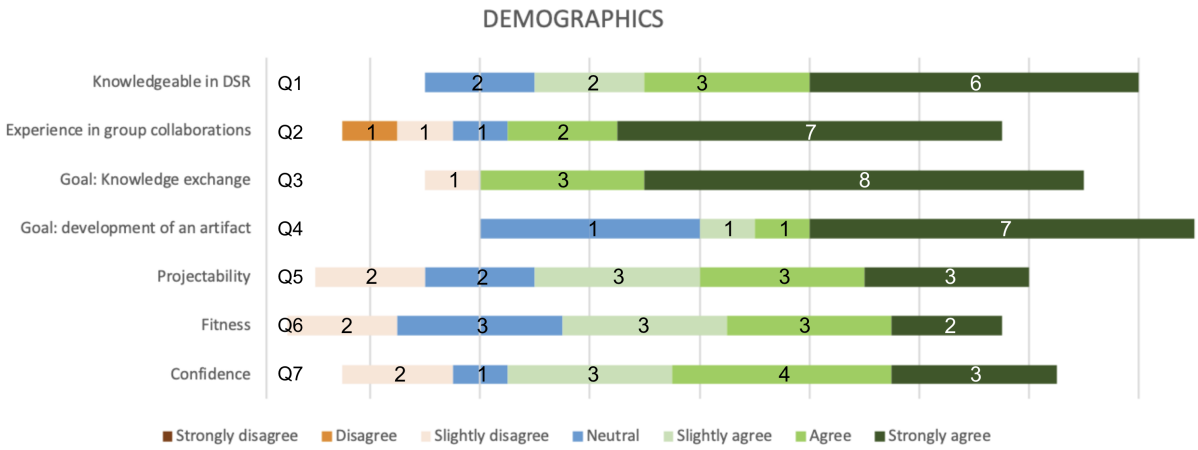

Fig. 3. The stacked bar chart for participants' demographics.

the three levels of trust distinguished by [41]. For each section, we asked one question for each trust-building mechanism gathered for that level of trust. These questions asked the participant to point out the usefulness of the mechanisms to foster trust-building in DSR collaborations using a LIKERT-scale (1-7) based on their experience. The questions were formulated as follows: *'In my experience, [mechanisms][example] fosters trust-building in DSR collaborations'*. For example, to assess the trust-building mechanisms of honesty, we used the following question: *'In my experience, demonstrating honesty (e.g., fulfilling promises, forthrightness, frankness) fosters trust-building in DSR collaborations'*. At the end of the questionnaire, we also provided an option to write text for comments, and suggestions or to give their email to receive the results.

Procedure Participants were contacted by email in February 2023. The sent email was written by introducing ourselves, presenting our work, asking them to fill up the questionnaire, and also pointing out that the results would be completely anonymous. In total, **13** people filled out our questionnaire, and also 4 of them got in touch with us, pointing out their interest in the topic or suggesting literature.

Results If we dive into the demographic questions (Fig. 3), we find that our study successfully targeted knowledgeable participants with experience in group collaborations (Q1-Q2). Additionally, Q3 and Q4 reveal that knowledge exchange and artifact development are common motivations for collaboration. As for questions related to improving design knowledge, we observe that the responses are evenly distributed among the three options. Enhancing confidence (i.e., the degree to which evidence from evaluations of a designed artifact's effectiveness is of high quality and convincing) shows only a slight difference compared to improving projectability (i.e., the ability of a designed artifact to be applied effectively

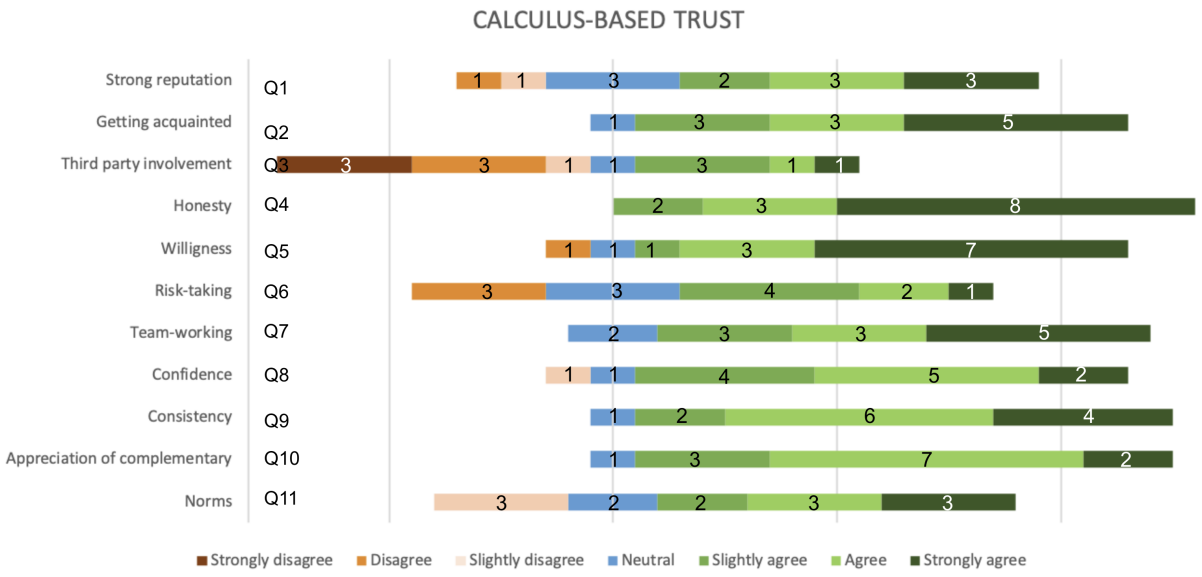

Fig. 4. The stacked bar chart for calculus-based trust trust-building mechanisms.

in different contexts) and improving fitness (i.e., the extent to which a designed artifact meets its intended purposes).

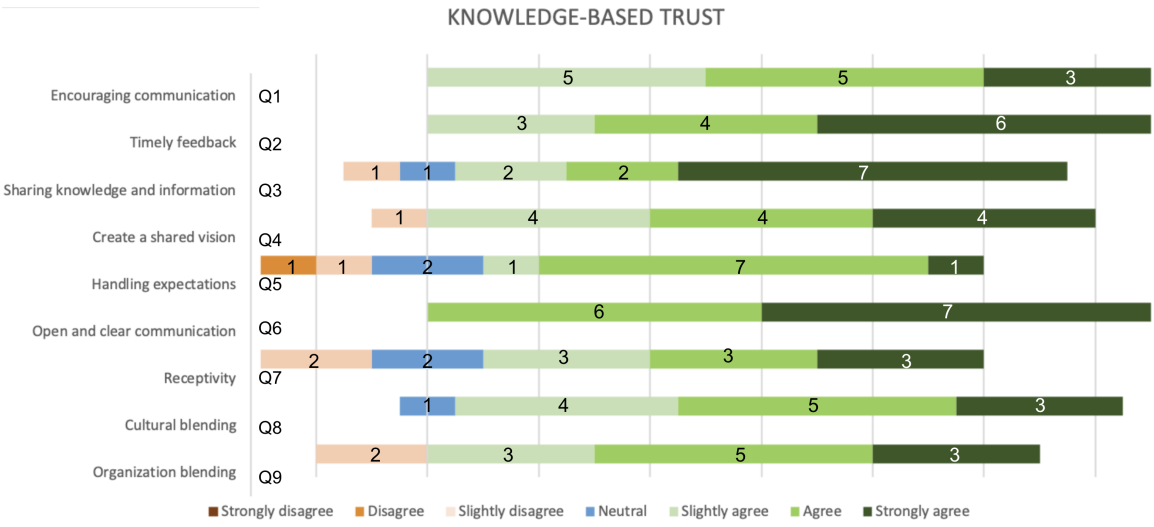

Fig. 5. The stacked bar chart for knowledge-based trust trust-building mechanisms.

We move to examine the results obtained for trust-building mechanisms. First of all, regarding the **calculus-based trust-building mechanisms** (see Fig. 4), the majority have been deemed useful for DSR collaborations. Demonstrating honesty (Q4), showing willingness to contribute (Q5), and getting acquainted (Q2) received the highest scores. Conversely, involving an auditing party (Q3), accepting the risk of harm (Q6), and establishing norms (Q11) were generally not considered useful mechanisms for building trust in this setting. ((–This might be because these mechanisms are closely tied to strict confidentiality and uncertainty, which are more commonly associated with industrialized contexts. In contrast, DSR collaborations tend to occur in a more open and transparent environment, which could explain why participants viewed these mechanisms as not applicable.–))

Next, concerning the **knowledge-based trust-building mechanisms** (see Fig. 5), as noted in Dickhaut et al. [23], communication and shared understanding are vital in interdisciplinary DSR projects. Our results indicate that effective communication plays a key role in fostering trust in DSR collaborations. Participants emphasized the importance of active communication, including encouraging communication (Q1) and providing timely feedback (Q2). They also consider the relevance of transparency by considering the importance of fostering open and clear communication (Q3), and sharing knowledge and information (Q4).

However, handling expectations (Q5) and communication receptivity (i.e., conveying enthusiasm) (Q7) did not receive high scores. ((—The former may be because it's challenging to establish expectations when collaborating on research projects because it's difficult to predict what can be achieved from the outset. In a business setting, collaborations often aim to achieve established goals, so managing expectations becomes crucial due to the various interests involved.–))

Finally, as to the **identification-based trust-building mechanisms** (see Fig. 6), the obtained results show a mix of both useful and not useful mechanisms, with some causing controversy among the participants. Some mechanisms such as demonstrating care (Q3), familiarizing with the process and milestones (Q8), and a good management style (Q11) received good scores. These mechanisms are associated with a positive attitude and adherence to the research methodology.

However, fairness in responsibilities (Q1), demonstrating concern about the long-term interests of other team members (Q4), being a good follower (Q6), and loose schedules with soft deadlines (Q10) did not receive high scores. ((–Some of these mechanisms are related to long-term outcomes (Q4, Q6), which cannot be ensured in research collaborations that tend to be short-lived. In contrast, Q1 and Q10 are associated with the need for flexibility. The low score in these mechanisms is consistent with the preference for organized and scheduled collaborations over those with high flexibility. –))

Finally, confidentiality (Q7), and information system support (Q12) have received divergent answers. These might be due to the different kinds of DSR collaborations that might have emerged among participants. ((–Some collaborators might tend to be more confident about their work and others may work more

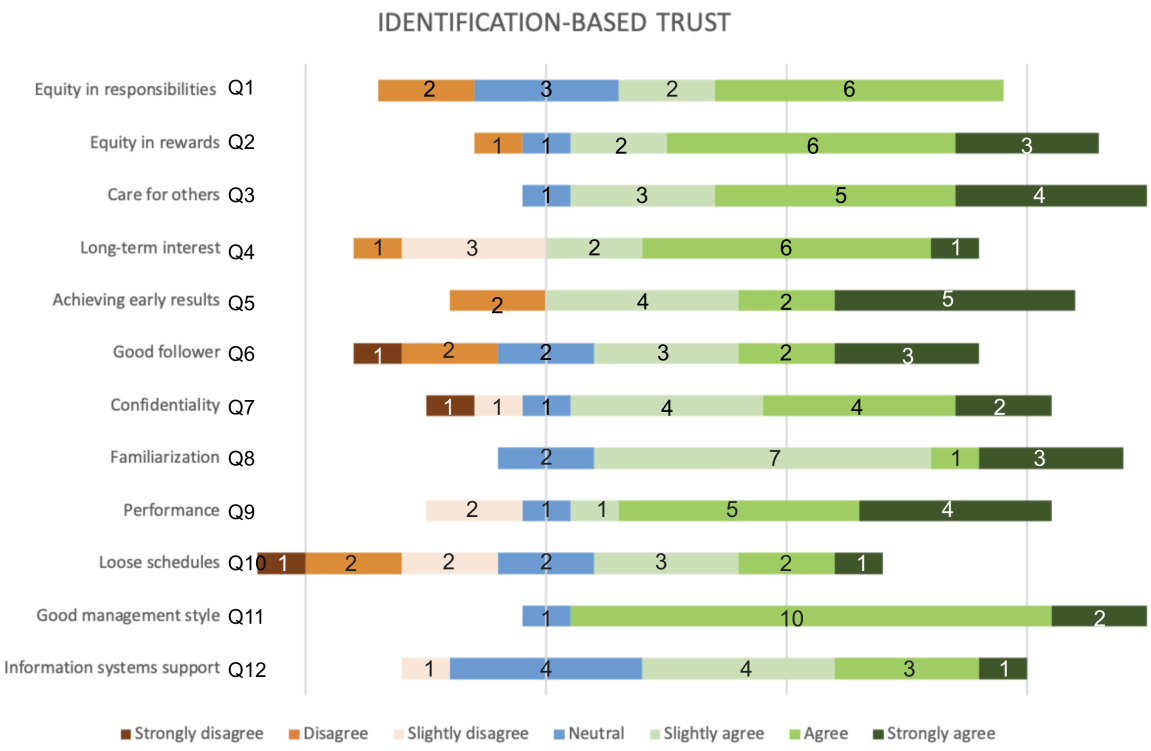

Fig. 6. The stacked bar chart for identification-based trust trust-building mechanisms.

transparently. Regarding information system support, it can also depend on the types of collaborations and the magnitude of the project that is undertaken.–))

8 Threats to validity

This section discusses the potential limitations, weaknesses, and biases that may have affected the validity of the study. The methodology of this work has involved a literature review and survey, therefore, we will address both methods [66].

Construct validity refers to the degree of accuracy with which the variables defined in a study measure the constructs of interest. Regarding the literature review, to ensure validity, the authors established clear inclusion criteria for papers in a DSR-like context. In cases of doubt, all authors reviewed the study to reach a consensus, and the full article was read if necessary during the initial filtering phase.

On the other hand, regarding the survey, an initial pilot study was conducted by sending the first version of the questionnaire to members of the research group to improve the comprehension of the questions and detect possible erroneous interpretations. This allowed the authors to identify any issues with the survey

questions and make necessary adjustments to ensure that the constructs of interest were being accurately measured. By taking these steps, the authors aimed to increase the construct validity of their study and ensure the accuracy of their findings.

Internal validity is concerned with the conduct of the study. First, in terms of the literature review, there is a possibility of obtaining an incomplete set of publications due to limitations in the search process. To minimize this threat, we followed the guidelines proposed in [39] and performed snowballing. However, it is possible that relevant articles were still overlooked or filtered out during our screening process.

As for the questionnaire, our first concern is the sample size. While the results are promising, larger evaluations are necessary to confirm them. Response rates can also introduce bias [59], and our study had a limited response rate of 13 out of over 140 DESRIST authors contacted. We attempted to create a brief and non-intrusive questionnaire, but we understand that researchers receive numerous emails daily and may not have had the opportunity to read or respond to our survey. Despite these limitations, we believe that the insights gained from our study provide valuable contributions to the field of DSR collaboration.

External validity i.e. the ability to generalize the results of our experiment to other settings. In the literature review, we synthesized trust-building mechanisms from various domains to evaluate their relevance to DSR collaborations. While our focus was on DSR researchers, these mechanisms could also apply to collaborations among practitioners, or other stakeholders. Therefore, our results may have implications beyond DSR..

Regarding the questionnaire, we collected demographic information to describe the characteristics of our sample. Our goal was to investigate how trust-building mechanisms influence the promotion of design knowledge accumulation and projectability in DSR collaborations. We found that participants reported similar levels of importance for projectability, fitness, and confidence in collaborations. Although our study focused on DSR researchers, we believe that our findings could also apply to other researchers who use systematic methodologies to address design problems.

However, we acknowledge that our sample size was limited, and our response rate was low. Therefore, caution should be exercised when generalizing our results. Future studies could replicate our approach with larger and more diverse samples to enhance the external validity of the findings.

Conclusion validity refers to the extent to which the conclusions are drawn from the data that were collected and analyzed.

In the case of the literature review, we departed from the dimensions previously proposed in [40] as an orientation to conduct the synthesis of mechanisms and group them, and then adapted them to the retrieved trust-building mechanisms. We conducted several iterations until reaching the last list and groups of mechanisms, which were collaboratively synthesized between authors. Finally,

the pilot study with the members of the research group also helped to redefine or group some mechanisms.

Questionnaire-wise, we opt for a 7-point Likert scale to increase the sensitivity of responses and provide a wider range of options for participants to choose from [35]. Although open questions for each mechanism would have been interesting, it was not feasible for the questionnaire and the participants. Overall, the careful attention to methodology and data collection processes enhances the conclusion validity of our study.

9 Conclusions

This paper emphasizes the importance of collaborations in Design Science Research (DSR) to address the need for cumulative knowledge creation practices. Through transdisciplinary (TD) collaboration among researchers from different fields, knowledge can be shared and combined to drive innovation in projects. However, building trust is critical to successful collaboration, which is why this paper investigates specific trust-building mechanisms used in various contexts and assesses their applicability to DSR project collaborations.

Our contribution lies in proposing and evaluating interventions (i.e., trust-building mechanisms) for DSR collaborative projects. Our findings suggest that factors such as attitude, communication, and effective project management play significant roles in reinforcing trust in collaborations, while factors related to high flexibility or risk mitigation are less relevant. Researchers can get great mileage out of these trust-building mechanisms to enhance trust and improve the success of DSR projects, considering mechanisms at the time of planning or seeking to establish collaborations. Even more, these mechanisms can be considered to create collaborative platforms that promote communication and the management of the projects.

Acknowledgments

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