

# Adopting and Adapting Design Thinking's Strategies in Distributed Research and Innovation Projects: A Case Study

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**Abstract** Innovation is risky and challenging by definition. Only a small fraction of all innovation initiatives result in a successful new material, process or product. Networked research projects, as those conducted by a distributed consortium involving multiple domains and with global coverage, constitute an opportunity for innovation. However, the distributed nature of these projects introduces additional challenges, not present otherwise. The RUC-APS project —<https://ruc-aps.eu>— is a European funded project whose goal is to enhance and implement knowledge based ICT solutions within high risk and uncertain conditions for agriculture production systems. Partners in the RUC-APS consortium are located in France, Italy, Poland, Spain, the United Kingdom, Argentina and Chile. Some of these partners are academic institutions, and some are companies, farms, or government dependent organizations. Partners have expertise in different domains such as computers science, business management, and agriculture. Interaction among partners —two or three partners at a time— takes place regularly throughout the year, in periods of one or two months of duration. This paper reports on a case study in which strategies of Design Thinking —which heavily depends on co-located, face to face interaction— were adapted to the distributed nature of the project. A proposal of how to

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adopt and adapt DT in distributed research and innovation projects is presented. In addition, a discussion is presented in relation to this kind of approach.

## 1 Introduction

Networked research projects, such as those conducted by a distributed consortium involving multiple domains and with global coverage, constitute an opportunity for innovation. However, obtaining a new product, material or process is not an easy task. Moreover, the distributed nature of these projects introduces additional challenges [18, 31, 32]. Thus, this requires dynamics for innovations that adapt to these kinds of projects.

Design Thinking —DT— emerges as a human-centered design approach for innovation [4, 10]. This term is used with different goals [23], for example, as a cognitive style, a general theory of design or as an organizational resource. DT is generally linked with the business domain; however, it can be used in any other domain purposes [5, 8, 15]. For example, Cross [10] mentions that DT is associated with the use of cognitive processes, thinking skills and designers' practices to solve problems, create new ideas or artefacts.

The Design Thinker profile is one of the key concepts associated with DT that defines the ideal profile for those people that participate in this design. According to [4], this profile involves the following skills: empathy, integrated thinking, experimentation and collaborations. In [4], the author mentions that any person, not only designers, could develop these skills. This opens the potential of using DT for multidisciplinary teams providing in addition support for decision-making processes [24]. However, developing these skills, in some cases, is not so easy [7]. Therefore, novice multidisciplinary teams required more guidelines to have success in applying DT [30].

Some conceptual frameworks emerge that help to put DT in practice [26]; each framework defines its own dynamics and phases. For each phase, different resources—or methods— can be used; for example, 172 resources are listed in [14]. One of the key factors to success in DT is to choose the appropriate resource [2]. Moreover, the framework selected could differ from the most used one, as it is mentioned in [6]; because it is critical that the selected framework makes sense for the domain. In some cases, this motivates to adapt an existing framework or to define a new one [6]. According to this, each domain or project could require not only different resources but also the more appropriate framework.

The aim of this paper is to present a proposal of how to adopt and adapt DT in distributed research and innovation projects. To do that, we use a case of study as is the RUC-APS project —<https://ruc-aps.eu>—. This is a European funded project whose goal is to enhance and implement knowledge based ICT solutions within high risk and uncertain conditions for agriculture production systems [16]. Partners in the RUC-APS consortium are located in France, Italy, Poland, Spain, the United Kingdom, Argentina and Chile. Partners have expertise in different domains such as computer science, business management, and agriculture. Note that some of these partners are academic institutions, and some are companies, farms, or government dependent organizations. This project has its own dynamics, for example, interaction among partners —sometimes two or three partners at a time— takes place regularly throughout the year, in periods of one or two months of duration. Thus, some key points of this project are described in this paper in order to describe some issues that can be handled with our proposal.

As part of our proposal, this paper analyses how to adopt DT in projects such as RUC-APS. To do that, it is important to take into account some resources that facilitate the development of the Design Thinker’s profile [4], for example, for the empathy skill. In addition, for the analysis of the adapting of DT it is crucial to consider, for example, not only the dynamic of the interactions between partners, but also that there can be multiple innovations in simultaneous [17]. Note that this changes the traditional way of use DT which focuses on creating only one product/idea/service at one moment [4, 10]. Therefore, some guidelines for the adoption and adaptation of DT in projects such as RUC-APS are presented in this paper.

In addition, a discussion is presented in relation to this kind of approach. We hope that this paper can be useful as guidelines in order to adopt and adapt DT in projects similar to RUC-APS.

The paper is structured as follows. Section 2 describes some background works related to the topic of DT and distributed teams. Section 3 analyses some key points of the RUC-APS project according to the aim of the paper. Our proposal for adapting DT in distributed research and innovation projects is presented in Section 4. A discussion related to the topic is analysed in Section 5. Finally, conclusions and future works are detailed in Section 6.

## **2 Background**

In this section, two main topics are mentioned related to the aim of this paper. One of them is design thinking and the other is distributed teams, focusing on presenting the most relevant concepts and issues related to these topics.

## 2.1 Design Thinking

The term Design Thinking —DT— has been studied from different perspectives [23]. Initially approached as the cognitive style of designing [25], it was later considered a general theory of thinking about the design process [10]. Finally, in recent decades a third vision completes this picture: design thinking as a strategy to organize the development and innovation process, an organizational resource [22]. One of the most recognized definitions of DT is the one by Tim Brown [4] that reads: “*it is a discipline that uses the designer’s sensibility and methods to match people’s needs with what is technologically feasible and what a viable business strategy can convert into customer value and market opportunity*”. This definition associates DT as an organizational resource.

DT has been used to transform organizations and to inspire innovations, as it is mentioned in [23]. Moreover, to effectively use DT tools companies need to adapt their own organizational cultures [13]. A framework based on experiential learning to incorporate DT transforming the organizational culture is proposed in [13]. DT has been used in other domains to solve problems in a creative and novel way, for example, for social purposes [5, 8] or teaching issues [15]. Thus, the practical applications of DT are diverse and continue to grow.

There is no "unique" way to put DT in practice; there are numerous conceptual frameworks of DT. In [26] the authors have done a systematic review of the DT literature identifying the three most influential frameworks: IDEO [20], Stanford Design School [28] and IBM [19]. Each framework defines its own phases and the relations among them. For example, IDEO framework defines inspiration, ideation and implementation phases. Stanford Design School identified the following phases: empathy, define, ideate, prototype and test. In IBM's framework the phases are called understand, explore, prototype and evaluate. Although the number and name of phases differ between these frameworks, all of them focus on a core cycle that goes from the identification of needs, the proposal of concrete alternatives of solution and their evaluation against the requirements. This cycle is iterative by nature as DT recognizes that it is not possible to clearly and comprehensively identify all requirements at the beginning of a project. These frameworks are mainly single innovation process oriented. The development of simultaneous paths of parallel innovations are usually out of their scope.

Each phase of the frameworks of DT can be addressed using different resources or tools. In [14] 172 possible resources are identified that can be used in DT, but in [26] the eight most frequently used are identified: Ethnographic methods, Personas, Journey map, Brainstorming, Mind map, Visualization, Prototyping, Experiments. However, as it is mentioned in [6], it is important to frame DT to make sense for the domain; sometimes to do that, the framework and the resources —or tools—

selected could differ from the most popular ones. Moreover, one of the key factors to success in DT is to choose the appropriate resource [2].

Another important key point to take into account in DT is the role of facilitators. In [27] has shown that success of a DT experience depends on the facilitator level of design expertise —as well as the complexity of the problem being addressed—. Furthermore, novice multidisciplinary teams required more guidelines to have success in applying DT [30]. This is because sometimes members of novice multidisciplinary teams —that participate in DT experiences— have not developed the Design Thinker's profile [4]. This profile involves skills such as empathy, integrative thinking, experimentalism and collaboration. These skills could develop and improve for any professional [4], but this requires training.

## ***2.2 Distributed teams***

A geographically distributed team [31] is as a team where members are dispersed in different locations across the globe and collaborate together to achieve a common goal; such teams have limited or no interaction in person with each other. As it is mentioned in [31] one of the big challenges to deal with is the language —different communication patterns— and culture in these kinds of teams, sometimes generating misunderstanding and miscommunication among teams. However, cultural diversity could be beneficial for the team sometimes, as it is analysed in [1]. Some challenges and opportunities of distributed teams are analysed in [18].

A co-design experience with geographically distributed teams is presented in [3]; the authors focus on understanding how effective co-design activities can be carried out. This co-design has been done with iterative phases of scoping, idea generating, and prototyping and refining. In [3] is mentioned that the leader's attitude is a determining factor for collaborative dynamics.

In [32] is analysed the main barriers of knowledge transfer between globally distributed teams. The authors mentioned that the complexity of knowledge transfer grows when the source and the recipient are located in different geographical locations. As it is posited in [32], one of the challenging issues to handle is tacit knowledge —gained through experience or personal skills— because it is difficult to communicate and formalize. Another challenge is the lack of formal guidelines and communication plans that impact significantly on knowledge transfer.

### 3 RUC-APS project

An outline of some key points of the RUC-APS project is described below, according to the goal of this paper in order to identify some open issues that can be handled using DT.

The consortium of RUC-APS project comprised 13 participants from five EU countries —France, Italy, Poland, Spain, and United Kingdom— and five partners from two-thirds countries —Argentina and Chile—, which in total involves more than 150 researchers [17]. These partners are not only academic institutions but also companies, farms and government dependent organizations. Therefore, RUC-APS project is a big multidisciplinary team with expertise in different domains such as computer science, business management, and agriculture. According to that, there are culture, goal and knowledge differences between partners that constitute a critical issue [31] that should be handled properly to the success of this kind of project. In this way, the empathy skills that could develop with DT should allow people to understand these differences. To do that, it is important not only to select suitable resources for the empathy phase of DT but also to help the partners to develop a Design Thinker's profile.

Another key point to analyse is the interaction among partners. In the case of the RUC-APS project, during the year there takes place some face-to-face interaction in which one partner —one or more people in representation— visits other partners in periods of one or two months of duration. Sometimes, these visits involve two or three partners at the same time that enrich interactions between them. In some cases, one partner visits another partner more than once; but generally, these people are not always the same. So, how is it possible to organise these visits to achieve empathy in one month. In this point, it is important to analyse what resources should be used before these visits in order to gather data useful to the visitors. Moreover, how can the data from earlier visits be used to improve following visits?. In this way, resources of DT for the empathy phase could be used not only to collect initial data before the first visit but also to enrich these data in each visit. Therefore, it is essential to select suitable resources to do that.

The gap to generate empathy is not the same in all cases. For example, generating empathy is critical when researchers visit a farmer; sometimes in these cases, researchers do not know what data should be collected; so, these interactions become a recreational visit. DT could help to guide this process using some specific resources to extract useful data. Figure 1 shows partners from industry and academia visiting a farm. In this case, collecting the tacit knowledge [32] is the most complex in the process of empathizing.



**Fig. 1.** Partners from industry and academia visit a farm as part of their knowledge exchange activities

Another key point is to generate results from each knowledge exchange. To do that, the complete DT cycle could be applied in each visit of a partner. This cycle consists in using the empathy phase as a starting point in order to identify possible problems/issues to resolve. Then, generating ideas to solve the identified problems, selecting some of them—for example, possible to put in practice—. Finally, generate an initial sketch prototype that in the context of DT could consist in showing the selected ideas—such as a paper sketch or a role-play to show the interactions of the solution—. Note that workshops should be organized to put in practice the DT cycle during the visiting of the partners using resources that are more suitable. In case these visits continue between the partners, these prototypes could be improved; or could apply the DT cycle complete again to discover new problems and then generate new prototypes. In addition, partners could continue collaboration in a virtual remote way to improve the prototype.

Figure 2 portrays a moment in a DT workshop at a farm. Farmers, researchers from Argentina and the UK—both, from computer science and agronomic sciences—discuss various possible features of a farm record keeping application.



**Fig. 2.** Ideation - farmers and researchers generate ideas for a farm record keeping application

By definition, the empathy phase is about understanding the needs and problems of the other party. Therefore, it is important for participants to put aside what they could offer —i.e., the existing software they have developed— in favor of fully engaging in active listening interaction with partners. This allows you to identify the real issues that will need to be addressed in the subsequent process. Note that some problems/issues may emerge that cannot be solved in one DT workshop; but all the generated material can be useful for other partnership collaborations. Thus, it is important to analyse the way to share all these data.

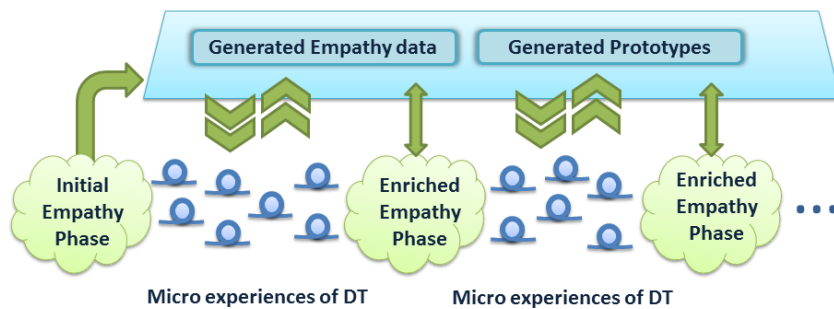
One of the aims of the RUC-APS project is to support innovation not only in the development of agriculture production systems, but also in logistics, operations and supply chain management. This involves all the stakeholders that participate in these issues in addition to the end customers. Therefore, in this kind of project multiple innovations could occur simultaneously. These innovations emerge from the interactions of all the partners involved as it is mentioned above. DT frameworks focus on producing one innovation at a time, so, DT should be adapted to allow it to be used in projects like RUC-APS; to take into account multiple innovations simultaneously.

As a conclusion, some key points are illustrated using a case of study to describe considerations in order to adopt and adapt DT to this kind of project.

## 4 Our Proposal for Adopting and Adapting DT in distributed research and innovation projects

In this section, a proposal for adopting and adapting DT in distributed research and innovation projects is presented. This proposal emerges from the analyses done by [6] in which the authors mentioned that the framework to conduct DT should be selected or created to make sense for the domain and to consider the features of the organization/group. In our case, the main feature is the distributed teams, with specific dynamics as described in Sect. 3.

We have used the guidelines proposed in [9] to design our proposal. In [9] the authors present a meta-framework to define DT experiences; it emphasized to consider the dynamics of the group to propose each phase of this kind of experience and select the most suitable resources for it. Take this into account, we have designed our proposal as a general guideline to adopt and adapt DT in distributed research and innovation projects. Our proposal is presented in Figure 3 and is described in more details below.



**Fig. 3.** Our proposal for adopting and adapting DT in distributed research and innovation projects

Figure 3 shows an initial empathy phase in which all the information related to each partner is collected. This phase is focused on generating a profile of each partner before they start to interact; this can be done virtually. For example, using the resource Persona [26] which is a symbolic representation of people who wish to empathize, in case of RUC-APS each partner. It can use any ethnographic methods [26] to collect information to generate one Persona for each partner. Empathy map [14] is another resource to enrich this phase. The empathy between partners is vital to the success of this kind of collaboration [31].

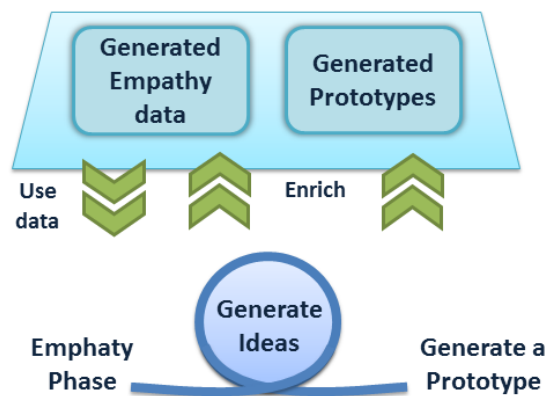
After the initial empathy phase, as is shown in Figure 3, micro experiences of DT occur. These experiences use the existing empathy data and can enrich them, for example, adding new profiles for the customer, end-users or any other actors. These

data can be useful for the following micro experiences of DT. Note that for each experience of DT there is generated one prototype that is shared for all the partners to know about all the simultaneous innovations that take place in the project.

Following, the enriched empathy phase happens as shown in Figure 3 in which, for example, some workshops could be organized virtually. It is recommended the participation in these workshops of at least one person for each partner involved in the previous past micro experience and all the partners that will involve in the following micro experiences. These workshops allow for sharing data and enriching empathy. In addition, it could emerge, for example, suggestions to change the selected resources for each micro experience.

These sequences of the enriched empathy phase and simultaneous micro experiences of DT repeat during the project. For example, the enriched empathy phase could take place every four-six month.

A general scheme of each micro experience of DT which starts with the empathy phase, then generates —selects— ideas and finally produces some rapid prototyping [26] as shown in Figure 4. These are the general concepts to handle for all DT frameworks as is described in Sect. 2.1. The generated empathy data is used for each micro experience of DT, these data can be improved and then share the generated prototype with all the partners of the project. Note that each micro experience of DT can focus on resolving a new problem or improving some exciting prototypes generated by the partners in a previous micro experience.



**Fig. 4.** General scheme of each micro experience of DT

To facilitate each micro experience of DT, any existing DT framework can be used, for example, IDEO [20], Stanford Design School [28], IBM [19], Design Council [11], Design Thinking 101 [12]; or it can do as a co-design experience [3]. Therefore, in each micro experience of DT, the used framework can be varied. Another

possibility is to define a new framework of DT for these micro experiences if it is necessary [6].

The most suitable resources in the selected framework can be used to support each phase. For example, 172 possible resources are listed in [14]. Some frameworks provide in addition possible resources to use, for example, IDEO [21] or Stanford Design School [29] resources.

A simplified example of a micro experience of DT is described below. This micro experience happened when an industry partner—dedicated to the certification process in the value chain—visited partners from another country such as a farmer, agronomic sciences researchers and computer science researchers. Some meetings have been organised for the empathy phase to collect more data from each other and identify which problems/needs they would try to resolve in this micro experience. The first meeting has occurred in the farmer's place—such as shown in Figure 1—; the members who represent each partner participates in this meeting. During this visit, the company's member has asked some questions related to country regulations and existing country certifications. It has made some other meetings in the researchers' place. One of the problems that have emerged from this phase was the lack of a place to look for all the regulations, certifications process and other relevant data about the agriculture value chain of the local country. This has been the selected problem to resolve. In the generated ideas phase, some brainstorming meetings—such as shown in Figure 2—have taken place such as an interactive process. For example, it has been identified that there is a lot of data to collect and organise; this task should be easy to upload and classify in an easy way. Other key points are identified from this phase. Using all the generated ideas, it has started to sketch the first solution; this has been done using, for example, post-it and paperboard. This micro experience has been finalized with the first paper prototype. However, taking advanced computer science research partner's knowledge, they have identified that this first sketch could be put in practice using a wiki that provides some advantage to handle some key points identified in the previous phase. Thus, the agronomic and sciences computer science researchers have continued to evolve this sketch to an initial wiki, which is being enriched.

Our proposal is flexible and it allows the selection of the most suitable way to put DT into practice, not only to select the more suitable framework of DT but also the resources.

## **5 Discussion**

Some interesting points to discuss are presented below. One of the critical issue in projects such as RUC-APS, are the culture, goal and knowledge differences between partners [31] in order to obtain the success as it is described in Sect. 3. This is

handled by our proposal with the initial empathy phase and then during the enriched empathy phases. The initial empathy phase allows each partner to start to empathize with each other previously to the first interaction. Furthermore, these phases help the partners to develop a Design Thinker's profile, especially the empathy skill.

Another point to discuss is how the previous visits data can improve following visits. To do that, our proposal is to share all the generated data and prototypes. Moreover, the workshops help to prepare the following partner for the micro experiences of DT that take place. In addition, these workshops allow adjusting any dynamic if it is required. It is recommended to offer as much assistance as possible to novice teams [30]. Thus, the first workshop can be done during the first visits of partners in order to detect any requirement that emerges.

Generating results from each interchange of knowledge is vital in networked projects. To do that, our proposal suggests micro experiences of DT during each visit, including rapid prototyping sessions. Our proposal is flexible enough, allowing us to choose the more suitable framework of DT and resources for each micro experience. However, for novice distributed teams sometimes requires more help [30]. Recommending to details the guidelines to the experiences of DT and to do a summary of possible resources that could be used.

Our proposal allows generating multiple innovations simultaneously, this is vital for projects such as RUC-APS. Moreover, sharing the data between all the partners allows more potential collaborations and innovations to emerge. From each micro experience of DT problems that can be solved by another partner that may emerge; then this can be a starting point for other micro experiences.

A key point of the Design Thinker's profile is to put aside what could offer and stay in a neutral space. This is facilitated with our proposal in each micro experience of DT because it always starts with the empathy phase. Some micro experiences of DT can only involve partners of the project; but, in other cases, they can add other actors—stakeholders—, so this requires generating empathy data about these new actors. To do that, it can be used, for example, ethnographic methods [26], Persona [26], Empathy Map [14].

The role of facilitator of experience of DT is not clear in this kind of project. As it is mentioned in [27] depending on the expertise of the facilitator, it could be the success of the DT experiences. Therefore, if this role is not present, maybe this kind of project requires more guidelines. Another option is that one member of the team takes this role in each micro experience of DT.

## 6 Conclusions and Future works

This paper presents a first proposal of how to adopt and adapt DT in distributed research and innovation projects. Some key points of the project RUC-APS are described in order to describe some issues that can be handled with our proposal. We hope that this paper can be useful as guidelines to put into practice DT in projects similar to RUC-APS. In addition, a discussion is presented in relation to this kind of approach.

Every distributed research and innovation project is different, so our proposal is only a possible starting point to conduct this kind of project. It is recommended analysing each case, to do that a meta-framework to define DT experiences is presented in [9].

In the future, we hope to put into practice our proposal to conduct this kind of project. This allows enriching our proposal and offering more complete recommendations to adopt and adapt DT by distributed teams.

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