

Industrial business associations improving the internationalisation of SMEs with digital platforms: A design science research approach

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ARTICLE INFO

Keywords:

Digital platforms
Design science research
CIMO-logic
Internationalisation of SMEs
Industrial business associations
Collaborative networks

ABSTRACT

This paper aims to contribute to the lack of design knowledge on digital platforms (DPs), by studying the new and specific context of DPs managed by industrial business associations (IBAs) to improve the internationalisation of small and medium enterprises (SMEs). A specific objective is to elicit detailed digital platform's requirements and features for this particular organisational context. A design science research (DSR) approach is adopted to develop design propositions (the artifact), following the context-intervention-mechanism-outcome logic (CIMO-logic). The design propositions are derived for DPs that can support different types of generative mechanisms of social interaction: information sharing, collaboration, and collective action. The design propositions are obtained by balancing empirical knowledge based on interviews performed with IBAs and SMEs in Portugal and in the UK, with theoretical knowledge from the literature of information systems, DPs and collaborative networks (CNs). The utility of the design propositions is further evaluated by experts and IBAs. The findings are proved to be relevant for practice, mainly for IBAs, SMEs, and digital platform designers to develop more effective collaborative DPs and sociotechnical systems, supporting CNs and the internationalisation needs of SMEs. The knowledge generated in this study brings new design knowledge on DPs, contributing with design propositions translated into tangible and concrete requirements and capabilities, situated in a specific context and empirical setting.

1. Introduction

The limited information management capability of small and medium-sized enterprises (SMEs) and their difficulties to establish and maintain collaborative networks (CNs) (Dutot, Bergeron, & Raymond, 2014; Camarinha-Matos & Afsarmanesh, 2005; Costa, De Sousa, Soares, & Jamil, 2016; Costa, Soares, & Sousa, 2016; Nguyen, Barrett, & Fletcher, 2006), hinder strategic activities such as the processes of internationalisation that require comprehensive knowledge, sourced from official channels (accurate information) and from peer organisations (past experiences and lessons learned). Due to their detailed knowledge of particular industrial sectors and because of their experience in supporting internationalisation processes, industrial business associations (IBAs) could appear as a main supporting actor for SMEs to obtain a proper access to international contacts and to valued international trade information that can better meet their needs (Costa, Soares, & Sousa, 2017). Nevertheless, IBAs are immersed in the current digital economy which has reshaped how SMEs conduct their international

activities across foreign markets (Giudici & Blackburn, 2013). In addition, many SMEs have multiple association memberships, both at the individual/staff and business levels (Boléat, 2003), which naturally creates some sort of competition environment among IBAs.

The success of international activities has often been based on firms' technological capabilities and technological knowledge (Sedoglavich, 2012). Therefore, if IBAs want to present themselves as an active supporting actor for the internationalisation of SMEs, they will need to improve their current services and consider these new digital requirements from SMEs, by promoting the digitisation of their internationalisation support activities (Costa, Soares, & Sousa, 2019). The adoption of digital platforms (DPs) could potentially lead to the achievement of these improvements.

DPs play a fundamental role in today's connected and data-rich society supporting information sharing, collaboration and collective action (Spagnoletti, Resca, & Lee, 2015), in cooperation settings such as online communities or enterprise networks. In the business domain, DPs have been fundamental for organisational strategies, with variations of

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DPs being designed and developed to improve the management of processes and activities, in particular supporting collaboration and information management (Bellini, Ascenzo, Ulaskaia, & Savastano, 2016; Carneiro, Soares, Patrício, Azevedo, & Pinho de Sousa, 2013). Notwithstanding all these developments, the full potential of DPs is yet to be released or even acknowledged by individual companies or business networks (Parker, Alstyne, & Choudary, 2016; Sebastian et al., 2017). The reason for this lies in two interrelated challenges: on the one hand, in the intrinsic organisational and managerial complexity in implementing collaboration-based inter-organisational structures and behaviours (Costa, Soares et al., 2016) and, on the other hand, in the lack of guidance in the design and implementation of DPs as socio-technical systems (de Reuver, Sørensen, & Basole, 2017).

Extant literature on business information technology and systems lack detailed case studies that could lead to theoretical and practical knowledge to help researchers and practitioners alike to better understand the complexities of the application of DPs to business networks. Senyo, Liu, and Effah (2019) identify research needs in the context of Digital Business Ecosystems that include digital platforms, process and service design, as well as artefacts such as methodologies, frameworks and models. Furthermore, research on the design of DPs has mostly addressed the development of design theory based on conceptual analysis and application scenarios, without going into the detail of real-world cases to enrich design theory (Spagnoletti et al., 2015). According to de Reuver et al. (2017), the current literature on DPs clearly shows the need for developing more direct design knowledge and design theories, in order to provide a better understanding on how organisations can effectively design DPs. Moreover, to obtain more valid and reliable design theories, research on DPs should also be situated in specific empirical contexts by specifying concrete requirements that can contribute to the design of DPs by organisations (Spagnoletti et al., 2015).

Accordingly, the aim of this research is to contribute to the design knowledge on DPs through an empirical study of business networks. To overcome the identified research limitations, we are focused on IBAs (a type of business network) and in one specific process: the support to the internationalisation of SMEs. This research can also contribute to the international business literature, as there is a lack of studies addressing the influence of IT and DPs as internationalisation support instruments for both IBAs and SMEs. Besides studying a new context in detail, another main contribution of this research is to look at this problem from a socio-technical perspective, as we believe this new context could represent a larger socio-technical ecosystem composed by DPs managers (the IBAs), users (the SMEs), and the corresponding social interaction mechanisms involved. Looking at the problem from a socio-technical perspective, we can deal with the multi-actor setting in which the DP is to be designed and understand the needs of multiple distributed actors with divergent goals. According to (de Reuver et al., 2017), this approach is not usually applied in studies of DPs.

Following the recommendations and research directions of Spagnoletti et al. (2015) and de Reuver et al. (2017), we employ a design science research (DSR) approach (Hevner, March, Park, & Ram, 2004; Van Aken, 2004) in this study to overcome the lack of design knowledge on DPs. The main goal of DSR is to create innovative artifacts (e.g. models, methods, instantiations, guidelines, design theories) addressing unsolved problems in organisations (Hevner & Chatterjee, 2010). As our artifact, we chose design propositions, following the CIMO-logic (Context, Intervention, Mechanism, Outcome) (Denyer, Tranfield, & van Aken, 2008; van Aken, 2015), to obtain design principles that could represent important requirements and features for DPs managed by IBAs to support the internationalisation of SMEs. Accordingly, our design propositions are derived for DPs that could support different types of generative mechanisms of social interaction: information sharing, collaboration, and collective action (Spagnoletti et al., 2015). These design propositions are developed and are supported by empirical knowledge based on interviews performed with

IBAs and SMEs, as well as by theoretical knowledge from the literature. For contributions to practice, these design propositions will hopefully help IBAs, researchers and practitioners, in designing more effective collaborative DPs and sociotechnical systems to improve the support to the SME internationalisation.

The structure of this paper is based on the publication schema for DSR studies, proposed by (Gregor & Hevner, 2013), and on the DSR methodology of (Peffer, Tuunanen, Rothenberger, & Chatterjee, 2007), recommended to conduct proper DSR in information systems. Accordingly, after the Section 2 of methods, which details the DSR approach adopted, we start with the problem identification and motivation to develop our artifact (Section 3). Section 4 summarises the objectives of the artifact to be developed, with the presentation of our vision for IBAs to improve the internationalisation of SMEs with DPs. Section 5 presents the artifact description. In Section 6, we show the results of evaluation for the artifact and Section 7 discusses the obtained results. Finally, Section 8 provides the main conclusions and contributions of this paper.

2. Methods

2.1. Fundamentals of design science research

DSR is now a well-established research paradigm within the information systems community and in business and management studies to create innovative artifacts. Such artifacts may include:

- conceptual artifacts, such as constructs, models, methods, and frameworks (Hevner et al., 2004; Peffer, Rothenberger, Tuunanen, & Vaezi, 2012);
- formal logical instructions, such as algorithms and instantiations (Hevner et al., 2004; Peffer et al., 2012);
- system design, language/notation, guidelines, requirements, patterns, and metrics (Offermann, Blom, Schönherr, & Bub, 2010);
- social innovations (Van Aken, 2004);
- new properties of technical, social, or informational resources (Järvinen, 2007);
- architectures, design principles, and design theories (Vaishnavi & Kuechler, 2015);
- design propositions (Denyer et al., 2008; van Aken, 2015).

(Hevner, 2007) develops a DSR approach based on a complementary 3-cycle model: (1) *relevance cycle* – to bridge the contextual environment with the design science activities; (2) *rigor cycle* – to connect the design science activities with the knowledge base (from scientific foundations, experience, and expertise); and (3) *design cycle* – to iterate between the core activities of developing and evaluating the design artifact.

Well designed and developed artifacts are expected to contribute with new knowledge to the body of scientific evidence and to real-world applications (Hevner & Chatterjee, 2010). (Gregor & Hevner, 2013) identify four types of knowledge contributions, based on the existing state of knowledge, in both the problem and the solution domains: (i) invention (new solutions for new problems); (ii) improvement (new solutions for known problems); (iii) exaptation (known solutions extended to new problems); and (iv) routine design (known solutions for known problems). In summary, to perform a good DSR project some fundamental aspects must be considered, such as the design and construction of a viable artifact (Hevner et al., 2004), the rigorous evaluation of this artifact (Peffer et al., 2012), and the knowledge contribution of the DSR project (Gregor & Hevner, 2013).

According to (Van Aken, 2004), in organisational and management studies, management is viewed, more and more, as a design science. The author suggests that the traditional description-driven research in management studies (based on the paradigm of the explanatory sciences) must be balanced with more prescription-driven research (based

Table 1

Components of the CIMO-logic for design propositions (Brouwer, Brekelmans, Nieuwenhuis, & Simons, 2012; Denyer et al., 2008; Holmstrom, Tuunanen, & Kauremaa, 2014).

Component	Component
C - Context	The results that human actors aim to achieve and the surrounding (external and internal environment) factors that influence the actors.
I - Interventions	Purposeful actions or measures (products, processes, services or activities) that are formulated by the designer or design team to solve a design problem or need, and to influence outcomes.
M - Mechanisms	The mechanism that is triggered by the intervention, in a certain context, by indicating why the intervention produces a certain outcome. It can be an explanation of the cognitive processes (reasoning) that actors use to choose their response to the intervention and their ability (resources) to put the intervention into practice.
O - Outcome	Result of the interventions in its various aspects.

on the paradigm of the design sciences) in order to mitigate relevance and utilisation problems. Consequently, in management studies, DSR is driven by field problems, with the aim of developing generic actionable knowledge, which is knowledge about the type of actions that can be taken to address a certain type of field problem (van Aken, 2015). In other words, the mission of design science is to develop knowledge that researchers and professionals can use to design solutions for their field problems (van Aken, 2005).

(Denyer et al., 2008) also make important contributions to the field of management and DSR, by presenting a DSR approach with a discussion of prescriptive knowledge in the form of design propositions, following the so-called CIMO-logic. CIMO-logic allows to obtain a systematic structure for the propositions, combining problematic Contexts with certain Intervention types to deliver specific Outcomes, following generative Mechanisms. Therefore, design principles that are formulated according to CIMO-logic indicate what to do, in which situations, to produce what effect, and offer understanding of why this happens (Denyer et al., 2008; van Aken, 2013). Table 1 presents more detail on the description of each component of the CIMO-logic.

2.2. Research design

The goals guiding this research are in Table 2. Following a DSR approach, our aim is to develop a set of design propositions (Denyer et al., 2008; van Aken, 2015) – our DSR artifact – following the CIMO-logic. The design propositions are developed to allow to obtain detailed requirements and possible features for DPs managed by IBAs to support the internationalisation of SMEs. In terms of contribution for DSR knowledge, the artifact represents an improvement (Gregor & Hevner, 2013), as the design propositions try to represent new solutions for known problems of the SME internationalisation. Fig. 1 shows the research design applied for this study.

The central part of the artifact design – the development of the design propositions – is supported by knowledge from the environment and practice, as well as by knowledge from existing theories and from the theoretical background involved (Senyo et al., 2019).

The practical knowledge is originated from different empirical studies that we performed with IBAs, SMEs and large and multinational enterprises (MNEs). We decided to include the latter organisation type to have their views about this topic as well. First, we made a small exploratory field research by interviewing 5 companies – 3 SMEs and 2

MNEs – associated with some IBAs in Portugal. One of the objectives was to understand their perspective about the use of DPs managed by IBAs to support their internationalisation activities. After that, we performed a larger exploratory field research, this time by interviewing 20 Portuguese IBAs from different industrial sectors, in order to extend the previous study. With this new study, we were able to increase our understanding on the current activities and the use of institutional network resources by IBAs to support and facilitate internationalisation processes of SMEs. Finally, in a new exploratory field research, we got the perspectives from additional prospective DPs' managers with new interviews performed with 1 IBA in France (because one of the authors had the opportunity to interview it in a specific international event) and 3 IBAs in the UK (as the same author also had a research visiting period in this country). This new study allowed us to increase the validity of our findings. Therefore, based on the insights from the 24 interviewed IBAs, the objectives of this study were: (i) to explain the factors that influence the adoption of DPs by IBAs to support SME internationalisation; (ii) to identify current DPs that are being used and to perform an evaluation of their potential for supporting internationalisation processes; and (iii) to help specifying a preliminary set of requirements and features for DPs supporting internationalisation.

In addition to our exploratory studies, we performed a single embedded case study (Yin, 2009) for a more in-depth exploration and understanding of the phenomena. The main goal was to obtain additional insights and empirical knowledge from companies and potential users of DPs, to be used together with our previous empirical data, in order to develop our design propositions. For this single case study, we have selected the Portuguese textile industry through a convenience sampling (Merriam, 1998), as access to data and contacts with companies was likely to be easy. The unit of analysis of this single embedded case study was the IBA of this sector and 14 of its members. To increase the validity of this case study, three different types of companies were considered: 1) 5 SMEs with experience in internationalisation processes; 2) 5 SMEs without or with little experience in internationalisation processes; 3) 4 MNEs with experience in internationalisation processes.

The sources of information for all these empirical studies were personal interviews and documentation. The procedure to perform these interviews was: (i) use an informed consent form; (ii) perform interviews with personnel working in internationalisation processes or with the owners/managers of companies; (iii) use a semi-structured

Table 2

Research goals.

	Goal
Management problem or opportunity	To significantly improve the performance of the internationalization process of SMEs, in the institutional context of Industrial Business Associations, through the use of Digital Platforms to support the internationalization informational and social processes, ultimately contributing to the digital transformation of IBAs.
Contribution to Design Theory	To contribute to the design theory of Digital Platforms through the specialization of the general design propositions found in literature for a specific class of problems/opportunities: transformation of IBAs in collaborative networks, through the evolution of online communities supported by Digital Platforms.
Contribution to Design Practice	To support the derivation of problem/case specific design requirements for Digital Platforms through a lookup and matching process of outcomes and interventions within a CIMO logic.

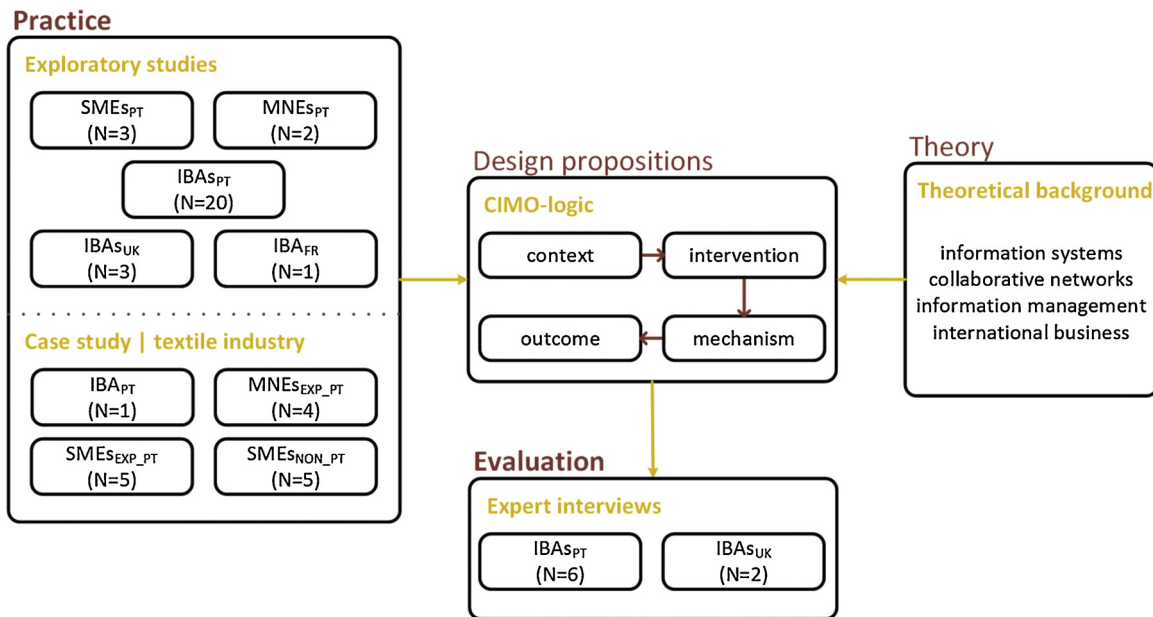


Fig. 1. Research design for this study.

Table 3

Collaboration and information problems faced by SMEs.

Problem	Transcription from the interview
Lack of collaboration	<p>"You know that the Portuguese are not very easy in this situation of collaborate with others because it is not easy... Our mentality cannot do that, the Portuguese mentality cannot do that."</p> <p>"Information sharing and joint strategy definition, this does not happen. Whether because of the specificity of each case or because we are very Portuguese... either because we do not like to share our information... I think things are very individual and casual, much more than a sectorial strategy of internationalisation."</p> <p>"Companies still live very closed to the past of "it's all theirs and none of others" and sometimes end up losing the business opportunity because they are not able to respond to a specific customer's demand. If instead they would share the customer's needs with others a little, they could satisfy the customer."</p>
Difficulties in managing information about markets	<p>"It is necessary to make trips, to know cities, to know people's ways of dressing, the consumption that people naturally have, colours that people normally use. All this information is important but difficult to be acquired."</p> <p>"Currently we continue to look for markets ... so, the degree of difficulty now is to arrange information on distributors and commercial agents. Our product is a product that requires distribution of commercial agents, so it's complicated."</p> <p>"What kinds of structures do we have to put together, in what form, and what is the size of the market..."</p>

interview guide; and (iv) record the conversations. Afterwards, data was analysed through the transcription and coding of the interviews, using the qualitative data analysis software MAXQDA. Some validity and reliability procedures were also considered, such as using documents and information from the companies' websites for data triangulation (Yin, 2009), using a diversity of informants for a more complete vision of the environment and for guarantying the construct validity (Barratt & Barratt, 2011) and using a study protocol to repeat the data collection procedures, ensuring the reliability of the study (Yin, 2009).

A rigorous evaluation of an artifact is one of the fundamental aspects to be considered in DSR projects (Hevner et al., 2004; Peffers et al., 2012). Due to time and financial constraints, this project did not evaluate the design theory based on the actual implementation of the proposed design propositions and artifact. Instead, we decided to evaluate the utility of our design propositions through 8 interviews with experts and IBAs, via personal contact and video conference, both in Portugal and in the UK. This was done to anticipate the actual validation of the artifact and provide some preliminary feedback on the design propositions. In each interview, we presented and explained the design propositions to the participants and we asked them to evaluate and rate each proposed intervention, by answering three questions, with classifications from 1 to 5:

- Level of importance for the design proposition;

- Ease of implementation of the design proposition;
- Additional comments to the design proposition (e.g. modifications or suggestions).

3. Problem and motivation

To obtain a better understanding about the challenges faced by both IBAs and SMEs, we frame our problem based on the current knowledge from the literature and with the help of our transcriptions from the interviews. The result is then based on a multiple stakeholder perspective about the problem and motivation to develop our DSR artifact.

3.1. Internationalisation challenges faced by SMEs and IBAs

It is well recognised in the literature that SMEs often face two particular difficulties in their internationalisation processes (Costa, Soares et al., 2016; Hsu, Chen, & Cheng, 2013; Ibeh & Kasem, 2011): (i) to establish CNs to gain competitive advantages in foreign markets; and (ii) to obtain the right information and manage it effectively. Our interviews with SMEs evidence these challenges, as demonstrated by some examples of our transcriptions (Table 3):

Nonetheless, the availability of information alone is not enough to improve decision-making within internationalisation processes. Mediation and other forms of knowledge sharing are needed, levered on

trustful, collaborative environments, such as the ones that could be potentially provided by IBAs (Costa et al., 2017a). IBAs are institutional membership organisations that either represent different firms of a specific industrial sector or are intermediaries within a multi-sectoral network of industrial companies (Costa, De Sousa et al., 2016).

Previous literature in the internationalisation of firms identifies IBAs as an institutional actor (Oparaocha, 2015), as an export promotion organisation (Wilkinson & Brouthers, 2006), or as an information broker for SMEs (Leonidou & Theodosiou, 2004). The problem is that IBAs are currently facing difficulties with problems related with low membership and high opting out, instability over time, and multiple association memberships by companies (Bennett, 1998; Boléat, 2003; Costa et al., 2017a).

Our interviews also show that the information management role of IBAs could be improved to better meet the internationalisation needs of SMEs:

- Improved information organisation e.g., by filtering and organizing information according to countries in which each member is present or have sales;
- More effective information dissemination e.g., by more selectively disseminating information about more specific subjects such as legal aspects (e.g. legislation and customs rules, patents);
- Promote information sharing among the members e.g., experiences and lessons learned;
- Improved information quality, by providing information specifically tailored to the needs of SMEs.

In addition, Table 4 presents examples of what SMEs want more from IBAs in internationalisation processes.

Therefore, in order to remain an important facilitator for the international business of both current and prospective members (SMEs), the present services and support activities promoted by IBAs should reflect and be adapted to the digital transformation that is occurring in every market and business sector. Particular attention could be given to DPs, as a means for the digitisation of their international business support activities and to foster CNs that could improve the international performance of SMEs.

3.2. Why digital platforms?

"Digital platform" is a broad term that is being used in many fields of research. (Sun, Gregor, & Keating, 2015) and (de Reuver et al., 2017) present an extensive list of definitions from the management and information systems areas. From a technical point of view, a DP can be considered as an extensible codebase to which complementary third-party modules can be added. Looking at the term in a more

sociotechnical perspective, it could be defined as a set of technical elements (software and hardware) and associated organisational processes and standards.

The disruptive power of platforms has been demonstrated by the rapid dominance of platform businesses over traditional industries (Parker et al., 2016). Accordingly, many DPs have been designed and used in organisations from different industries, for a variety of purposes, such as to facilitate the communication inside work groups (Mansour, 2009), support online communities (Spagnoletti et al., 2015), create knowledge (Tseng & Johnsen, 2011), manage knowledge in clusters of firms (Cremona, Ravarini, & Sutanto, 2014), and establish collaborations (Carneiro et al., 2013). Parker et al. (2016) explain that the rapid rise of the DP model has been already transforming many major industries and will transform many others in the next few years. In this way, digital industry platforms represent a technological trend that is having a profound impact on companies.

3.3. Current challenges for digital platforms

(Mergel, 2017) argues that a digital transformation requires a holistic effort by organisations, in a way of rethinking and changing their main processes, beyond the traditional digitisation efforts from the past. Accordingly, a digital transformation requires cultural, managerial, process and developmental changes by the organisation as a whole.

Due to the variety of the growing user base, and with the constant development and addition of new IT capabilities and complements, the design context of DPs is subject to a wide range of changes (Spagnoletti et al., 2015). Therefore, efficient platform designs must meet the needs and requirements of their community of users. Nonetheless, according to (Spagnoletti et al., 2015), there is still a lack of understanding on how organisations can effectively design DPs supporting online communities. In addition, by analysing and presenting the main issues, risks and recommendations for digital platform researchers, one of the main problems found by (de Reuver et al., 2017) is also the lack of design knowledge on DPs.

To cope with this problem, (Spagnoletti et al., 2015), based on the works of Boisot (1995) and Ciborra (1996), start to propose an overarching proposition that the main components of the architecture of DPs should support the mix of three distinct types of social interaction mechanisms for online communities:

- **information sharing:** actors make their own contents available on the internet; resources are available to all; free participation is allowed;
- **collaboration:** actors follow rules and engage in activities that require group coordination; participants adapt their behaviour to others; a greater alignment is required between the objective of the

Table 4

What the SMEs want from the IBAs.

Need	Transcription from the interview
A place to access market opportunities	"Maybe a kind of database of business opportunities... If I somehow knew that there was a concentration of information somewhere, it would be easier for me to find out from there... the bottom line was the international customers, through some mechanism, arriving in Portugal and having a vehicle there to reach several Portuguese suppliers."
An improved IBA's website with organised information	"Information about business opportunities, I think it would be very useful and interesting in this matter and in other matters." "I think the IBA's website page, with the current trends that exist today, should be much more updated and much more recent. It needs to be a page that would also serve as a platform for all information and be more aggressive. Be at the level of exports we make." "Especially the IBA's website... is not organized in an easy way. So, they have a lot of useful information, but it is scattered and not well organized. In fact, I think it is an aspect that should be improved, not only for internationalisation but for other areas. This is important because in fact, I think, that in our case, the source of privileged information is the IBA because it has information that is focused on our sub-sector."
Updated information about players in markets	"The data update, of the IBA, of customers, agents. Because there is many information that they give us that later we will see and have no value. It has to be updated." "...if we want to go into a specific branch of this country, if we want to go to focus on the most segmented product level... if the IBA would have some kind of business intelligence, to tell us who are the main actors in this sector...it could be more important." "Lists of clients. If I could get more information about potential clients, brands, department stores, etc., that would be good."

group and the objective of the individual;

- **collective action:** actors follow a common goal and stand by common rules established by group membership; regulations are complex, and a close coordination is required; decisions made by group members prevail over personal interests.

These three types of social interaction mechanisms still useful both as an analytical framework to study online communities supported by digital platforms, and as a design framework for such socio-technical system. There area, however, some points in the characterisation of these mechanisms made by (Spagnoletti et al., 2015) that, in our work, were interpreted differently. We have conceptualized the social interaction of SMEs as collaborative networks (Camarinha-Matos & Afsarmanesh, 2005) instead of online communities. It is out of the scope of this paper to explore the practical and theoretical differences of such conceptualizations, being sufficient for now to recognize that SMEs interaction happens in a mix of personal/social and institutional (Costa et al., 2017a; Costa, Soares, & Sousa, 2017) spheres, while online communities mostly happen in the personal/social one. This has influence, for instance, in considering identity, reciprocity, and institutional values equally important for the characterisation of the three mechanisms, unlike considered by (Spagnoletti et al., 2015).

3.4. Current offer of digital platforms managed by IBAs to support internationalisation

Regarding the international business, some studies have been discussing the importance of digital technologies to support the international activities of SMEs (Brouthers, Geisser, & Rothlauf, 2016; Giudici & Blackburn, 2013). Some DPs have been developed to support the internationalisation of SMEs in the EU, mainly to facilitate cooperation between European clusters (European Commission, 2014).

For instance, our interviews show that some more active and developed IBAs also gained interest on this kind of technology and are currently using DPs, for example, to support members with information about markets or by allowing large companies to subcontract smaller ones for specific international operations. Nevertheless, most of the IBAs are still using basic forms of technologies to support international trade activities and to interact with their members. The email and the dissemination of information through websites are the channels typically used for communication purposes. Through our empirical studies, we present the following main conclusions about DPs in IBAs:

- the existing offer of DPs supporting internationalisation, managed IBAs, does not meet important requirements to the creation of effective CNs (Carneiro et al., 2013; Fedorowicz & Sawyer, 2012), or to enhance social interaction structures of online communities (Spagnoletti et al., 2015);
- the majority of the identified DPs are still new, and it seems too early to understand the real impact that they are having in the international activities of SMEs;
- it was possible to identify a few cases of failure, mainly evidenced by the lack of involvement of companies;
- there are also overlaps in terms of support activities to SMEs, between sectoral IBAs, multi-sectoral IBAs, trade agencies, and governments, evidenced by the development and use of similar digital tools and services.

4. Objectives of the artefact and of the research on design theory

With the problem and motivation defined, we are now in a position to define the specific objectives of the digital platform as the artifact to be designed. First, it is important to clarify the definition of “digital platform” in our study. (de Reuver et al., 2017) consider that management research does not have in consideration the specific digital characteristics and components of platforms. Instead, the used

classifications of technological platforms are only based on the organisational arrangements or, in other cases, the technology and digital part is not considered as theoretically relevant. Therefore, to avoid misinterpretations, and following the recommendations of these authors, we first use a clear definition of what we consider in this paper as a DP, drawing upon the established definitions from previous research:

“A digital platform is a building block that provides an essential function to a technological system and serves as a foundation upon which complementary products, technologies, or services can be developed” (Gawer, 2009; Spagnoletti et al., 2015).

Thus, when we use the term “digital platform” we are focusing on the technical concept of DPs and on their respective features and services (the unit of analysis) that can be used by organisations to improve management processes. In addition, (Sun et al., 2015) show different interlocking research themes that were studied in previous research on DPs: digital platform investment, design, development, governance, adoption, usage, and impact. In this paper, we are mainly concentrated on the design, where the aim is to develop design principles for DPs managed by IBAs to support the internationalisation of SMEs.

(Spagnoletti et al., 2015) explain that few design theories have been developed for DPs supporting online communities. (de Reuver et al., 2017) also supports that argument, clarifying that previous research on DPs has so far not revealed much direct design knowledge. The design theory of (Spagnoletti et al., 2015) offers us significant knowledge for our study, addressing ways in which DPs can effectively support three types of social interactions mechanisms in online communities: information sharing, collaboration, and collective action. Nevertheless, the propositions developed by these authors are situated at the high-level/conceptual principles, so they recommend further developments of their work by translating those propositions into tangible and concrete requirements and capabilities, situated in a specific context, for obtaining more valid and reliable design theories (Spagnoletti et al., 2015).

As defined in Table 2 (see Section 2), our research aims to contribute to this research direction by further developing design propositions for DP by addressing a specific class of management problems: the support to the internationalization of SMEs in the institutional context of industrial business associations. Based on previous research, we argue that IBAs may provide a more proper digital support to the internationalisation of SMEs, when compared with other institutional entities such as governments or export agencies. The reason is that there is a general agreement that the DPs from governmental entities and from agencies are useful to have access to statistics, studies or more general information about internationalisation. But, for more specific information about each sector, it is always difficult to find valued information that can be used by companies in their decision-making processes. Furthermore, knowledge on specific issues of the internationalization process arise from SMEs that somehow already have done it. Due to their vast experience, social capital and specific knowledge about their respective industrial sectors, IBAs could be in better conditions to enact a collaborative environment, providing more detailed and focused information, as well as to facilitate knowledge sharing among SMEs.

The rationale for this vision is that a digital platform for internationalisation should support communication and information management processes, as well as the establishment of CNs, by means of three distinct types of social interaction mechanisms (information sharing, collaboration, and collective action), and following an organisational network governance structure where the IBA is the network administrative organisation (NAO) (Provan & Kenis, 2008). Thus, although we adopt a technical perspective for defining the concept of DPs, we also use in our artifact a sociotechnical view to represent a larger sociotechnical ecosystem, including: (i) the network and DP managers (the IBAs); (ii) the DP users (the SMEs); and (iii) the related

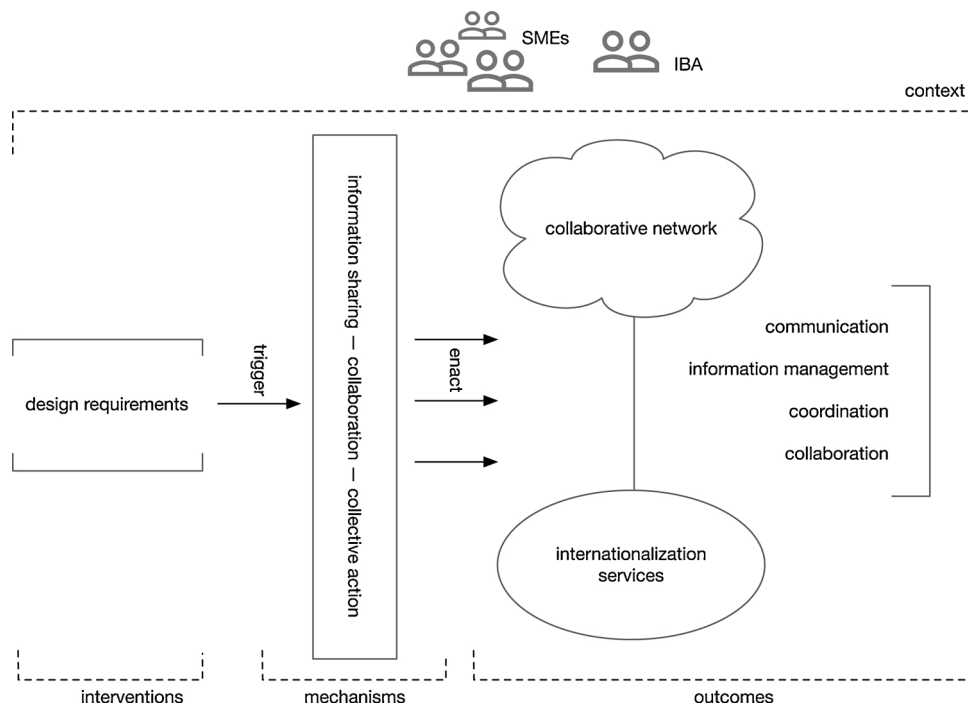


Fig. 2. Specific DP design theory framework for IBAs aiming to improve the internationalisation process of SMEs.

social interaction mechanisms. By doing this, we are dealing with the multi-actor setting in which the DP is to be designed, allowing us to understand the needs of multiple distributed actors with divergent goals, which is an approach that has not been applied in studies of DPs (de Reuver et al., 2017). This is depicted in Fig. 2 where a framework for specific DP theory is outlined, built upon the CIMO-logic.

5. Artifact description

As explained in the previous sections, the design propositions are shaped according to the CIMO-logic, to deliver a prescriptive framework that might be used by different IBAs to improve internationalisation processes of SMEs with the support of DPs. Accordingly, we present specific features and requirements of DPs that are based on previous studies in the literature, as well as on our empirical studies with IBAs and SMEs.

Within this context, a concrete goal for the DPs is to support the establishment of CNs, following three distinct types of generative mechanisms of social interaction: information sharing, collaboration, and collective action. Having in consideration all this information, the next sub-sections present and discuss the design propositions, according to each generative mechanism. Each design proposition comprises a combination of interventions ($I_1 \dots I_n$), following one specific generative mechanism (M) to produce particular outcomes ($O_1 \dots O_n$) in a specific context (C).

5.1. Information sharing generative mechanism

In information sharing-centred CNs of SMEs, actors make available their own codified, abstract and diffused information to all, and free participation is allowed (Spagnoletti et al., 2015). The design proposition for the generative mechanism of information sharing is:

Design proposition 1: In the context of IBAs seeking to improve internationalisation processes of SMEs with the support of digital platforms (C), by performing different interventions (I_{IS1} to I_{IS7}), following generative mechanisms of information sharing (M_{IS}), will help to deliver specific Outcomes (O_{IS1} to O_{IS7}).

C: IBAs seeking to improve internationalisation processes of SMEs with the support of digital platforms

I_{IS1} : Using online social networks and including a video channel (e.g. YouTube);

M_{IS} : Information sharing

O_{IS1} : Improve the communication and social connections among the CN of SMEs, disseminate information about internationalisation, create online working groups, and create live streaming services, as well as potentiate the digital communication of the IBA and improve the processes of learning and capacity building of members.

I_{IS2} : Having an open and interactive directory of members with organised and detailed information about each member and each sub-sector;

O_{IS2} : Facilitate internal and external matchmaking processes and increase the visibility of each member for stakeholders in international markets;

I_{IS3} : Personalise information for each type of user by means of user-centred design and artificial intelligence tools by presenting and structuring the information in a simple, clear and precise way, and organising and filtering it by sectors and sub-sectors of the IBA;

O_{IS3} : Rise the interest of members to use the digital platform for their internationalisation decisions and avoid overloading members with information that is not relevant for their internationalisation activities;

I_{IS4} : Managing and supporting the whole information life-cycle (information sources, information acquisition, information dissemination, and information utilisation);

O_{IS4} : Help CNs of SMEs to have a more efficient and effective access, processing, and utilisation of valued internationalisation information;

I_{IS5} : Creating a specific feature for the organisation of trade fairs and trade missions that allow members to register and express their interest in particular events and to contact with each other;

O_{IS5} : Facilitate the management and logistics of trade fairs and trade missions, provide essential information about each event, and improve processes of communication and coordination;

I_{IS6} : Facilitating the organisation and application of competence mapping models;

O_{IS6} : Contribute to the provision of roadmapping and matchmaking services by the IBA, identify new international business opportunities and the

I_{IS7}: Including a digital market observatory with market sheets, prospective reports and market studies and detailed internationalisation support guides;

respective missing competences to exploit these new identified markets;
O_{IS7}: Analyse, systematise, discuss and make available relevant information on emerging international markets that may be priority targets for the sector, in order to facilitate the international expansion of members;

DP1-IS1: online social networks and video channel | (Spagnoletti et al., 2015) state that effective DPs supporting information sharing-centred online communities should be connected to online social networking services. Many of the IBAs and SMEs that were interviewed consider that social networks such as Facebook, LinkedIn and Twitter, are the ones of interest for a more direct communication about international trade activities promoted by the IBAs and for sharing some news. Those social networks allow users with similar interests and needs to communicate and exchange ideas and other information (Brouthers et al., 2016) and encourage social connections by allowing users to create their own business network and to post, view, forward, share and comment on its content, in the form of comments, links, photos, and videos (Smallwood, 2014). Such platforms also have an extensive offer of APIs (Tiwana, 2015), which can be chosen by developers to meet some specific requirements. Therefore, IBAs could disseminate in the digital platform and through social network services information about internationalisation promotional activities (trade fairs, trade missions, promotional actions, and events), best practices of members, and general news about international trade activities. Working groups could also be created in social networks for a particular network partnership to share ideas and information to pursuit a specific internationalisation opportunity. Finally, an IBA could use social networks for live streaming services, for example live from one important trade fair or internationalisation-related event.

Our empirical studies also show that both IBAs and SMEs think that DPs can improve the digital communication to the outside world, as well as promote the image of the sector and of the country. Therefore, besides the connection with popular social networks, another feature of a digital platform could be to have a video channel (e.g. YouTube) with the objective of representing another way of advertising and promoting the industrial sector of an IBA. A video channel could easily be integrated in a digital platform of support to internationalisation through available APIs and add-ons on the market. As demonstrated by previous studies, mass media can be a strong communication channel for creating awareness about an innovation (such as internationalisation), for disseminating general and non-specific information, and for rapidly deliver information to a large number of people (Brouthers et al., 2016). This video channel could also be used by IBAs for training purposes and to better prepare their members for an international expansion, by including videos explaining important internationalisation issues from which members are currently struggling with, such as international marketing strategies, credit insurance, international trade tariffs, and transportation (Costa et al., 2017a).

DP1-IS2: digital directory of members | Another intervention for the digital platform is to have a detailed digital directory of members of an IBA. Previous studies in the literature show the significance of keeping up-to-date and maintaining a publicly accessible directory of members of an IBA in its management activities, as many times it represents the first point of contact for external entities of interest to their members (Bennett, 1998; Boléat, 2003). Through our empirical studies, we found that most of the directories in IBAs are not intuitive or only present minimum information of each member, such as its name and business sector. The main outcome of having detailed directories is the possibility to publicise and promote a company by facilitating consultation for improving international business relationships with the general public or with entities of interest and clients. Having detailed

information about members could also facilitate matchmaking processes, both internally (within the IBA) and externally (to find partners in other sectors). Therefore, such business directory in the digital platform should be organised by sub-sectors and should include information about the contact of each member, together with more thorough information on its activity and its international presence. In addition, this digital directory should be interactive, with a search field/functionality connected with a set of filters to improve the search of each member. For example, maps could be used to point the geolocation of each member.

DP1-IS3: information personalisation | (Peschken, Shukla, Lennon, & Rate, 2016) explore the decisions of SMEs' decision-makers in internationalisation, explaining that the structure of the available information to internationalise has a strong influence on decisions regarding cognitive resource requirements. Accordingly, platform designers should also have this issue in consideration. Many IBAs still present outdated and old-fashioned websites and the interviewed companies from our case study think that the information in the IBA's website is poorly organised and dispersed, which negatively affects the image of the sector. They also think that it is important to make the information of internationalisation more accessible because they prefer to resort to the textile IBA, instead of accessing general internationalisation information from other institutional entities. An IBA has the potential of providing a more detailed information, focused on the specific sector. However, due to the different problems and functioning that characterise each sub-sector of this specific IBA, there is a general agreement that, in order to satisfy the information needs of the largest possible number of members, this information should be organised and filtered according to each sub-sector. Lastly, the information must be simple, clear and precise to increase the interest of companies for accessing the digital platform.

Another important requirement for the digital platform is to provide flexibility in sharing and disseminating the information. Many times, companies are overloaded with information about trade fairs or information about some specific internationalisation opportunity that it is not of interest for them. Each sub-sector of an IBA needs different kinds of information, so allowing to easily select the type of information and the targets or members to send the information within the digital platform could be a relevant feature (Costa et al., 2019).

DP1-IS4: information management | The management of information in internationalisation processes is another relevant factor to take into consideration, especially when dealing with the large amount of information that typically characterises these processes (Costa, Soares et al., 2016; Xie & Amine, 2009). For (Detlor, 2010), information management concerns controlling the whole information lifecycle to help people and organisations accessing, processing and using information efficiently and effectively. (Theodosiou & Katsikea, 2013) explain that the export/internationalisation information system comprises four key dimensions of support to the information lifecycle: information sources, information acquisition, information dissemination, and information utilisation.

- **Information sources:** Based on previous literature and on our empirical studies with different IBAs and SMEs, we are able to identify and synthesize data and information sources to support internationalisation processes. This information can be consulted at (Costa et al., 2017b). These information sources could be useful for both improving the IBAs' support and the internationalisation of SMEs to have access to a more diversified information content.
- **Information acquisition:** IBAs could use formal (market research) and informal techniques (relying on gatekeepers) to gather and acquire information from different sources (Rodriguez, Barcos, & Álvarez, 2010). For this stage, consider the use different export information acquisition modes (Souchon, Dewsnap, Durden, Axinn, & Holzmüller, 2015):
 - export marketing research, which is formal, systematic and

objective and can be carried out both internally and/or externally;

- export assistance, which includes market information and guidance on exporting and export marketing;
- export market intelligence, which is an informal, experiential export information acquisition mode that comprises obtaining information from network sources, such as customers and distributors, through participation in international trade fairs and shows, or in a more direct way, through foreign visits.

Our interviews also show the importance for an IBA to have a more direct contact with some particular institutional entities (e.g. external trade and investment agencies), promoting a more fruitful sharing of information between them to better support the SME internationalisation. To filter information about a specific industrial sector, IBAs should create better connections with external entities related with internationalisation and establish some kind of protocol and feature in the digital platform, to allow these external parties to feed the platform with specific information of interest for the sector of an IBA.

- Information dissemination and information utilisation: Regarding the detail of the content to be disseminated in the digital platform,

Table 5 compiles the information content for internationalisation processes that was indicated by IBAs in our interviews. From the other side, **Table 5** also shows the needs and the information that SMEs look for in internationalisation processes, which result from our case study. Particular emphasis must be done to provide access to detailed information and to databases of potential agents in each foreign trade country (most mentioned on the case study). Additionally, particular emphasis should also be made by each IBA to improve their market intelligence, by having in their digital platform the following reports:

- Annual report of the sector, with information that could guarantee a thorough knowledge of the sector and its economic reality;
- Annual prospect report, on the global business of the sector and its evolution;
- Market sheets, that characterise relevant foreign markets for the industry and for internationalisation;
- Market studies, to find new markets for members and to discover international business opportunities and development in markets.

DP1-SS5: trade fairs and trade missions | Our case study reveals that trade fairs are still the main path for internationalisation for most

Table 5
Information content to be disseminated in the digital platform (from our interviews).

Information content indicated by IBAs	Information needs indicated by SMEs
Statistical data of the industrial sector: <ul style="list-style-type: none"> ● evolution of the sector; ● exports/imports by country; ● number of companies in a specific country; ● main foreign importers. News and information about the industrial sector: <ul style="list-style-type: none"> ● about national and international companies of the industrial sector; ● success stories; ● events. Opportunities for internationalisation Legislative changes Regulatory and political aspects: <ul style="list-style-type: none"> ● international trade agreements; ● analysis of international trade agreements; ● analysis of bilateral agreements; ● agreements between the EU and other countries. Information about promotional actions: <ul style="list-style-type: none"> ● trade fairs; ● trade missions; ● events and exhibitions; ● calendar of actions; ● detail of each action (dates, location, requirements, costs). Visits of potential clients Information about specific companies (national and foreign companies) Contacts in national and international markets Information about training activities: <ul style="list-style-type: none"> ● workshops; ● seminars; ● other training actions. Information of opportunities about applications for national and European projects: <ul style="list-style-type: none"> ● deadlines; ● requirements; ● benefits; ● costs. Information from own market studies: <ul style="list-style-type: none"> ● new trends; ● key players in markets; ● how the market works; ● credit insurance; ● market data and financing conditions. Information from own databases: <ul style="list-style-type: none"> ● companies' characterisation; ● products that export; ● countries of exports; ● product labels and product details; ● practiced prices. 	Main actors / players in new markets Database / list of agents in each country: <ul style="list-style-type: none"> ● lists with more detail and more updated; ● full details of the agents; ● type of brands; ● type of market; ● type of clients; ● type of collections, products, or services; ● billing volume. Database / list of distributors in each country (as detailed as possible) Database / list of potential clients in each country (e.g. brands; department stores) New markets / trends of markets Database / list of suppliers in each country (as detailed as possible) Other detailed information about a specific market: <ul style="list-style-type: none"> ● potential of markets; ● costumes; ● consumptions; ● preferences; ● interest of that market for a specific type of product; ● practiced prices (e.g. average product price, sale price); ● existing support in that market. Detailed reports about the sector and sub-sectors of the IBA (market studies) Financing: <ul style="list-style-type: none"> ● credit insurers; ● credit insurance; ● letters of credit; ● payment options. Analysis of the competition from other markets and countries of the sector

of the interviewed companies. Therefore, independently of the trade fair support that is provided by each IBA, a digital platform could facilitate and help in the organisation of all the logistics processes involved in such events. Instead of sending invitations and organising all the logistics via e-mail, a feature specifically focused on trade fairs and trade missions could be introduced in the digital platform. This feature could provide detailed information about each fair and the costs involved. After that, each member could register and express its interest in a particular trade fair, through a login on the digital platform, and have access to the detail of that fair but also to information about other registered members of the IBA. Besides that, this feature should provide a communication channel, in order to facilitate the coordination between the IBA and all the participants in each trade fair, for example by scheduling and agreeing times and meeting points or, if it is the case, to coordinate the managing and loading of trucks with materials and products from participants that would be disposed and exhibit in the trade fair. Apart from the potential improvements in communication and coordination, this feature could also bring improvements in terms of logistics sharing processes and information organisation, as well as in giving more visibility to each participant in each trade fair and in reducing times of preparations of such events by the IBA. In addition, this feature could include the companies' feedback for each trade fair or trade mission organised by the IBA. To increase the visibility for this type of service provided, the result of this feedback should be accessible to everyone, to understand the potential of each event and to increase further participations.

DP1-IS6: competence mapping models | A detailed mapping of the competences and skills of the members of an IBA could contribute for both the roadmapping and matchmaking services. Therefore, another design recommendation for the digital platform is to provide a tool that can allow to identify, in a structured way, the main competences of each member. (Lämmer-Gamp, Köcker, & Nerger, 2014) show a good example of such model, which was applied in a cluster of companies in Austria and that can be adapted to promote more collaborations for internationalisation in IBAs:

- 1 Self-evaluation by each member of the IBA;
- 2 Workshops with experts and with the IBA to discuss and structure competences;
- 3 Analysis of potential markets for the member;
- 4 A second workshop to discuss the knowledge obtained in the competences and markets analysis.

This model could allow to identify new international business opportunities, as well as missing competences that are needed to exploit the new identified markets. In this case, the digital platform can facilitate the organisation and application of the model.

DP1-IS7: digital market observatory | Based on the benchmarking realised in this study, another possibility for IBAs is to develop and include in the platform a digital future market observatory, to analyse emerging foreign markets of priority for the sector and for their members. The main outputs previously mentioned in the market intelligence could be produced and made available in this digital observatory of markets.

Another important requirement mentioned in our empirical studies is related with training. Many SMEs from our case study in the textile industry would like to have some sort of guidelines or internationalisation support guides in such digital platform. For example, to have guidelines on how to proceed for opening a new company in a certain country, and on the related conditions, requirements, legal and financial aspects, entities that should be contacted, and rules and documents needed to achieve that. Having such information in the digital platform could facilitate the international expansion of companies and improve the digital support provided by IBAs.

5.2. Collaboration generative mechanism

In collaboration-centred CNs, actors adapt their behaviour to others and engage in activities that require group coordination and, like information sharing-centred CNs, the information is codified, abstract and diffused (Spagnoletti et al., 2015). Consequently, many of the interventions previously presented may also support collaboration mechanisms. In this way, in this section we only add a few more interventions for the generative mechanism of collaboration:

Design proposition 2: In the context of IBAs seeking to improve internationalisation processes of SMEs with the support of digital platforms (C), by performing different interventions (I_{C1} to I_{C5}), following generative mechanisms of collaboration (M_C), will help to deliver specific Outcomes (O_{C1} to O_{C5}).

C: IBAs seeking to improve internationalisation processes of SMEs with the support of digital platforms

I _{C1} :	M _C :	O _{C1} :
Encouraging a fully interactive and digital multilateral communication between its members, by including chat services, discussion groups and online forums;	Collaboration	Improve synchronous and asynchronous communication among the members of the IBA and foster the share of information and ideas related with internationalisation;
Having a restricted area with private groups for each sub-sector of the IBA;		Potentiate the sharing of information and sharing of experiences of internationalisation among members;
Promoting more events where foreign companies or members can share their stories and experiences;		Encourage the sharing of experiences about international markets, in a more informal way and by personal contact;
Developing roadmappings that are a combination of skills mapping (competences available in the IBA's members) and foresight (future trends, future requirements, potential partnerships, prospective markets and competences needed);		Improve the provision of market intelligence services by the IBA and potentiate different types of collaborations;
Having a marketplace for the placement of offers and market opportunities from foreign entities and clients.		Foster matchmaking processes and allow users to apply and pursue new opportunities for international expansion.

DP2-C1: fully interactive multilateral communication among members | (Brouthers et al., 2016) explain the functioning of ibusiness firms. This new type of firm results from the continuous advancements in information and communication technologies and are considered as "firms that offer a digital platform that allows users to interact with each other and generate value through user co-creation of content" (Brouthers et al., 2016). Regarding the types of communication in such firms, ibusiness firms encourage strong and fully interactive multilateral communication between its users in the interactive platform, instead of only a two-way (non-interactive) communication or reactive (quasi-interactive) communication. This means that ideas and information are shared between users to create collaborations and generate user value. In our opinion, besides its role as a Network Administrative Organisation, an IBA should also be more like an ibusiness firm, in order to increase value and collaborations between members in internationalisation processes.

Therefore, besides the communication that can be improved through social network services, which provide tools to support participant communication, such as email, message boards, or chatrooms (Lee, Vogel, & Limayem, 2003), a digital platform should support a much wider communication system to foster collaboration-centred CNs of internationalisation. (Cremona et al., 2014) show that DPs may improve synchronous and asynchronous communication among a network of companies. A chat service, activated for users connected to the digital platform, can enable a synchronous communication between two or more companies. Discussion groups and online forums should also be

used for asynchronous communication and by sharing information in thematic groups or by posting information, insert multimedia objects (images and videos) or attach different types of files.

DP2-C2: restricted areas | Our case study allows us to realise the content for the ideas and information flows to be shared by members of the IBA. The interviewed companies indicate the type of information to support internationalisation that they are willing to share with or that they want from other members in a digital platform:

- Bad experiences in specific foreign markets (e.g. “a specific client does not pay” or “this client or agent already gave me this problem”). Unsurprisingly, the good ones they will not share because they do not want to give information on their good clients and good contacts to others;
- Difficulties and barriers found in specific countries, in order for others to avoid making the same errors;
- Experiences, processes and lessons learned in each market;
- Own detailed data, such as product typology, business sector, commercial contacts, market segments, and countries where they are inserted, to increase the visibility and the possibility of creating more contacts and more collaborations with other members of the IBA;
- Short-term and long-term strategies and visions, to understand if some specific member can be a potential partner for future internationalisation growth and to know the future markets for investment.

To tackle problems of lack of cooperative and collaborative mentalities in companies (confirmed by our interviews), a possible idea could be to join companies and members that have interest in collaborating and sharing this type of experiences and information, by creating private groups or restricted areas in the digital platform. By doing this, only the companies with a real interest in collaborating could have access to that information and could potentiate the information flows among them. Due to the clear differences in terms of processes, services and products between each sub-sector that compose the textile IBA, the interviewees think that it is difficult to share information and experiences about internationalisation with other sub-sectors. Therefore, another digital platform feature could be the establishment of restricted areas for each sub-sector of the IBA, where companies could enter and access information only about their respective sub-sectors.

DP2-C3: personal contact and events | Some interviewees state that the collaboration can happen not only by means of technology but also through more informal and by personal contacts in events, to create a network of people who really want to be part of such collaborative processes. Some suggestions for promoting the sharing of experiences is for the IBA to organise more events, by inviting foreign companies or own members to share a story or an experience in a specific market and then to create potential synergies for collaboration.

DP2-C4: roadmappings | (Lämmer-Gamp, Kergel, & Nerger, 2014) develop a service portfolio for the strategic promotion of cross-sectoral collaboration to support the development of new value chains across industrial sectors. They explain that before reaching the stage of developing projects in collaboration, two types of services are needed: market intelligence services and matchmaking services. Following their recommendations, we suggest a new collaboration feature for the digital platform, for the creation of roadmapping strategies to improve the provision of market intelligence services. We consider here roadmapping as a combination of skills/competence mapping (understand the competences available in the IBA's members) and foresight (future trends, prospective markets and competences needed). The results of a roadmapping can normally contribute for the compilation of information for the market intelligence (Lämmer-Gamp, Köcker et al., 2014) and can certainly have a strong impact on the overall strategy of the IBA, by setting up both a relevant internationalisation and general

future strategy and innovation agenda. Therefore, the role of the IBA here is to moderate, run and publish this roadmapping, in close collaboration with its members and with other partner institutions. Such roadmapping may allow the identification of future inter-sectoral and cross-border cooperation in new areas of internationalisation related to the respective industrial sector. Missing competencies may also be identified, as well as possible partnerships that can bridge the identified gaps.

DP2-C5: digital marketplace - opportunities from external sources | To stimulate more collaboration-centred online social interactions of associate companies, IBAs could also provide more business matchmaking services, facilitated by the creation of new features in the digital platform. The meetings, workshops, trade fairs and trade missions promoted, as well as having a detailed business directory (already mentioned before), can already enable this matchmaking among members. However, our empirical studies and interviews also show that both IBAs and SMEs see a digital platform as a potential tool to provide an updated and diversified offer of foreign market opportunities for both increasing internationalisation and facilitating matchmaking processes. Therefore, this new feature could be a marketplace for the placement of offers and market opportunities, where the IBA is the main responsible to feed with new information this part of the digital platform. Many foreign entities and clients usually contact an IBA, asking for suppliers or distributors within its members. Thus, this information of opportunities from external sources that the IBA receives could be displayed in the digital platform through messages like “the client X is interested in the product or service Y”. Having access to such information, its members could apply and contact other interested parties for pursue a specific opportunity for international expansion. Finally, this feature of the digital platform could also allow users to receive notifications on new information or new opportunities from this marketplace.

5.3. Collective action generative mechanism

In the case of collective action-centred CNs, there is a close coordination between actors, following a common goal and common rules established by the group members. Here, the information shared is not only abstract but also concrete, uncodified and relatively diffused (Spagnoletti et al., 2015). In this section, we present additional interventions for the generative mechanism of collective action:

Design proposition 3: In the context of IBAs seeking to improve internationalisation processes of SMEs with the support of digital platforms (C), by performing different interventions (I_{CA1} to I_{CA5}), following generative mechanisms of collective action (M_{CA}), will help to deliver specific Outcomes (O_{CA1} to O_{CA5}).

C: IBAs seeking to improve internationalisation processes of SMEs with the support of digital platforms

I_{CA1} : Providing advanced communication features;	M_{CA} : Collective action	O_{CA1} : Allow to manage the access to shared resources, together with synchronous and asynchronous communication;
I_{CA2} : Developing collaborative decision-making models and approaches;		O_{CA2} : Facilitate decisions (partner selection, entry mode selection, and foreign market selection) and the management of collective actions in CNs for internationalisation;
I_{CA3} : Including subcontracting services;		O_{CA3} : Allow large companies or international experienced companies to subcontract services from smaller companies or less experienced companies of the IBA, increasing the international activities of SMEs.
I_{CA4} : Allowing members to insert and feed the digital marketplace with information about internationalisation		O_{CA4} : Let other members to apply to those opportunities for increasing their international activities, produce an added value and benefit for both parts interested,

opportunities from their contacts and clients;
I_{CAS}: Including logistics services of warehouse sharing and transportation sharing.

and create an incentive for members to use the digital platform;
O_{CAS}: Allow members to share available storage space in particular warehouses or to share transportation capacities and routes, promoting collaborative advantages in terms of costs and optimisation of resources for a proper international expansion and sharing economy.

DP3-CA1: advanced communication features | For the communication part in collective action activities, besides the other proposed interventions for improving communication presented in the previous sections, here we only adapt the suggestion of (Spagnoletti et al., 2015) for the digital platform to have advanced features that can allow to manage the access to shared resources and to allow both synchronous and asynchronous communication to support the formation and continuous evolution of CNs. As demonstrated by these authors, these communication mechanisms for collective action are relevant to ensure convergence and conveyance.

DP3-CA2: collaborative decision-making | (Spagnoletti et al., 2015) also argue that having advanced communication features in DPs could also support collective decision-making processes. (Costa, Soares et al., 2016) also conclude that the development of collaborative decision-making models and approaches is an important requirement for SMEs to manage collaborations in international strategies, mainly for the selection of partners, entry modes and foreign markets.

DP3-CA3: subcontracting services | To stimulate more collective action-centred online social interactions of associate companies, and based on the suggestions from our case study, the digital platform could have a feature that allows subcontracting services between companies. Depending on the industrial sector, with our interviews with IBAs from different sectors, we understand that in some cases, only a small percentage or only large enterprises have the capacity to successfully internationalise. Thus, in those cases, the given suggestion is to create a feature that could allow a market of buy and sell between companies of the same sector. In addition, it could be done a collection of the capacities of each member to reach the ideal situation of having the needs from large companies, contrasted with the capacity from the small companies. Other interviewees also suggest subcontracting services of external companies, in cases of not finding the right resources within the IBA. Therefore, we are talking here about two types of subcontracting services: (i) between members of the same IBA; or (ii) of external companies.

DP3-CA4: digital marketplace - opportunities from members | The subcontracting services could be easily connected with the marketplace mentioned in the previous section. Very often, in some specific sectors, a member of an IBA receives an order from an international client and has no productive capacity to satisfy the order. In these cases, a company may resort to its competition, independently of the size of the competitor, to meeting the order and to deliver the material or product in time. Therefore, instead of only having internationalisation opportunities from external sources that are inserted by the IBA, concrete opportunities posted by members could also be added to the digital marketplace. This situation can not only foster members to also share information in the digital platform but also increase the sharing of resources and collective actions in internationalisation. With these new findings, we can have two new types of situations:

- “I need X to meet an order or demand of client Y” - a member shares the information and need of a client of interest and does not have the capacity to fulfil its demand alone; at the moment, the member has interest in the client and wants to collaborate with other members;
- “There is a client that needs the material or product X” - a member

shares the information and need of a client but has no interest or capacity to meet the demands of that client; at the moment, the member has no interest in the client and is sharing the opportunity for other members.

In both situations, members and users of the digital platform could feed this part of the marketplace with their own information or with information of opportunities that they receive from external sources. At the end, each member may either insert or apply to specific international business opportunities, which can increase directly or indirectly their international activities and can create a feature of demand and supply of internationalisation services. According to the interviewees, this is the type of information that seems more realistic to share with other members (instead of the previous experiences in markets) because it creates a real need and benefit for both parts interested. This feature could also meet one of the main requirements mentioned by IBAs (Costa et al., 2019) of creating features in a digital platform that can add a real value for the members and that create an incentive for companies to use such tools.

DP3-CA5: logistics sharing services | A few companies and IBAs mention that one of the main difficulties in internationalisation processes is the logistics and transportation of materials and products. A typical problem is related with the lack of warehouses to save materials. Therefore, a feature for logistics services could allow a member to post detailed information about the available space in one of its warehouses that exists in a particular country, such as its location, available storage space, or type of warehouse. Having access to this information in the digital platform, other members could decide to start exporting to a new country using a shared warehouse from another member of the IBA, allowing collective action processes. (Reitmaier, Ou, Tsai, & Sanchez, 2017) also provides scenarios of warehouse sharing in DPs for improving supply chain operations of SMEs, based on a sharing economy.

Another typical logistics problem is related with routes that have empty trucks. Therefore, a member of an IBA could also insert in a digital platform detailed information about a route or transportation, such as information about destinations, transportation modes, delivery frequency, and delivery times. An example can be to share information about a specific route that one of its trucks usually performs without materials or with some space available for transporting other materials. In this case, another member can enter in contact with this company and share transportation modes for matching routes or destinations. All these logistics services could provide clear collaborative advantages in terms of costs and optimisation of resources. The study of (Reitmaier et al., 2017) also provides scenarios of transportation sharing in DPs for improving supply chain operations of SMEs.

6. Evaluation

Due to time and financial constraints, this project did not evaluate the design theory based on the actual implementation of the proposed design propositions and artifact. Instead, the utility of the design propositions was evaluated by interviews with eight experts and IBAs, six in Portugal and two in the UK, as a way to anticipate the actual validation of the artifact and provide some preliminary feedback on the design propositions. The results are presented in Table 6.

In general, the feedback concerning the importance of the proposed interventions was very positive. The interviewees seemed enthusiastic and even surprised by some of the proposed interventions, because some represented ideas they had not yet thought of. The majority were classified as “4 - Very important” and “5 - Extremely important” by the interviewees. There are some cases where the classification was lower (2 and 3), mainly because of particular interventions that do not fit well in certain industrial sectors. For example, DP3-CA3 and DP3-CA4 concern to have subcontracting services inside the IBA. In the case of V4, a classification of “2 - Slightly important” was given to those design

Table 6
Feedback on the design propositions.

Design proposition	Evaluation								Ease of implementation							
	V1	V2	V3	V4	V5	V6	V7	V8	V1	V2	V3	V4	V5	V6	V7	V8
DP1-IS1	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
DP1-IS2	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
DP1-IS3	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
DP1-IS4	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
DP1-IS5	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
DP1-IS6	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
DP1-IS7	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
DP2-C1	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
DP2-C2	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
DP2-C3	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
DP2-C4	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
DP2-C5	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
DP3-CA1	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
DP3-CA2	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
DP3-CA3	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
DP3-CA4	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
DP3-CA5	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****

Level of importance:
 ***** (1 = Not at all important)
 **** (2 = Slightly important)
 *** (3 = Moderately important)
 ** (4 = Very important)
 * (5 = Extremely important)

Ease of implementation:
 ***** (1 = Very difficult)
 **** (2 = Moderately difficult)
 *** (3 = Neither easy nor difficult)
 ** (4 = Moderately easy)
 * (5 = Very easy)

propositions because companies of the particular sector of this IBA tend to not subcontract services to other members or to other external companies.

Regarding the ease of implementation, we were already expecting lower classifications, meaning that some interventions may be difficult to implement by IBAs, mainly considering the actual situation. Nevertheless, evaluating this factor of the implementation was important for us to get a sense from the perspective of potential DPs managers, as well as to help triggering their minds for thinking about new ideas that can meet the internationalisation needs of their members.

7. Discussion

Moving on to the discussion of the design propositions, we can start with the sharing of information by SMEs. In theory, fostering members of an IBA to share information about their experiences in foreign markets could help others in overcoming barriers and learning to avoid making the same errors. But the reality can be different, mostly because of the current panorama. Considering the interviews from our case study and with these new interviews of the evaluation, the conclusion is that, in some cases, SMEs would not have any problem of sharing information in a digital platform, because they are more dynamic companies that are confident on the quality of their products and services and who state that are not afraid of the competition. However, on the other hand, specifically in traditional industrial sectors such as the textile or footwear industry, we still assist a lack of cooperative and collaborative mentalities, with many companies being afraid and reluctant in sharing their information and knowledge with others. Almost everyone state that the main problem is related with the “Portuguese mentality”, where companies tend to see other national companies as their competitors, instead of potential partners to achieve better results in international trade activities. One interviewee stated that business deals are many times lost because companies do not talk to each other.

Accordingly, most of the design propositions that imply SMEs to share their information or experiences in DPs were classified by IBAs as, from one side, being very important but, from other side, of difficult implementation, as they believe that SMEs are still not ready to take this step. Before going to such levels of collaboration and collective action, the mentality of companies has to change and IBAs should make an additional effort to foster information flows and to start with the lower level of promoting the information sharing among members. Chat services, discussion groups and online forums (DP2-IC1), both through social network services and using a digital platform, seems to be a simple first test to achieve that.

The proposed logistics services of warehouse and transportation sharing (DP3-CA5) were some of the interventions that generated more interest from the IBAs. For most of them, these services are very

important because one of the main problems that companies face in their internationalisation is exactly related with logistics and transportation costs. Although aware of the difficulties to their digital implementation (as again it requires SMEs to share their information with others), this is seen as being crucial for the resource and cost optimisation in the SME internationalisation. To stress out that the purpose of the digital platform here is to provide this logistics information to all members and to facilitate the contact and collective actions among them. All the subsequent decisions and negotiations are of the responsibility of each member. Companies sharing information about their specific orders and opportunities (DP3-CA3), warehouse capacities (DP3-CA5), transportation routes and capacities (DP3-CA5) seems more realistic for the interviewees, in comparison with the sharing of information about opportunities for other members (DP3-CA4). The first ones have a direct purpose and impact in the activities of companies, so there are higher probabilities of members to share their information. The latter would be also interesting, but the reality is that companies currently do not act like that, i.e. it is rare to have situations where a member approaches the IBA saying “I have received an opportunity, but it is not for me or I am not interested in it, so you can share this opportunity with other members”. Again, it is a matter of changing minds in companies and showing them the benefits of proceeding like that, in a win-win logic of “if you share opportunities to others, others can also share opportunities for you, and everyone wins”.

Additionally, based on the feedback obtained in this evaluation, some design propositions should be reformulated, and new ones generated. For the interactive directory of members (DP1-IS2), although most agree with an open directory, some interviewees contend that this should be closed, only for the IBA and its members, as some companies do not want to have their information accessible to all. Therefore, we reformulate this design proposition:

DP1-IS2: In the context of IBAs seeking to improve internationalisation processes of SMEs with the support of digital platforms (C), by having an interactive directory of members, with the possibility of being open or closed, with organised and detailed information about each member and each sub-sector (I_{IS2}), following generative mechanisms of information sharing (M_{IS}), will facilitate internal and external matchmaking processes and increase the visibility of each member for stakeholders in international markets (O_{IS2})

For the feature of trade fairs and trade missions in a digital platform (DP1-IS5), there was one IBA that gave two different classifications for this design proposition. The system of online registration to each event is seen as interesting and important (4) and of easy implementation (5). However, the communication component (“allow members to contact with each other”) or having the results of the feedback about each trade fair, open to all other members or available to the public, will have another classification (3;3 respectively). The justification provided was

that, for the first one, the personal contact is preferred by companies and, for the second one, at the maximum it can be general tips for a particular trade fair. Nevertheless, we maintain this design proposition at it is now, as other interviewees showed interest in having such features.

The intervention proposed for DP3-CA1 “Providing advanced communication features” was not clear to all interviewees, as it is a more general intervention. To avoid future misinterpretation, we reformulate this design proposition by specifying examples of what can be advanced tools for communication:

DP3-CA1: In the context of IBAs seeking to improve internationalisation processes of SMEs with the support of digital platforms (C), by providing advanced communication features such as shared calendars, video chats, and shared repositories of concrete and uncoded information (I_{CA1}), following generative mechanisms of collective action (M_{CA}), will allow to manage the access to shared resources, together with synchronous and asynchronous communication (O_{CA1}).

Finally, new design propositions are added, based on the suggestions given in this evaluation. In DP1-IS4 (information management), for the stage of information dissemination and information utilisation, by focusing at one of the main information needs of SMEs from our case study, we suggest providing access to detailed databases of potential agents in each foreign trade country. This specific intervention was also often mentioned in the evaluation. However, this feature is not explicitly enunciated in the description of the intervention for DP1-IS4 “Managing and supporting the whole information lifecycle (information sources, information acquisition, information dissemination, and information utilisation)”. Accordingly, we decided to separate these specific interventions, by proposing the inclusion of different types of databases:

DP1-IS8: In the context of IBAs seeking to improve internationalisation processes of SMEs with the support of digital platforms (C), by having detailed databases of agents, distributors, suppliers and clients (I_{IS8}), following generative mechanisms of information sharing (M_{IS}), will add a real value and create an incentive for accessing the digital platform (O_{IS8}).

A new design proposition is also added to the collective action, which relates to office sharing and flexible workspaces:

DP3-CA6: In the context of IBAs seeking to improve internationalisation processes of SMEs with the support of digital platforms (C), by including services of office sharing and flexible workspaces (I_{CA6}), following generative mechanisms of collective action (M_{CA}), will allow members to share available offices spaces or desks and promote collaborative advantages in terms of costs and optimisation of resources for a proper international expansion and sharing economy (O_{CA6}).

This new design proposition was proposed by one IBA, as many times members contact this IBA to know any available office space or desk in a particular foreign country. This could be useful for SMEs looking for flexible workspaces to internationalise to a certain country, and for meetings with potential clients and agents. Different companies have been created in the market to offer this type of services. Nonetheless, including such services inside the IBA could potentiate synergies among an already established network of companies.

7.1. Contributions to theory and theoretical implications

This research contributes to the design theory of Digital Platforms by putting forward a specialization, for a specific class of problems/opportunities, of the general design propositions found in literature. The goal is the transformation of IBAs in collaborative networks, through the creation and evolution of online communities supported by

Digital Platforms.

Design propositions can bring new design knowledge and can elaborate on reliable design principles on DPs, contributing with propositions translated into tangible and concrete requirements and capabilities, situated in a specific context and empirical setting. The adoption of a sociotechnical perspective can also represent an important theoretical contribution, as we are dealing with a larger sociotechnical ecosystem for studying DPs, composed by the multi-actor setting of IBAs and SMEs, together with their involved social interaction mechanisms. With this approach, we can understand the needs and the requirements of multiple distributed actors with divergent goals in which the digital platform is to be designed.

As suggested by (Dutot et al., 2014) research should seek a deeper understanding of how SMEs develop their IT capabilities based on different internationalization strategies. Adding their business partners' perspective could also be important in better understanding the internationalization strategies of SMEs. Our research contributed to understand more comprehensively the needs in information sharing, collaboration and collective action of networks of SMEs managed by IBAs regarding internationalization and, in more detail, the general design requirements for Digital Platforms structured around those mechanisms.

Finally, our research design contributes for the Design Science Research knowledge, as the artifact represents an improvement (Gregor & Hevner, 2013), and the design propositions try to represent new solutions for known problems of the SME internationalisation.

7.2. Implications for practice

The results of this research can pave the way to a systematic process of deriving specific and detailed design requirements for future digital platform-based information systems for individual IBAs. This process will be based on the data collected, analyzed and structured in design propositions according to the CIMO logic. Fig. 3 shows the general approach in which the results of our research are applied in supporting the requirements engineering process through a DPI design aid derived from the DPI design theory framework. The most relevant advantage of this conceptual (and, eventually, semi-automated tool), is to improve the relevance and precision of the detailed requirements generated by the analysts for this class of DP.

At this point, we can say that the approach depicted in Fig. 3 suggests that it can be generalized to digital platforms with goals other than supporting the internationalisation of SMEs. Contexts involving any kind of a collaborative network of organisations e.g., “regional clusters fostering circular economy” or “innovation networks for social change” will need to develop online communities to achieve their goals, being the digital platform concept and technology the most effective instrument nowadays. These will benefit from this approach as the mechanisms of information sharing, collaboration and collective action are invariant (in our theory) as well as the structure of the CIMO-based design propositions. However, Identifying and structuring the interventions and outcomes is always empirical. Either a new study similar to this one is made, or some kind of lighter approach can eventually be devised.

The design propositions can help IBAs, researchers and practitioners in designing and obtaining more effective collaborative DPs and sociotechnical systems to support the internationalisation needs of SMEs. By effective DPs we mean DPs that support different types of CNs and social interaction mechanisms. The detailed digital platform's features for this particular organizational context can allow platform designers to develop technology to meet the requirements of companies in internationalisation activities.

Regarding the impact on the internationalisation processes, (Dutot et al., 2014) observed that SMEs adopting a more complex form of internationalisation have more developed IT capabilities. By endowing IBAs with the capability to provide advanced IT services to their

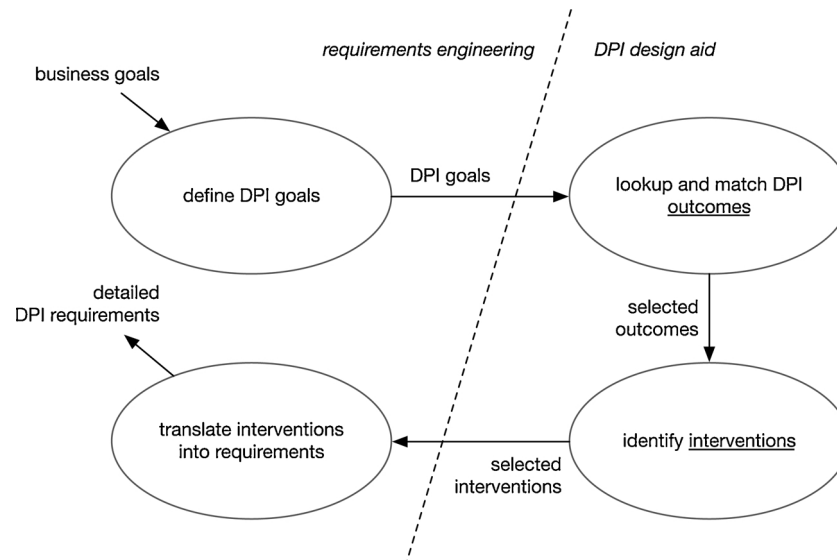


Fig. 3. Application of the Design Theory framework to inform and support a DPI design process.

associated SMEs, more effective internationalisation processes can be put in place both individually and in collaboration. The results from our research contribute to lower the barriers in adopting digital platforms by IBAs, allowing them to develop advanced and effective IT services supporting several modes of internationalisation.

7.3. Limitations and further research

Due to time and financial constraints, this project did not evaluate the design theory based on the actual implementation of the proposed design propositions and artifact, which represents the main limitation of the study.

The current enactment of the design theory framework presents a one-to-one relationship between outcomes and interventions, for a given generative mechanism and context. This is a simplification of reality and a limitation to the analysis. In fact, an outcome can be triggered by a combination of interventions and an intervention can trigger several outcomes. Further research will be needed to expand the design theory framework towards full relationship types.

Due to differences in terms of resources, capacities and size that may exist in the universe of IBAs, some proposed interventions may not be applied or may be very difficult to implement by some of those organizations. However, our contribution here was to explore and present different kinds of interventions that may require more basic or more complex resources. Then, it is up to each IBA to use the knowledge generated in this study according to their strategy and capabilities.

The methodological approach used in this research is qualitative, which can normally imply some additional difficulties in generalising the findings. Although we consider we have a good sample of interviewed companies for a qualitative research, we are also aware that further developments of this work may also require research in a more quantitative basis, as a way to complement the obtained qualitative insights.

Future research opportunities exist in advancing design theories on DPs for this specific context of internationalisation, or in developing new theories for new specific organisational contexts. More applied and practical research using the CIMO-logic could be developed, in order to further strengthen the role of this method in the current literature. Finally, future research could also be developed by translating our design propositions into specific requirements to validate the design propositions, and to develop and implement DPs in practice.

8. Conclusion

Following a DSR approach, new design principles and a new artifact were proposed and evaluated in this study, in the form of design propositions. The CIMO-logic proved to be a useful framework for presenting and structuring this artifact. Three general design propositions, together with the associated interventions and mechanisms, were proposed for the context of IBAs to improve SME internationalisation with DPs, to produce particular outcomes. These design propositions were developed by balancing existing theoretical knowledge on DPs, IBAs, CNs and internationalisation of SMEs, with new empirical knowledge obtained with several exploratory studies and one single case study. In total, 25 IBAs and 19 companies from Portugal, UK, and France, were interviewed for this study.

The utility of the design propositions was also evaluated by eight Portuguese and British IBAs from different industrial sectors. Results showed that most of the design propositions can bring a potential impact to the internationalisation support activities of IBAs. New design propositions were also added with this feedback process, and minor changes in the final design propositions were made.

Due to time and financial constraints, this project did not evaluate the design theory based on the actual implementation of the proposed design propositions and artifact, which represents the main limitation of the study. Further research will be needed to expand the design theory framework towards full relationship types, by a combination of interventions that can trigger multiple outcomes. In addition, an evaluation of the actual impact of the implementation of the design propositions in practice will also be needed in further developments of this study.

Acknowledgements

This research was funded by the Portuguese funding agency, Fundação para a Ciência e a Tecnologia (FCT), through the Ph.D. Studentship SFRH/BD/110131/2015. It was also supported by the Project “TEC4Growth - Pervasive Intelligence, Enhancers and Proofs of Concept with IndustrialImpact/NORTE-01-0145-FEDER-000020” financed by the North Portugal Regional Operational Programme (NORTE 2020), under the PORTUGAL 2020 Partnership Agreement, and through the European Regional Development Fund (ERDF).

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.ijinfomgt.2020.102070>.

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