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Design-intensive start-ups: A new application field for design thinking?

ABSTRACT

This article analyses a new phenomenon that has until now been poorly researched both in entrepreneurial and design-related literature, namely start-ups that focus on design as the primary source for their development (i.e. design-intensive start-ups, or DIS).

Two main questions underpin the study, which is explorative in nature. Firstly, how do DIS differ from new technology start-ups (NTS) in terms of critical dimensions for development? And secondly, do DIS use design in a specific way?

A multiple case studies protocol was adopted to investigate these two questions. Results show that DIS not only differ from NTS with respect to several core dimensions, but they also differ in terms of overall new venture creation logic. The theoretical and practical implications of these findings for design thinking studies are discussed.

INTRODUCTION

Since the end of 1990s, the topic of entrepreneurship has animated the agenda of managers, policymakers and economists (Scott and Venkataraman, 2000). The increasing ease of access to different 'nets' – for instance, logistics, crowd-funding, distributed manufacturing technology, and information networks supported by the Internet and social media – has recently enabled more fertile conditions to promote and support different forms of entrepreneurship.

Technology plays a relevant role in prompting, supporting and moulding novel products and services in the creation of entrepreneurial activities. Specifically, Park (2005, pp. 740–41) identified a new technology start-up (NTS) to be a 'firm that uses or invests in rapidly emerging or evolving technology as a key part of its product development, production or marketing strategy'.

Despite the heterogeneous nature of entrepreneurship literature, some key concepts in the domain of start-ups can be fruitfully applied to NTS. Valid concepts for NTS include 'scalability', the protection of technology-driven competitive advantage through patent, the 'lean' form and the 'minimum viable product' approach, venture capital-based funding models, the founders mix composition (usually where a mix of management and technology profiles are suggested) and business model evolution; these are largely recalled in consistent frameworks and proposed through 'handbooks' (cf. Roberts, 1991; Baum and Silverman, 2004; Ries, 2011; Blank and Dorf, 2012). In these start-ups, design remains an ancillary asset to technology, where it mainly represents a lever aimed at facilitating and optimizing technology use in order to maximize new technology diffusion (Eisenman, 2013).

On the other hand, some scholars have recently highlighted how design can be leveraged in the creation of new ventures and innovative forms of entrepreneurship (cf. Hargadon, 2005; Bianchini and Maffei, 2012; Bettiol and Micelli, 2014). Recent studies (Design Intech, 2016;) report how Fortune's 'Unicorn List' (the ranking of start-ups valued at $1 billion or more) recognizes the presence of the designer in the founding team as a valued asset.

Nevertheless, start-ups where the relationship between design and technology is overturned (i.e. where design is a major asset) still constitute a neglected research stream in both design and entrepreneurship fields. To address and increase an understanding of the specific traits of these new ventures, we performed an explorative study of what we recognized as 'design-intensive start-ups' (DIS).

By framing design as a strategic means of affecting the user experience (Forlizzi and Ford, 2000), attaching new cultural messages to products/services (Ravasi and Rindova, 2008; Rindova, Dalpiaz and Ravasi, 2011) and creating radical new meanings related to current sociocultural models (Verganti, 2008; 2009), we developed a case study analysis using qualitative research (Miles, Huberman and Saldana, 2013). We selected five start-ups using a skimming process conducted on the Italian Register of Start-ups, launched in 2012. Interviews were recorded and transcribed, before some peculiar constructs of DIS were identified and frozen through a snowballing reiterative process (Miles, Huberman and Saldana, 2013).

The article shows how DIS, in contrast to NTS, seldom use patent policies to protect new technologies, do not pursue global scalability, admit different forms of ties with social capital, do not employ industry-specific business models, and are guided by founders mostly inspired by strong intrinsic motivation and passion. These findings are discussed within both the theoretical and practitioner-based framework of design thinking (DT).

On the one hand, our contribution adds a novel perspective to DT literature, which is typically utilized to foster innovation and to apply new organizational logic to existing companies. This article indeed tends to stretch and clarify new boundaries of DT, adding scope and theoretical references to open a fruitful research strand in which DT overlaps with entrepreneurial studies. Moreover, the article clarifies how both NTS and DIS leverage two different reasoning patterns in DT.

On the other hand, from a practical perspective, the article pinpoints an alternative mode for conducting and developing entrepreneurship, showing that typical design-thinking toolkits should incorporate new creativity tools which address opportunities for designers to create their own ventures.

METHODS

Research design

In order to define and investigate the nature of this new form of entrepreneurship, we performed an explorative study consisting of multiple case studies analysis (Eisenhardt, 1989). We used an inductive method based on the examination of five case studies to develop new constructs of how DIS emerge and consolidate. This choice was a consequence of missing literature references about these kind of ventures, both in the entrepreneurial and design fields, which meant we were unable to find strong theoretical foundations on this specific topic on which to base our study.

By using multiple-case research, each case either reinforced or disconfirmed the preliminary insights drawn from its predecessor, enabling us to identify characterizing constructs about DIS that could be common to many cases. This allowed us to develop a more robust definition of our theory (Santos and Eisenhardt, 2009).

Our research consisted of four activities: (1) interviews with prominent scholars; (2) case study collection and selection; (3) data collection; and (4) data analysis. The combined result of this was new constructs about DIS properties.

QUESTIONNAIRES WITH SCHOLARS

The first research activity consisted of interviews with prominent scholars in the field of entrepreneurship, design and innovation management, and was aimed at identifying first-hand relevant issues related to DIS to be further investigated by the case study analysis. We invited eleven international scholars to partake in interviews, of which eight accepted. We involved scholars from several different geographical regions (Australia, Denmark, Italy, the United Kingdom and the United States) and research fields (design, entrepreneurship and innovation management) in order to assess the boundaries, main features and relevance of this phenomenon from an open perspective.

Interviews were performed by means of online questionnaires composed of five open questions. Questions were addressed to confirm (or disconfirm) the existence of the DIS phenomenon, and to obtain insight into first-hand differences between a technology push and design-intensive entrepreneurship. From this first activity, two main results emerged.

The first result concerns a general agreement among prominent scholars on the existence of new forms of entrepreneurship that differ from the one most investigated in existing literature (i.e. NTS). The second result was a set of relevant issues/properties/problematic areas that constitute DIS, and which should be further investigated to highlight the differences and peculiarities of

the DIS entrepreneurial model in relation to tech-based start-ups. This set of issues included: the motivation for the start-up's foundation; personal stories related to the business; the presence of a founder team; idea inspiration, genesis and evolution; the business model construction logic; sources of value; and user-engagement models. These insights were used as underpinning knowledge in the subsequent steps of our study.

CASE STUDY COLLECTION AND SELECTION

The second activity consisted of collecting and selecting five case studies to be used as primary sources in our inductive research process. We decided to extrapolate our cases from an official and well-structured database of start-ups – the Italian Start-up Register. This register, launched in 2012 includes all the start-ups that meet a number of criteria set by the Italian government to define and officialise Italian (mainly tech-based) start-ups.

Our reasons for choosing this database are twofold. Firstly, the Register contained many data related to the listed start-ups, which helped us to select the ones that best fit our study. Secondly, it provided us with a large set of ventures all over Italy, which allowed us to avoid the risk of focusing on well-known cases.

In order to identify the cases we would analyse in depth, we ran an initial skimming activity, applying the following selection criteria:

1. Survival. We discarded start-ups founded later than 2011 because we were interested in analysing ventures that could be considered robust enough to overcome the first three years of activity.
2. Information richness. We discarded start-ups lacking a website, because this would impede access to secondary sources useful for our study.

As a result of this skimming activity, the initial panel of 2,622 potential start-ups was reduced to 211. For the second selection activity, we focused on the start-ups' relevance to our topic of interest, i.e. their relation to design. In order to be deemed design-related, each start-up had to possess at least two of the following three features:

1. At least one of the start-up's founders is a designer, architect or artist.
2. A user-centred approach is easily recognizable in the start-up's purpose (be it a product or a service).
3. Attention is paid towards aesthetic and/or experiential aspects, both on the website and in the company's purpose.

Following this second step, 38 design-related start-ups were selected, which could be considered a suitable number of cases for our subsequent analysis. However, in order to reduce the number of cases further, we selected those start-ups that addressed different markets (e.g. business to consumer [B2C], business to business [B2B], and business to government [B2G]), that delivered different design 'artefacts' (from pure product to pure service) and that contemporarily offered the greatest range of information. This was achieved through initial desk research performed on each of them.

On the basis of these last three criteria, we were able to select the following five start-ups: Milan Farming (B2C, product/service), Municipality 3.0 (B2G; service), Immersive Events (B2B, service), Safe Mooring (B2B; product) and Infant Tracking (B2C/B2B; product).[1]

DATA COLLECTION

In order to analyse the selected start-ups in depth, we performed two data-collection activities based on both primary and secondary sources: website and press article content analysis; and interviews with the start-ups' founders.

The first activity consisted of a content analysis of the start-ups' official websites (primary sources) and press articles about the start-ups, collected via a web search based on keywords (secondary sources). This exploration was useful in obtaining a preliminary understanding of the start-ups' features, activities and history, which helped us to better structure and perform the subsequent interviews.

The second activity consisted of interviewing the founders of each start-up. These interviews were performed to confirm the data collected by the first analysis, and to fill any identifiable gaps, for instance the ones related to the motivations of the founders or the idea generation path.

Interviews

We performed semi-structured interviews with the founders of the five selected start-ups. The interview structure consisted of seven areas: (1) their motivations and personal stories; (2) the founding team; (3) idea generation and development; (4) sources of value; (5) user-engagement models; (6) business model features; and (7) idea diffusion and networking. Each area was explored by one or two open questions. Questions were intentionally kept open-ended and explorative, as they were aimed at generating discussion around the identified topics.

The interviews were performed by four researchers, who were mixed according to their different backgrounds (i.e. architecture/design, sociology and management) to create pairs of interviewers with diverse yet complementary points of view. The interviews ranged from one hour to 90 minutes in length. We recorded them, took notes to highlight the emerging issues, and subsequently transcribed the records.

Case study descriptions

The data collection resulted in a deep understanding of the five selected start-ups, whose main features are reported in Table 1. A short description of each case study follows.

Milan Farming is an online marketplace for organic and fresh food from local farmers. They select the best farmers, and connect them directly with consumers through their website and home delivery service. Their products are always seasonal as they come directly from the nearest producers. Their aim is to build a sustainable network for the delivery of fresh food.

Municipality 3.0 designed and developed a web-based tool and management platform that helps citizens and municipalities work together to resolve urban problems. Citizens report issues from their smartphones or personal computers, which enables municipality employees to resolve problems faster and better.

Immersive Events creates three-dimensional, highly persuasive visual content suitable for all types of non-conventional communication. Thanks to continuous testing of new digital languages, it responds to the growing demand for advanced creativity from the market, and meets companies' visibility and promotional needs through artistic experimentation.

	Milan Farming	Municipality 3.0	Immersive events	Safe Mooring	Infant tracking
Founding Team	Telecommunication expert, Engineer	IT engineer UX designer	Team of designers/ artists	Team of engineer, accountant, and manager	Engineer and designer
Domain	Vegetable and fruit home delivery	Municipality-citizens relationship	Multi-media events	Yacht and boat equipment	Body data monitoring
Initial Funding	VC	Self-funded + small regional funding	Self-funded + small European funding	Self-funded	Self-funded
Location	Milan	Monte San Pietro (BO)	Bologna	Milan	Monza
Year of foundation	2011	2011	2010	2011	2010
Internal informants	CEO/founder	CEO/founder Designer	CEO/founder PR/founder	CEO/founder General manager/ founder	CEO/founder

Safe Mooring designs, manufactures and develops the ultimate in mooring equipment. Their first product – a stopper fairlead – was purposefully conceived for owners and captains of both sailing and powered super yachts. The company's primary aim is to redesign mooring operations to make them safer.

Infant Tracking designs and produces a wearable biomedical system for infant monitoring. Sensors are built inside children's clothing, thereby helping them to stay in the right position, and making them safe and easy to use. Their core product is for monitoring premature babies, but other products have been designed (e.g. sportswear).

DATA ANALYSIS

The collected data were analysed following the grounded theory method (Strauss and Corbin, 1997). First, we performed an in-depth analysis of data from the interviews, websites and press articles. Each researcher read the cases independently, highlighting 'conceptual blocks' that represented a start-up's traits clashing with the typical traits of NTS identified in the dominant literature (McGrath and MacMillan, 2000; Ries, 2011; Blank and Dorf, 2012). To be considered relevant, conceptual blocks had to be present in more than one case. The researchers discussed their findings in a focus group aimed at connecting and grouping blocks into more general and higher constructs. These were subsequently labelled 'design approach', 'entrepreneurial motivation', 'business model development', and so on.

After identifying nine high-level constructs embodying differences between DIS and NTS, we visually summarized the results using a matrix. This matrix associated cases and constructs; in other words, we described how each construct manifested in each case. While filling out the matrix, we

realized that some cells were ambiguous or blurred due to lack of data. This required us to go back to the informants in order to clarify the information we had collected.

At the end of the analysis activity, five constructs were assessed as suitably relevant and robust. We feel they clearly represent the properties of DIS, and clearly diverge from those of NTS that are predominant in the domain's consolidated literature. The five main constructs are described in the following section, highlighting the most significant quotes that helped in their identification.

RESULTS

Design as a transformative agent

The first construct resulting from the analysis is related to the use of design. Design is largely identified as a discipline with a deeply transformative role, aimed at enhancing or radically changing the user's experience. In conceiving new products and services, designers are employed to 'reframe' the problem (Dorst, 2011), change product meaning and purchasing 'reason-why' (Verganti, 2011), and to attach new cultural messages and symbolic value to products/ services (Ravasi and Rindova, 2008).

Moreover, design penetrates business activities and approaches, building a stream of practice and literature labelled as 'design thinking'. Here, design is conceived as a process that reframes and challenges problematic situations through divergent and convergent reasoning to improve current solutions (Beckman and Barry, 2007; Brown, 2008; Dorst, 2011).

The key concept of 'reframing' an existing situation and attempting to transform the user experience is recognized as the basis of the analysed case studies. In fact, the role of design in reframing and transforming a problem into a new and satisfying user experience is exemplified by the Municipality 3.0 case study. Municipality 3.0 conceived a software-based application that allowed citizens to flag urban problems, enabling the municipality's employees to follow easy protocols to fix them. According to the CEO:

> We overturned the citizen-municipality relationship. Since Facebook was born, some municipalities opened their virtual walls, but they mostly received complaints and not so reliable messages. With Municipality 3.0, the institution receives specific alerts from an identified citizen, activates an internal checking procedure and starts a solving process with the identification of a supervisor. In other words, we support municipalities to offer a satisfying service to citizens.

Another good example of this reframing is Milan Farming, which transformed a routine, low-efficiency process – supermarket shopping – into an e-shopping experience centred on 'zero kilometre' products. In doing so, the company emphasizes the freshness and seasonality of food, and the environmental sustainability of the process. To do this, they leveraged the vegetables and fruits available in the agricultural surrounding to the south of Milan, designing a delivery system which takes care of all the service aspects: the visual image, the delivery process, the packaging and the payment system

(based on a monthly or yearly subscription). Their experience-centred view of design is expressed by the words of the CEO:

> [Milan Farming] takes care of the entire shopping experience: the product is the core of the offer, but also the service component is very important. By service, we mean both the digital component (website and online selling) and the tangible component (packaging, product delivery, waste disposal process). Milan Farming thus deals with both the sell-in and sell-out, with the aim of maximizing the consumer experience. We want our customers to perceive the whole process as an efficient one, which avoids any feeling of waste […]. I have a holistic idea of design, which is connected to the whole user experience, not only to single details such as the logo, or the button on our website user interface.

In a similar vein, Safe Mooring reframed the mooring experience by reducing the potential dangers related to its operation. Their reasoning was based on the fact that although sailing tourism is growing, young crew members do not have the same sailing capabilities as old sailors. Their design approach therefore consisted of transforming cockpit operations during mooring so that this activity is perceived to be safer and routine (i.e. without creating anxiety and concerns in the often inexperienced crew). According to the words of the CEO, the use of design can be expressed as follows:

> Our bet is innovating a sector which has a high propensity for conservation by technology, design and security. Indeed, with a distant remote control, now you can manage and overcome situations that so far were managed by high sailors' skills that today are disappearing. […] The levers of our product are safety and simplicity […]. The product simplifies the operation and consequently makes it safer. On the one hand, it adds the possibility to free the moorings from a distance. Therefore, a single person can set everything, go to the helm with the motors on, free the ropes and leave. This is much appreciated by captains, who otherwise would be forced to hire a guy only to get on, free the ropes, do nothing until they arrive to [sic] the new port and do the operation again. On the other hand, it is safer because when you have to take the moorings, you don't have a tightened rope in your hands.

In short, the five start-ups we analysed used design to 'reframe' a situation around the user, thus discovering a set of 'meaning-based needs' (Beckman and Barry, 2007). In conceiving their business space, these start-ups do not codify product meanings, cultural messages and symbolic values according to existing industry players. Instead, they propose products and service meanings/messages that change the user experience to satisfy a need, a desire, to 'get a job done'.

Intrinsic entrepreneurial motivation

Another construct that strongly emerged from our analysis of the start-ups is related to entrepreneurial motivation. Different studies of entrepreneurship dedicate great attention to the personal traits of the entrepreneur (cf. Gnyawali and Fogel, 1994; Miner, Smith and Bracker, 1994; Shane, Locke and Collins, 2003; Segal, Borgia and Schoenfeld, 2005; Wadhwa et al., 2009).

Concepts such as 'need for achievement', 'risk-taking', 'tolerance for ambiguity', 'locus of control', 'goal-setting' and 'independence' recur in different studies where personal traits have been related to entrepreneurial success.

While this is generally valid in entrepreneurship, we saw something different with entrepreneurs in design; this is related to the designers' tendency to interpret the world through their own personal experiences, and to introduce something aligned to their personal experience, credo and values (Durgee, 2006; Bianchini and Maffei, 2012). A strong intrinsic motivation based on personal experience guides designers to create their own venture (i.e. to solve a problem experienced by them), or to change the unsatisfying traits of a consumption experience so that it matches their own set of values.

The creation of a new venture centred on intrinsic motivation is evident in the words of Safe Mooring CEO:

> We are three friends that share a passion for navigation and sailing. At 50 years old, we have the wish to initiate something new. We asked ourselves 'what to do' and the first idea has been centred on what we like. We tried to be focused on motorboats because two of us have a professional experience in navigation. Moreover, for several years we have been sailors for other people, and we know how difficult and dangerous is when mooring, where damages happen and the people's safety is undermined. We know how much the competence and navigation capabilities decreased during [the] last years […]. Consequently, the security issue has become a priority in navigation and sailing.

In a different way – but sharing the same intent to radically change actual situations that provide frustration and disappointment – the founders of Municipality 3.0 started to think about their new venture while personally and routinely experiencing a dissatisfaction in their region:

> I was at home during Christmas, and my father tried to flag to the municipality some road problems: a broken street lamp, a broken dumpster, the ice outside our home. He tried to flag this through all the available channels: by phone, by email, and also some personal relationships. [Despite] the numerous and repeated warnings, my father did not receive any answer. At that point, it was clear to me the communication flaw in the relationship between citizen and municipality: on one hand, we have a sentinel citizen in the region, on the other hand, we have a municipality that avoids informing about the received information.

The genesis of Infant Tracking also started from a personal resolution. One of the founders had personal involvement with premature infants and attempted to remedy a hospital's shortcomings by conceiving a new product:

> One of our co-founders had a family textile company that specialized in the ideation and production of garments for kids. Her cousin had two premature twins, so she developed […] clothes for those infants. The hospital head physician contacted me, putting me in contact with her because he knew I handled tracking sensor technology. He said to me:, 'It's time you meet this person because you handle sensor technology and she produces garments for kids […] the matching could solve different problems for premature infants'.

In brief, personal experience, passion and intrinsic motivation seem to represent the fundamental ingredients that steer the creation of a DIS entrepreneurial experience.

SOCIOCULTURAL NARRATIVE IN BUSINESS MODELS

Another construct that emerged from the case analysis relates to business model development logic (Osterwalder and Pigneur, 2010). In classical business literature, business models are moulded by competitive forces and industry logic (Osterwalder and Pigneur, 2010; Amit and Zott, 2012). For instance, in developing a business model, a new software producer in the Web 2.0 domain has to consider the features of the technology itself as well as the structural features of the IT infrastructure (O'Reilly, 2007), with constraints and opportunities derived from the business ecosystem. However, this logic appears to be radically different for DIS.

Design is traditionally interpreted as specific sociocultural trends (i.e. 'design discourses') formed from diffuse tendencies shaped by media, artists, retailers, technologists, manufacturers, sociologists and marketers who attribute specific meanings to certain artefacts (Verganti, 2008; 2009). Thus, 'design-driven innovation' is not the solipsistic act of a single designer; on the contrary, new products – and the new meanings they promote – are the result of an interactive process that involves social and cultural forces (Geels, 2004). According to Krippendorff (2006), the meaning of an artefact is determined by the narratives in which it appears as soon as it enters the conversation of stakeholders, bystanders, critics and users. For this reason, such meanings primarily depend on context and culture (Verganti and Öberg, 2013). The same artefact may invoke different meanings at different times and in different contexts, and in each case be perceived differently by each person.

In this vein, the business model for DIS is not formed within a specific business ecosystem, although there is a progressive alignment between the business model and the social discourses that arise from a precise context (Battistella, Biotto and De Toni, 2012).

In this respect, the interview of the CEO of Milan Farming seems to be emblematic:

> We were at the height of the green economy boom launched by Obama, Expo 2015 was just assigned to Milan, and in 2008 there was a sort of 'down-shifting' in different industries that provided a review of distributive models. In a nutshell, there were different suggestions, different, changing drivers from the demand side, and a clear offering gap. […] Our price has to be fair for us, for our user, but also for our producer: for the large supermarket chains, the goal is to narrate themselves and create customer loyalty, the same is also the case with a private labelling policy. Contrarily, we want to create value with the stories of every single farmer, creating a strong relationship between farmer and final user. In our offering, product and consumer are at the core, we just provide 'direction'.

Beyond the interactive aspects of a business model, the choice to leverage local agricultures, their 'zero kilometre' product philosophy, the selling of only seasonal and organic products, and the overcoming of past distributive and logistical patterns constitute a cultural proposition that gives a specific voice to local discourse surrounding the food industry.

The concept of adapting a business model to the habits and cultural behaviours of local forces is also apparent in Immersive Events. The CEO provided evidence of avoiding interactivity in Italy:

> For example, we do not offer interactive experience. Nobody in Italy wants it, nobody uses it, nobody makes it. […] In USA, they do it […] with Kinect; you can find all the interactivity you wish [but] not in Italy. In Italy, the interactivity is not cool for the recreational activity the producer aims to create. The maximum interactivity we can do consists of designing an interaction with a controller.

DIS business models seem to not only utilize business logic, but also tie into social and local cultural forces. As mentioned earlier, these models apparently contain a narrative power that propels new cultural frames, which in turn spread new consumptions and use values.

LEVERAGING SOCIAL AND LOCAL CAPITAL PERMANENTLY

The emerging fourth construct that characterizes design-intensive entrepreneurship – and one directly connected to the previous one – deals with leveraging social and local capital. Several studies have shown the relevance of social capital to entrepreneurship (cf. Westlund and Bolton, 2003; Kim and Aldrich, 2005). Social capital is usually employed in NTS as a temporary market in which to experiment and test new technology during the early developmental phases. After these early phases, NTS usually aims at scaling up by seeking areas of the global network where the possibility for growth is larger.

In DIS, employing the logic of social and local capital appears to be more permanent, and follows several different avenues. Specifically, social capital is employed as a form of offering, as a key provider that is difficult to replace during the growth process, and as a communication vehicle to narrate the new cultural meanings associated with the product or service.

According to the CEO of Safe Mooring, it is easy to ascertain social capital's logic as a key provider:

> Identifying the production company happened fast. Probably our past experience of work in the north of Italy, with the foundries in Brescia, helped us. It takes a second... you search on the Internet and you can find four foundries. You ask to visit them on Saturday and you've found the company to work with. It's fundamental that the designer is close to the assembler and the producer in order to clarify doubts. So, we contracted a foundry very close to the designer.

Conversely, the case of Milan Farming shows that DIS employ aspects of social capital which offer 'soul' and core values:

> A fundamental aspect to guarantee the quality of our offering consists of the farmer selection (rigorously at a local level) and the presentation of their offering on our website. We want to help farmers to narrate themselves and their product in order to create the strongest relationship between producer and final user, increasing the latter consciousness: the zucchini we deliver is not an ordinary zucchini, but it's a product

identified with a precise farmer, with a name, a story, a productive pattern. When we created Milan Farming, one of our goals consisted of impacting the territory beyond our direct profitability. The stories of our affiliates demonstrate that.

In the case of Immersive Events, social capital constitutes a critical part of the offering. This start-up provides an immersive experience through the mapping of historical buildings, which represent a diffuse resource of the Italian cultural heritage. Without historical buildings and the local cultural heritage, this DIS could not exist.

CONTEXT-DEPENDENT COMPETITIVENESS

Unlike new technology, design creates new meaning from new user experiences (Levin, Cohen and Mowery, 1985; Teece, 1986; Lerner, 1994); as such, it cannot really be protected by patents. Moreover, because product-service meanings may be exposed to rapidly changing sociocultural trends (e.g. fads), design is unlikely to be a source of sustainable competitive advantages for companies and ventures.

For this reason, rather than leveraging the protection of a regulatory system that preserves the exploitation of new products, design-oriented strategies continuously challenge existing paradigms about product meaning, as well as its relationship with the context and stakeholders (Krippendorff, 2006; Verganti, 2009; Cross, 2011; Dorst, 2011).

As a result, the continuous approach to experimentation in DIS often goes beyond exploitative logics. The words of the founder of Infant Tracking clearly explain the protection mechanism adopted by design entrepreneurs:

In order to be protected from imitation, we can use patents. However, another strategy consists in staying a step ahead of the others. When we launch a product on the marketplace, it's because we already have the second release ready to be launched and we are developing the third one.

A similar view is shared by the CEOs of Municipality 3.0 and Safe Mooring:

At this moment, we are working on the fourth website release and the third app release. We are committed to renewing the graphics, to improve the user experience on both sides – the citizen and the municipality employee – at least once yearly. The operational part, instead, is changed at a constant pace, at a functional and layout level. For instance, to assign a request to a colleague today, you have just to drag the colleague icon on that request and he'll receive the email. Then we introduced the possibility to invite an external stakeholder to collaborate on the problem-solving, the possibility to create statistics and automated reports for municipality management.

(Founder of Municipality 3.0)

To be protected from imitation we have a drawer full of ideas that we'll work on, and our catalogue will pass from one to three products in four to five years […]. We like that this company is going to become a leader in the mooring operation domain that has been stagnant for 50 years.

(Founder of Safe Mooring)

DIS seem to overcome their lack of resources by focusing managerial attention on design innovation trajectories and stretching their scope, rather than on looking for international legal protection. The words of the CEO of Infant Tracking confirm this concept beyond question:

> The underpinning problem is about how to protect a patent that is very expensive for a nascent company. If you start to run and you increase the gap with competitors, or you design a niche market that is too small to be served by leaders and big companies, you can gain a certain competitive advantage.

DISCUSSION

The empirical evidence from the five case studies demarcate five conceptual constructs:

1. Design use: the degree to which design shapes and affects the creation and development of a new start-up (Hargadon, 2005; Design Intech, 2016).
2. Entrepreneurial motivations: the purposes that drive founder(s) in creating the new venture (Gnyawali and Fogel, 1994; Segal, Borgia and Schoenfeld, 2005; Carsrud and Brännback, 2011).
3. Business model development: the process that leads to the definition of the mechanisms by which the start-up appropriates value (Osterwalder and Pigneur, 2010; Zott and Amit, 2010).
4. Value network creation: the process by which the new ventures search, identify, select and interact with the social capital and local stakeholders (Bourdieu, 1997; Peppard and Rylander, 2006).
5. Competitiveness: the mechanism that the new venture adopts to grow, scale and renovate an advantage over competitors (Gloor, 2005; McGrath, 2013).

For each of these constructs, DIS show some peculiarities that are distinctive from the corresponding characteristics of NTS.

In DIS, design is applied as a transformative agent; it can perform a problem-reframing process aimed at finding and conveying new meanings and cultural messages related to the firm, thereby changing the customer's overall experience. In other words, a new or improved solution is proposed to users, a different script in the consumption process is promoted, and a solution in the sociocultural context is affirmed to transform the overall customer experience (cf. Beckman and Barry, 2007; Desmet and Hekkert, 2007; Ravasi and Rindova, 2008; Verganti, 2009; Dorst, 2011; Rindova, Dalpiaz and Ravasi, 2011). This stands in contrast with the use of design in NTS, in which companies root their competitive advantage in technological novelty, usually expressed in the form of new functions or performance improvements. In this setting, design (when applied) is conceived as an interpreter able to 'translate' technological novelty into something that the user can understand and accept. As a matter of fact, rather than being the problem-reframing agent, design is a lever to increase the likelihood of market success of a supposedly superior technology (Eisenman, 2013).

In DIS, entrepreneurial motivation is largely intrinsic: it based on the internal purpose of the entrepreneur, and on his/her personal experience and priorities. Any assessment of market opportunity therefore lies in the

background, being the value of reframing a problematic situation to make it more relevant. Motivations appear to differ from those that emerged in our literature research as typical of NTS. NTS entrepreneurs are said to exploit new technologies that address opportunities based mainly on market evaluations (McGrath and MacMillan, 2000; Park, 2005). Motivations are therefore described as mostly extrinsic and driven by external purposes. In other words, while DIS entrepreneurs are mostly driven by personal intent to change close or well-known situations, NTS entrepreneurs tend to build a start-up as way to exploit their proper knowledge and/or experience along with external opportunities (McGrath and MacMillan, 2000; Park, 2005).

Moreover, DIS business model development is employed as a vehicle to narrate new emerging sociocultural solicitations. Conversely, NTS business models are defined through a search of the 'best fit' with the technology features and eventually with the structure of the industry (O'Reilly, 2007; Zott and Amit, 2010). The new technology often suggests its own exploitation logic, and provides the direction in which to change the current business ecosystem or to build an entirely new one.

DIS social capital and local value networks are considered a permanent source of value for the development of new ventures. In different forms – as a form of offering, as key provider or as part of the narrative – DIS inextricably link local stakeholders and territorial forms of capital to the venture structure. Again, this greatly differs from NTS seen in our literature review, where technology characteristics largely dictate the preferred mode for determining partners. After the very early initial phase, technology entrepreneurs usually search for global partnerships to scale-up their new venture. While social and local capital play a limited role in NTS – being an initial platform to pilot and test a new product eventually intended for the global market (Blank and Dorf, 2012) – social and local capital in DIS represent a permanent asset to sustain the entire business life.

Finally, competitiveness is achieved by continuously engaging the firm's customers and other relevant stakeholders, nurturing a social discourse about the product meaning and replicating successful traits in new contexts. Competitive advantage appears transient in nature (in some cases, the start-up may be seen as a transient organization). In NTS, technology is usually conceived as a source of stable and sustainable competitive advantage. Therefore, in this type of start-up, all efforts are devoted to protect the intellectual property related to the new technology (through patenting policies) and to exploit technology-based innovation (through scalability) to the maximum possible extent.

Table 2 summarizes the main characteristics of DIS and highlights the ways in which it most notably differs from NTS.

The differences between DIS and NTS can be further analysed by referring to the two forms of productive thinking applied in DT (Dorst, 2011).

As anticipated, NTS often uses design; however, the essence and nature of design in NTS and DIS differs. The core principles of DT – reframing a problem and challenging a paradigmatic frame – can be referred to a specific form of reasoning known as 'abduction', which differs from deduction and induction patterns (Dorst, 2011). In abduction, hypotheses are advanced through rule of thumb, delineating reality based on experience, past errors and moving away from consolidated truths.

NTS and DIS seem to follow two different abduction logics. Here, they are represented as Abduction 1 and Abduction 2 (Dorst, 2011).

Construct	Design-intensive start-up DIS	New-technology start-up NTS
Design use	User experience transformative agent	Technological novelty translation agent
Entrepreneurial motivation	Mostly intrinsic motivations based on inner purposes/personal experience	Mostly extrinsic motivations based on external opportunities
Business model development	Socio-cultural response Narrative for new values and meanings	Industry fitting Technology dependent
Value network creation	Social capital guided engagement	Global search guided engagement
Competitiveness	Transient Replicability based	IP protection based Scalability based

In Abduction 1, both the final 'value' created and how this is achieved are known. What is unknown is the 'what' – an object, a service, a system – that will deliver the value aimed for when applying the chosen working principle. NTS creation seems to resemble the Abduction 1 thinking process, where both the value and the working principle are known, but what needs to be defined is the 'what' (i.e. the final solution). When both technology and the operating principles are known, entrepreneurs can use designers to operatively embed the new technology into a new application (i.e. the 'what').

Conversely, our empirical evidence suggests DIS creation resembles the Abduction 2 reasoning pattern. Here the challenge is '[…] to figure out "what" to create, while there is no known or chosen "working principle" that we can trust to lead to the aspired value. That means that we have to create a "working principle" and a "thing" (object, service, system) in parallel' (Dorst, 2011, p. 524). Indeed, the creation of the new venture begins with founders that are interested in reframing a given (problematic) situation. To do so, they do not possess or control any technological innovation. They therefore apply design reasoning to develop both a solution and a working principle that are mutually suited to reach the intended value.

This difference has implications both on a theoretical and practical level. From a theoretical viewpoint, DIS represent a new field of investigation for both design and entrepreneurship scholars. In particular, the DIS phenomenon can add a novel perspective to DT studies by broadening the current boundaries and application field from existing firms to hypothetical ones.

In a recent article, Carlgren, Rauth and Elmquist (2016) propose an interesting framing of the concept of DT, resulting from a study of six large organizations who claim to use DT in various ways. The five themes identified by these authors – namely user focus, problem framing, visualization, experimentation and diversity – remain valid for DIS, as do the majority of practices and techniques that are linked to each theme (Carlgren, Rauth and Elmquist, 2016). Nevertheless, it is also evident that, from a DIS perspective, this framework seems to be too narrow. Indeed, it takes for granted that DT is applied within existing organizations, with all their rules, conventions and constraints. In other words, here the designer is interpreted as a transformative agent in a well-structured context. In our view, it is pertinent to increase the empirical understanding of how DT is practiced by a designer-entrepreneur intent on creating a new venture. In this case, everything needs to be defined from scratch. Searching for DT in entrepreneurship will enrich the design field by

creating new conceptual frames to explain new applications of design and new entrepreneurial development patterns. Indeed, from a practical perspective, DIS represent an alternative entrepreneurial model, which is not yet supported by the information channel nor entrepreneurial infrastructures such as incubators, policies and tools.

The practical implication derived from this study consists of including DIS as a specific reference in the entrepreneurial ecosystem. Admitting the existence of different models of growth, competitiveness, ways to engage social capitals, entrepreneurial motivations and business model development involves recognizing that DIS require new approaches, services and tools to make them survive and grow.

Furthermore, the constructs which have emerged from the present study constitute a conceptual platform for the development of creative tools useful in guiding the conceptualization of DIS. These constructs can inspire designers-entrepreneurs to think about their intrinsic motivation and personal experience, the local social capital and any relevant emerging trends, which can feed DT processes aimed at conceptualizing a novel venture.

All of the above-mentioned theoretical and practical challenges represent a fertile ground for future research, confirming a need to update DT's theoretical lens and methodological framework.

CONCLUSION

Start-up creation is a growing phenomenon, with an undisputed relevance to and impact on economic development. Both scholars and practitioners are devoting an increasing amount of attention to understanding how new ventures can be promoted and supported. Accordingly, a large academic literature has flourished, and a huge set of entrepreneurial policies and practices has been established. However, all such efforts tend to share a common view of start-ups that relies upon the assumption that new technologies are the most important engine of successful new ventures. NTS have clearly become the dominant stereotype to rule the academic scene, as well as the fields of finance and politics. However, in recent years, the flourishing of different species of start-ups has started to challenge the dominance of NTS, as their traits and peculiarities do not easily reconcile with the characteristics of NTS. A broadening of both the academic body of literature, and the tools and practices aimed at sustaining new venture creation, is thus required to account for the specific needs of a radically new species of entrepreneurs.

By highlighting the peculiarities of start-ups centred on design as an overall approach to address human needs and desires, this study represents a first attempt towards such broadening, both in terms of DT and entrepreneurial studies.

Nevertheless, this study is explorative in nature and not immune to limitations. First, the limited number of case studies impacts the extension of the results to other DIS.

Furthermore, the way of framing design has been centred on a specific stream of design literature; encompassing other design perspectives could either cut off or embrace other venture categories. Lastly, the national-based sampling could have biased the constructs. New research avenues could enlarge the sampling by searching for data in different economic or national systems, thus embracing additional frames of design.

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