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Design Capabilities for the Pursuit of Innovation in an Academic Environment

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The design capabilities of dynamic teams pursuing innovation in an academic context

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Design research is moving beyond the study of industry based practices and towards the stewardship of design-led innovation for business development and economic growth. To this end, it is now required to evidence the benefits it creates. To examine these notions further this paper presents an approach for design-led innovation within an academic context. The authors build on the concept of design capabilities to develop a framework of evaluation that provides a platform for which the impact and value of design to industry and the formation of diverse teams can be critically discussed. Furthermore, this study contributes to the burgeoning cognisance of design capabilities as a means to understand value, by indicating potential pathways towards yet further application of design research in the industry context. It closes with reflections and reveals how lessons from this study can contribute to future of university-industry partnership working.

Keywords: Design in Action; Design Capabilities; Knowledge Exchange; University-Industry Partnership

Introduction

The relationship between higher-level research institutions and industry are undergoing a period of transformation, and the Knowledge Exchange Hub Design in Action (DiA)¹ is both

¹ Design in Action (DiA) was a £5m Arts and Humanities Research Council (AHRC), Knowledge Exchange Hub for the Creative Economy. The project was also awarded £400k from Creative Scotland to support small and medium enterprises to utilize design as a strategy for innovation, within and beyond the creative economy.



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reflective and an active part of this change. The shifting backdrop is a landscape of new complex demands and challenges for higher-level education institutions, where impact is now deemed critical to the success of research. In the UK, this is evidenced by the recently published Dowling Review (2015), which has outlined the government's role in fostering further business-university research collaborations, namely, to provide academia with the groundwork to allow for wider impact for research, allow companies to enhance organizational activity through new technologies and processes, and further the capabilities of businesses and de-risk research investment.

This relationship between design-led business development and the academic environment is often thought of as a beneficial pairing in itself, and as such, is of growing attention to institutions across the world (e.g. d.school, USA; Business & Design Lab, Sweden; PolyU Design, Hong Kong). New challenges are revealed in this circumstance as the juxtaposition between long term planning in academic research and emergent and spontaneous nature of small businesses and entrepreneurship, are some of many elements that demonstrate the complicated relationship between these endeavours. It has been argued that design research is uniquely placed to tend to the complexities and exploit the potential of interdisciplinary knowledge exchange within a university environment (Davis, 2008). However, the capture and analysis of these new hybrid models of research and practice with a high industry impact agendas presents an ongoing challenge for academia. In this context, research is moving beyond the capture and analysis of industry based practices and towards the facilitation of design-led innovation for business development and economic growth, and it is now a requirement to evidence the benefits it creates, both in regards to tangible and intangible value. Responding to this contextual shift, and ever expanding challenges, this paper seeks to consider the following research question:

RQ: Taking a holistic approach and with attention to the academic context and a process of design-led innovation: How do those from diverse backgrounds (academics, designers, businesses, entrepreneurs, NGOs, policy makers and wild cards) form teams and which design capabilities are evident as they mobilize innovative ideas?

To examine these notions further, this paper presents the DiA approach for design-led innovation within an academic context and the authors apply the concept of design capabilities to investigate the role of design in the process and delivering project outcomes. Using a case study methodology, a design capabilities framework is employed as a means to analyze the activities and impact from the DiA project. This includes an evaluation role of design in both the formation of design-led businesses and the wider design advocacy programme led by the project.

Explicating Design Capabilities

Design capabilities are gaining ground in scholarship surrounding areas of design leadership in enterprise performance. It follows a rise in the specific use of design to address the indeterminate nature of decision-making and problem-solving in management, which has been described as a "paradigm of design as general capability" (Cooper & Junginger, 2011). Evolving alongside the transformations in design, the concept of design capabilities was initially employed to describe the leadership activities of a business (Jevnaker, 2000) but has since expanded to tend to the complex nature of

organizations and systems, as it can be used to study design at multiple levels within systems and between organizations and the wider environment (Mortati, Villari & Maffei, 2014). Further to this, some use the concept of design capabilities as a method for analyzing the value of design in systems extending from production innovation (Fernandez-Mesa, Alegre Vidal, Chiva & Gutierrez-Gracia, 2013), or as a means to investigate the absorption of design in SMEs (Acklin, 2013), and even as a way to uncover design in public sector services (Malmberg & Wetter-Edman, 2016).

The etymology of design capability rooted in the strategic management concept “dynamic capability”, which describes an organization’s capacity to develop, embed, and adapt in highly transformative contexts (Teece, Pisano & Shuen, 1997). Furthermore, dynamic capabilities are important in entrepreneurial activities within businesses that equip organizations with the tools, processes, and systems to scope and adapt for sustainable growth and high performance (Eisenhardt & Martin, 2000; Teece, 2007). Dynamic capabilities share components with theories in management strategy, i.e. resource-based view and minimizing competitive threats (Teece, et al., 1997). Taking a resource-based view, Eisenhardt and Martin (2000) describe dynamic capabilities through the categorization of key characteristics within successful businesses. These characteristics include the processes for innovative product development, strategic planning and action, and enhance existing resources to develop and sustain competitive advantage (Ibid.). Indeed, this may be achieved by using this concept as a way to understand the needs of stakeholders and clients.

Dynamic capabilities within organizations assist in the effective identification and reaction to the external industrial environments and shape those environments through innovation and leading market change (Teece, 2007; Teece & Pisano, 1994). Much of the rhetoric around dynamic capabilities has resonance with the emerging landscape of design management and has been noted in several studies which aim to develop ideas on design capabilities (Malmberg & Wetter-Edman, 2016; Mortati et al., 2014; Acklin, 2013; Fernández-Mesa et al., 2013; Jevnaker, 2000).

Building on the notion of dynamic capabilities, design capabilities are also perceived to support competitive advantage and form flexible and effective organizational practices (Acklin, 2013). Furthermore, it has been argued that design capabilities are important to achieve innovation and should be embedded in the overall learning capacity of an organization (Fernández-Mesa, et al., 2013). Acklin (2013) contends that where a resource-based view of an organization examines assets, processes, information, a design capability framework can extend further to illustrate the sustained competitive advantage of the business.

Furthermore, Mortati et al. (2014) state that the main obstacles in measuring the value of design are: the lack of frameworks for the capture and analysis of design capabilities in a business; the lack of appropriate metrics which would demonstrate design’s impact on organizational performance; and, the ability to translate an appropriate metric system into an approach for measuring design as an intellectual capital. They assert that design capabilities can capture the skills, capacities and resources of a business, in addition to demonstrating the outcomes of knowledge exchange between human resources and intellectual capital (Ibid.).

Jevnaker (2000) sought to explore the strategic use of design capabilities as an approach to design advocacy and describing the leadership activities that design has in wider value

creation. From this research, they develop a framework of six-themes to illustrate the leadership actions which describe these organizational design capabilities [Table 1].

Table 1 Actions Underlying Design Capabilities (Jevnaker, 2000).

Organizing Design Capability	Leadership Action Involved
Design resourcing	Starting-up design or development initiatives. Accessing best suitable design and business expertise. Resourcing money, time, projects, and facilities without detrimental overload of capacity.
Design combinative capability	Configuring design resources. Tapping and connecting to firm-specific resources, strategic assets, or otherwise distinctive resources. Creating interaction of design resources and the firm's core competent people.
Design learning capability	Communicating design with ethos repeatedly to multiple stakeholders. Exposing and testing design within a reciprocal and acknowledged design relationship. Inaugurating design experiences to key stakeholders. Debriefing design building memory.
Design innovation capability	Adopting new knowledge and ideas. Fostering creative design developments. Nurturing open exchange and taking advantage of creative abrasion.
Design-strategic capability	Providing a strategic focus while allowing out-of-the box discovery. Anchoring design developments in business and strategy and strategists. Implementing strategy stretch.
Design advantage-protecting capability	Protecting new design designs by patents, licensing, and pattern protection. Capturing design-based value and sharing risks through legal agreements, royalties and relational contracting. Sustaining design capabilities through design alliancing, R&D partnering.

The Design Management Absorption Model (DMAM), which describes the capacity of a SME with little previous design experience to absorb design knowledge into the business, also denotes a distinction between design management and design leadership capabilities (Acklin, 2013). Through the process and the socialization of design knowledge, design

leadership capabilities, which acquire and assimilate design knowledge, are a precursor to those more affiliated to design management capabilities, which transform and exploit design knowledge. This has great significance in this study, as in this context there is a similar delineation of capabilities through the DiA process. To further understand the importance of design capabilities in the design-led process of innovation in an academic context, this paper presents a case study of DiA and the research approach to building and evaluating this case study is discussed below.

Research Approach

This paper seeks to understand the value of design in the development of new businesses by examining the design capabilities that underpin the innovation process. Using the existing literature and existing frameworks on the design capabilities, the activities of DiA are evaluated through a longitudinal case study methodology (Bryman & Bell, 2007).

The case study format is selected not for methodological preference but as the object of focus, what is being studied takes precedence, it is a study about ‘both the process of learning about the case and the product of our learning’ (Stake, 1998, p. 87). Therefore, it is proposed that case study methodology in this context is a way of creating a strategic research process, one which is able to define and achieve the aim of this study: namely, the presentation of new knowledge in the design-led innovation of business within an academic environment. Crucial to this research is the notion that only case study can adequately attend to the complexities of undertaking research in design, in that it enables a holistic view, and allows the interlaced relationship between them to be captured and analyzed.

Methods

The collection of data in this research is reflective of the diverse nature of the project. The mixed-methods applied in this study include; surveys with participants of DiA events, semi-structured interviews with individuals who led on successful businesses, document analysis of funded business proposals, and the interim and final business reports. In addition, the DiA process model was developed through a co-design approach incorporating the perspectives of both the operations and research teams of DiA. Analysis of this data was considered in relation to the research question and positioned in the design capabilities framework. Table 2 provides an overview of the methods, participants, data collection tools, and frameworks for analysis in the study.

Table 2. Research Methods

Methods	Participants	Data Collection	Analysis
Post-ideation event surveys	Ideation events participants (n=124)	Sales Force survey software	Theming using DC framework (Jevnaker, 2000) and DMAM (Acklin, 2013)
End of project survey	DiA participants from across all events (n=46)	Sales Force survey software	Theming using DC framework (Jevnaker, 2000) and DMAM (Acklin, 2013)

Semi-structured interviews	Individuals with DiA funded businesses (n=4)	Interview transcripts	Theming using DC framework (Jevnaker, 2000) and DMAM (Acklin, 2013)
Document analysis	Business proposals, interim business reports, final business reports	Project archives	Theming using DC framework (Jevnaker, 2000) and DMAM (Acklin, 2013)

Case Study: Design in Action (DiA)

DiA was a knowledge exchange hub that brought together the arts, technology and business communities to work with academia around common themes or problems. Initially based out of six Scottish universities, DiA grew an expansive network of businesses, academics, designers, and creatives who wanted to make new connections and find new pathways for exploration and innovation.

The priority was to bring innovation capacity to Scottish SMEs, as it forms 99% of the country's businesses. DiA was a research project, with the research occurring in real-time. It examined the process of business formation, the diverse requirements of each one, support mechanisms and the issues that require action for sustainable businesses to emerge.

For DiA, knowledge exchange was a crucial component in the design-led innovation process. DiA initially delivered its activities across five sectors (food, sport, rural economies, ICT and health and wellbeing) because the government recognized these areas as having high growth potential. However, due to externally commissioned partnerships and contracts, the project widened its focus to include legal services, digital imaging crypto-currencies and the circular economy.

This unique opportunity for knowledge exchange highlights the commercial potential for design in the Scottish economy and also the relevance of design-led business innovation, and capitalizing and amplifying academic research in the humanities, in a variety of sectors where it might not be immediately associated.

Chiasma and teams in the pursuit of innovation

Chiasma was the term used to describe a method of ideation and collaborative innovation engineered and coordinated by DiA. In science, "chiasma" refers to a biological term meaning the overlap of two chromatids in the process of meiosis. DiA appropriated the term to describe ideas meeting at the point of creation and used it as the title for the ideation events the project produced. The approach endeavoured small groups of individuals from different walks of life, to solve complex problems by generating new ideas and business models in a fast-pace, design-led environment. Some of the ideas were funded to take the concepts to prototype and business formation stage. The chiasma events were simultaneously creative and focused to catalyze the design process by bringing together the right mix of participant skills, interests and experience. The resultant

new companies and developments have led to new near-to-market products and provided valuable insights into how design can assist businesses from their genesis.

During the chiasma events, participants from a variety of backgrounds form teams (ideally of five people, or less, including at least one professional designer) to create ideas around a specific sectoral problem. Through specifically created design-led innovative techniques, devised by the academic team leading the research, the teams combined their knowledge and skills over the course of the event to create a commercially-viable ideas that were then presented to an expert panel on the final day. The intellectual property that was generated and demonstrated in the final presentation was then held centrally at the DiA hub for the protection of all participants (further discussion in findings section below).

Six-weeks after ideation, all participants had the opportunity to apply for up to £20k grant funding which secured them the exclusive rights to further explore the commercial viability of the idea and generate a prototype. All applications were considered by the DiA grant funding panel who decided which teams are funded to business formation stage and received additional support on securing patents, design, consultancy, testing, materials, and additional time costs along the way. One of the benefits of being a DiA member is that any idea resulting during chiasma that was not awarded Grant Funding could eventually be accessible for development by the wider DiA network.

Design in Action Key Performance Indicators

Throughout the project, DiA involved over 630 businesses in its programme of; seminars, workshops, annual design summits and fifteen residential Chiasma. These events lead to the formation of 17 design-led businesses, with a collective turnover in excess of £3 million, and with a total of 76 new jobs created.

Table 3. Design in Action Key Performance Indicators

Operational
5172 organisations and individuals engaged with Design in Action
3762 attendees at 25 Design in Action events
633 SME's attended Design in Action events
300 Ideation event participants from business, academia and design
14 Ideation events
£318,937 of DiA grant funding approved for projects
£672,400 of partnership funding/support raised by DiA for the projects
Post-Operational
17 funded projects, with 13 (76%) predicted to launch
£1,121,000 of additional funding raised by the projects
£3,068,000 annual turnover of the funded businesses (2015)
£3.44 leveraged by the businesses for every £1 invested by DiA (+70%)
113 products, processes and services developed
113 jobs created (81 by the funded projects and 32 at Design in Action)
7 trademarks; 2 RSE Fellowships; 1 patent filed
Research
£11,616,207 of additional research grants and funding awarded
101 research papers, publications and conference presentations
298 Arts & Humanities researchers engaged with DiA

However, the activities of DiA did not always result in direct or immediate commercial benefits. It was recognized that the project supported various constructs of knowledge exchange between many different groups of individuals. The benefits of which may only come to fruition in the long-term and could include economic and societal impacts over varying timescales. Some of this was captured through the collection of key performance indicators (KPIs) gathered by the project over the course of four-years [Table 3]. However, a need to understand the role of design in the process led to an exploration in the wider DiA process, including an examination of the approach for developing the ideation events and the subsequent support in the formation of the businesses.

Design in Action Knowledge Exchange Process Model for Innovation

Over the course of the research project, DiA developed a way to communicate how knowledge exchange is critical to a design-led innovation process. In design, models are often used to explain the use and application of design to its context (e.g. Design Council's Double Diamond, IDEA Design Thinking Process Model and the Danish Design Centre's Design Ladder). The Design in Action Knowledge Exchange Process Model explores the different forms of knowledge exchange and whether the instance requires internal or external engagement and participation (Woods, Marra & Coulson, 2015).

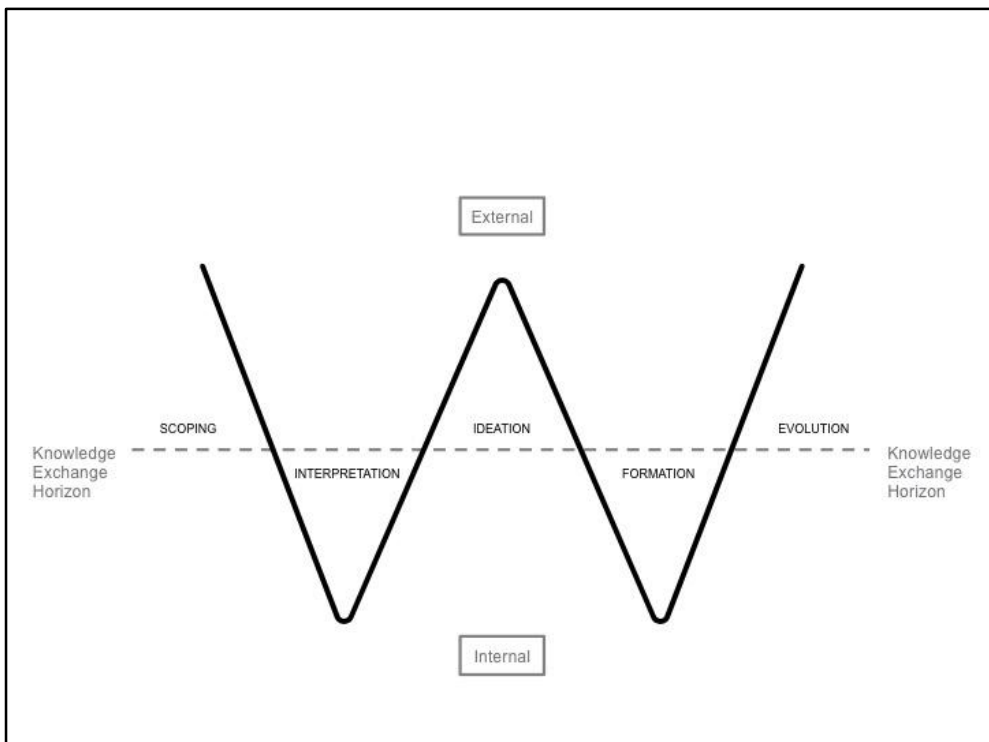


Figure 1 *Design in Action Knowledge Exchange Process Model. This model illustrates Design in Action's role in facilitating and supporting design-led innovation. It does this by*

demonstrating the full, staged, process of business development delivered in an academic context.

The Design in Action Knowledge Exchange Process Model [Figure 1] illustrates five stages of design-led innovation, brought about by processes of external and internal participation. The boundary between these different modes of knowledge exchange is represented by the “knowledge exchange horizon” line. Above the horizon are the activities mediated through, broadly, processes of external engagement with an open uptake of individuals from the arts, business and technology sectors. Below the horizon are the internal activities which mobilize innovation through curated teams, and selected individuals who contribute additional knowledge and expertise. The model demonstrates that team formation crosses back and forth across the horizon, to maximise the potential of these varying, but crucial, forms of knowledge exchange.

The phases of the design-led innovation process, are defined through the areas of knowledge exchange. Each phase has been identified by the Design in Action team as varying and important stages in understanding the process.

Scoping - Discover

This stage is one centralized on participation which aims at identifying critical challenges and the key stakeholders that may contribute to near future innovation opportunities in specific sectors. More than a traditional review, scoping is an active and open process of discovery using methods of co-operative inquiry (Heron & Reason, 2008) to collectively question and position the gaps in the sector.

Participants include; academics, businesses, communities, non-governmental organizations and government.

Interpretation - Framing

Driven by academics and peer reviewed by invited external experts, this is the stage where material gathered on the sector is synthesized with existing literature. The aim is to define three to four key challenge areas for an industry sector and support a narrative for the innovation call to prospective participants for the ideation event. This stage includes the creation of appropriate design methods and tools to support ideation with potential participants and identifies a more extensive network of potential participants to ensure that certain skills and knowledge are brought to the ideation phase.

Participants include; research team, academics and industry experts.

Ideation – Concept Generating

Ideation begins with a sector call for applicants for the ideation event (Chiasma), which frames the event through three to four key challenge areas for an industry sector and supports a narrative for future innovation possibilities. Here, design as strategy for business development underpins the process which facilitates and supports ideation. The event enables collaboration between the assorted group of participants and leverages knowledge exchange to for the inception of novel business ideas.

Participants include; designers, entrepreneurs, businesses, academics, and wild cards.

Formation – Business Modelling, Prototyping

Ideas are brought forth from the ideation phase, and teams move into a stage of research and development to form a business model that meets, or creates, a need and tends to an innovation challenge. Teams work within an internal network, with information coming from selected experts as facilitated by business support staff based with the academic

environment. It is a stage driven by design-led prototyping, feedback, and refinement to prepare the product or service for market through funding and design expertise.

Participants include; business teams, designers, academics, external experts and prospective users.

Evolution – Market Feedback

The final stage of the DiA process is the launch of the product or service into the market, this public introduction allows the business to evolve. The business does so by evaluating targets and gathering insight on general success and from customers to evolve and move forward. The new business does this independently, but still receives support on critical business issues from the DiA hub. Businesses are also further involved through mentoring and showcasing opportunities delivered by the hub.

Participation is wide open.

The DiA process model enabled a way to articulate a wider approach to supporting innovation within an academic environment. However, there was still a need to develop further understanding on the various design capabilities that existed in the process. Therefore, the following discussion engages both the DiA process model and the design capabilities framework, using the data gathered through the mixed methods approach to discover where and what capabilities are evident in the innovation process, and the teams that enabled these capabilities.

Discussion: design capabilities in the DiA process

DiA developed a process of design-led innovation between arts, technology and business, by creating platforms to overcome cultural and infrastructural silos that were thought to restrict business development. This was achieved in a number of ways. Firstly, it engaged the specific sectors through a scoping process; listening to the challenges and issues which were stifling progress and development and responding by creating tools and approaches to overcome these barriers. It developed a process that considered the holistic needs of design in every aspect of delivery, including the design of the physical spaces for ideation, bringing in the right stimulus from key speakers and advisors, building scaffolds for co-creation with specifically developed methods and tools. It provided a programme and educational and engagement activities that advocated for design practices and articulated and advanced design knowledge and use, to help develop insights into the opportunity offered by strategically building design into core business processes. It built the confidence in the academy to support the SME sector and advance their opportunities, by providing access to knowledge, introducing SMEs to experts in support of their ideas, helping teams make the transition from idea into a viable and sustainable business.

Through the analysis of the data collected throughout the project, this study examined the role of design capabilities in the DiA process and considered how these capabilities might change as the phases and the groups involved and adapted to the needs of the process.

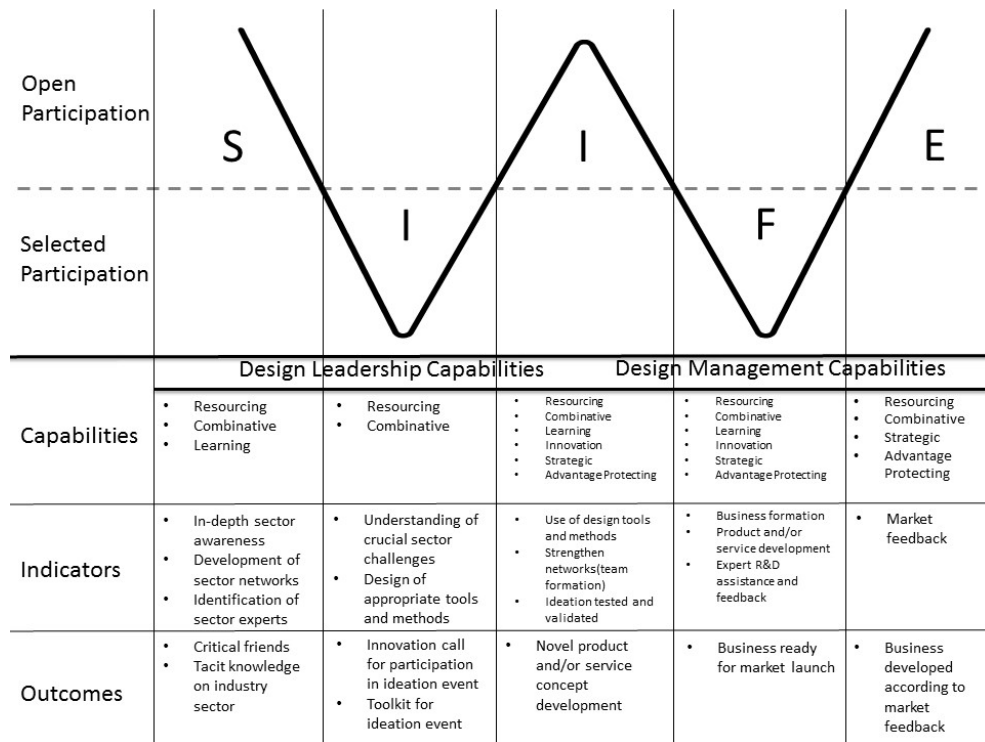


Figure 2 Design in Action Knowledge Exchange Process Model: design capabilities, indicators, and outcomes. A visual representation of the design capabilities that exist throughout the design-led innovation process.

As can be seen in Figure 2, differing design capabilities are more evident in certain phases than others. Similar to the Design Management Absorption Model (Ackin, 2013) design leadership capabilities; such as resourcing, combinative, and learning were more evident in the early stages of the innovation process. Phases which required high levels of design capabilities existing in the ideation and formation phases of the innovation process. Furthermore, there is an interesting relationship between who is involved in each phase and which design capabilities were required to mobilize the process. Scoping and interpretation were primarily led by the DiA academic research team, and they also led on the ideation phase and Chiasma events. During the ideation phase the teams that were formed at the event became the drivers of innovation and concept development. These teams received business support during the formation and evolution phases from the DiA operations team and external experts. Although there was interest from the DiA academic staff to assist more of the later phases of development, they often did not have much contact with the teams during this time.

In addition, although many design capabilities exist across the DiA process, the indicators and outcomes of these activities facilitated by knowledge exchange and design capabilities varied. In some instances the demands on certain design capabilities were higher than others. The capabilities that came through in each stage are discussed below.

Scoping

The in-depth sector awareness that was required during the scoping phase demanded appropriate resources for facilitating and harnessing the outcomes of knowledge

exchange (Coulson & Woods, 2016). Therefore, the teams that were leading on scoping had to access and connect with specific resources. This was both research and human-resource based, i.e. the identification and building a network of sector experts which can collaborate to identify the gaps and opportunities for innovation. As much of scoping is done with experts from various backgrounds, many did not have a previous understanding of design, and DiA advocated and educated these participants in the enabling multifaceted value of design.

Interpretation

Interpretation seeks for the best and most suitable expertise to feed into the development of sector understanding, and to help form and articulate the critical challenges that were used for the call for the ideation events. This is also the phase when the teams developed the tools for successful innovation in the subsequent ideation phase. For this, the appropriate resources were sought and pulled together from various subject areas and sector experts. This included the methods developed that combined existing design methods and other areas of research. For instance, DiA developed a Likert scale method, an approach from psychology, but tailored it so it became a collective activity and a way to share opinions and preferences around a certain theme or topic.

Ideation

For the ideation phase (Chiasma), the DiA team held responsibility for creating the appropriate scaffolds to stimulate idea generation. There was also much preparation done in terms of bringing the right skills and knowledge into the room, and the DiA team took a lot of time and care in selecting the right participants for the ideation events. As one participant noted:

It's one of the main opportunities of chiasma to be put together with people from those different perspectives and coming up with an idea together. Starting collectively...and coming up with it together. You get the chance to meet someone who has a problem and you figure it out. It's really rare to get that opportunity (Chiasma Participant, Funded project).

Furthermore, the ideation phase was as much about advocating design as it was about initiating new products and services. The intent was to build on the pre-existing knowledge and skills brought in by the participants and form a common platform with design. The methods and tools, and other activities such as presentations and talks from renowned individuals were embedded into these events to educate people about the value of design.

It made me realize how design runs through the business, not just in branding but also business models/strategies (Chiasma Participant, Survey).

Design as strategy was a core concept at the forefront of this learning agenda. This was in part due to the lack of common understanding of design in this role. However, the activities supported teams in thinking about how design can be built into the business from the very early start of idea generation.

The lean start-up approach and the design process are not incompatible, but it takes hard work for them to be complimentary. Bringing the design process into start-up will ultimately lead to better user experience and therefore better business (Chiasma Participant, Survey)

Design capability of advantage protecting, which is the preservation of new ideas, was embedded into the DiA process from the beginning of the ideation phase. As DiA was founded on a knowledge exchange innovation model, questions were raised early in the project regarding intellectual property in collaborative settings. Therefore, the project developed a concept for intellectual property called the “IP Shelter” which allowed DiA to address and incentivise collaborative practices and build a framework of working in this highly collaborative area [Figure 3].

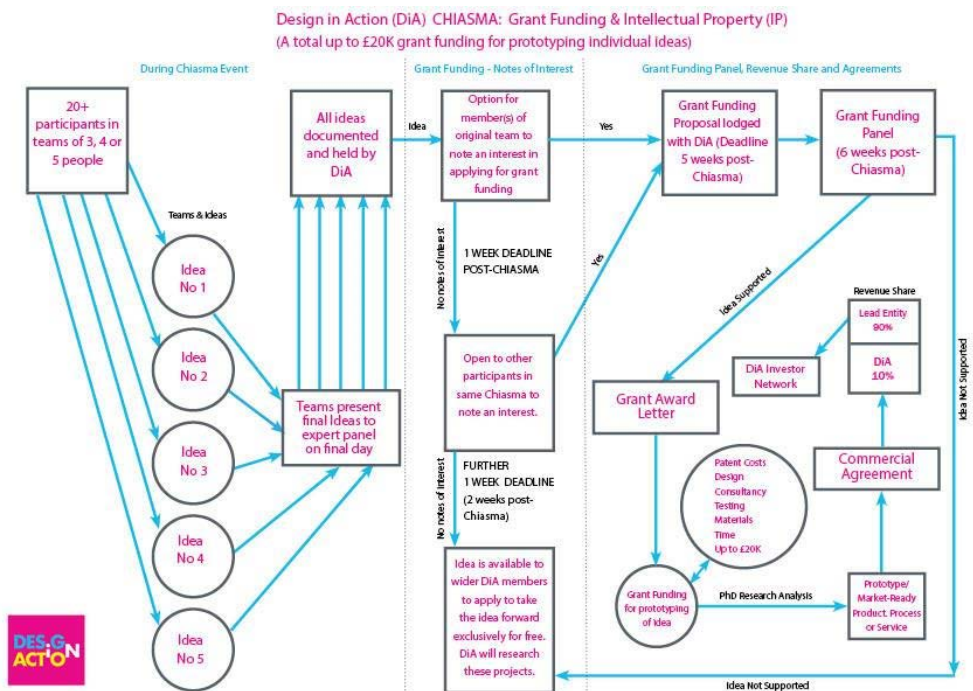


Figure 3 Design in Action IP Shelter

This was created within the specific needs of the project and the IP Shelter provides a framework for an approach to protecting innovation in co-creation and co-design. It allows for ideas to be shared freely amongst teams. It signifies way that academic institutions can develop pathways for building ‘safe-spaces’ for knowledge exchange and platforms for initial ideas to be test and verified without putting potentially profitable IP at risk.

Formation

Design as resourcing capability within the formation phase is of high importance. The DiA Hub supported the teams in developing the concept into a tangible product, service, and business. The DiA operations team at the Hub worked with the innovation teams to access best suitable business expertise, and find the resources (i.e. money, time, and facilities) for the teams, without overburdening them.

It's been an iterative process because you don't quite know where things are going to go and what it's going to look like at the end. You're moving forward without knowing exactly how you're going to get to that end result and there are big blanks, which could be difficult for someone who isn't familiar with design process. The iterative process is the key in design. A lot of projects or new product developments fail because that process hasn't been followed. You need to bring in all different elements – engineering, market priming – that come together for one proposition and because design is multi-faceted, it enables that (Chiasma participant, funded project).

The above quote not only touches upon a resourcing capability, but also the design combinative capability through the many forms that design is used. Again, this is a crucial part of advocating the scope and possibilities of design-led innovation in the project. For many it was the first time they discovered, and indeed used, design in this way.

Up until that point I hadn't done anything involving design and now everything is all about that completely. If you get it right, it can add a ton of value to what you're doing and it separates you from your competitors. It adds to the experience and adds real value (Chiasma participant, funded project).

The IP Shelter, discussed above continued to provide support in the formation of the businesses, and the operations team sought out further support and advice in this area for the burgeoning businesses during this phase.

Evolution

Once the new business launched into market, there was a continued relationship between the teams and the DiA Hub. This continued support focused on effective use and development from the feedback that was gathered from initial market review. Moreover, the IP Shelter assisted new businesses in maintaining their USP once the product was out in the public sphere.

Limitations and further research

DiA did not set out to discover the nuances in the design capabilities, or understand those different requirements, which were more evident in some phases of the innovation process over others. Therefore, the methods for data capture and evaluation of the full scope of process delivery focused heavily on the ideation events and the formation of the businesses. This is noted in the strong qualitative evidence given in this study to the phases of ideation and formation. Data gathered on scoping and interpretation was collected through systematic document analysis in the project archives, but further research into the application of this process would build a more robust system for the collection of information and evaluation in the earlier stages.

Concluding Remarks

The role of support within an academic institution for the development of new businesses is a new and unexplored area. This paper addresses the rising interest in the diversification

of academic institutions activities, with noted hubs that form relationships between the university and the third party organizations from industry.

Further to this, the research specifically examines the role of design capabilities in team formation and the mobilization of innovative business models, and products and services. Although this paper is focussed on the innovation pipeline driven from within an academic institution, the work is also applicable to team capabilities and the support of the same in comparable innovation events e.g. hackathons, design-sprints and co-creation events (Trainer, Kalyanasundaram, Chaihirunkarn & Herbsleb, 2016). Academics already participate in these spaces, particularly from the fields of design, computing and the creative industries. Although potential novel products, services or start-ups are developed, these events have not explicitly sought to support post-sprint business development. We have highlighted the importance in bringing the right skills into the different phases of design-led innovation and to support knowledge exchange. Recognizing that it is not just designers that are required, but bringing in those from the arts, technology and business sectors to encourage knowledge exchange and design-led innovation. However, facilitating knowledge exchange through a common platform enabled by design capabilities.

By revealing key design capabilities that are commonly required by teams at different stages of a design led innovation process, we can further support these by more easily identifying gaps and tailoring advice. This may overcome common roadblocks and provide opportunities for a more targeted, streamlined approach to university-business entrepreneurial efforts as well as scaffolding university-industry partnership working. This is an ongoing consideration for further research in this area.

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