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The satellite applications catapult: Design's contribution to science and technology innovation services.

Alison Prendiville
a.prendiville@lcc.arts.ac.uk
University of the Arts, London, UK

Abstract

This positioning paper presents a six-month scoping study on the role of design in one of the UK Governments' science and technology innovation centres, the Satellite Applications Catapult. Established in 2013 by Innovate UK, the remit of the Satellite Applications is to support economic growth through the exploitation of space with the application of satellite technologies. As one of the earliest adopters of design, the Satellite Applications, with the Transport Systems Catapult, was selected by the UK government's innovation network, the Knowledge Transfer Network (KTN), to be the sites for this research. For the purpose of this paper the Satellite Applications Catapult is presented as a case study as a first step to explain how different design practices shape the organisation's innovation capability with the paper conceptualising how these activities work at different levels of the organisation. To reflect on design more generally across the Catapults this paper also frames these innovation services as Knowledge Intensive Business Services (KIBS), so that design's capability within these contexts can be better understood as knowledge sharing and transformational practices within the organization and externally with clients.

KEYWORDS: design, KIBs, service innovation.

Introduction

As service design grows as a field, there is a need to validate its adoption through better understanding of its range, influence and role within technology-enabled innovation. Service Design Research indicates that there are still thematic gaps in service design research that need attention (Sangiorgi and Prendiville 2014) including the area of science and technology enabled innovation. In addition, within service innovation, little is known of design's application in down-stream developments and this knowledge gap extends to sector areas such as design's role in 'big data' digital services (Prendiville, et al 2017), SMEs, transportation and energy sectors (Sangiorgi & Prendiville 2014).

As well as these thematic gaps, Buchanan (2008:3) draws attention to the need for ‘academic consideration to be given to the role of design in organizational change through the practical activities of design, noting critically that “design” should be explored more explicitly from a broader range of perspectives than it has had in the past’.

This paper will provide a systematic overview of the design activities within the Satellite Applications, as a first step to show how different practices shape an organisation’s innovation capability and strategic direction within science and technology innovation services. In addition, the research frames the Catapults as KIBs to explain design practices as part of their service delivery to enable emergent, knowledge co-creative collaborations.

Background

The origins of the Catapults as Technology Innovation Centres (TICs) were conceived through Herman Hauser’s 2010 seminal report ‘The Current and Future Role of Technology and Innovation Centres in the UK. In this work he identifies a ‘critical gap between the UK’s capability in research and its inability to capitalize on these in order to deliver economic benefits’ (p3). The report recognised best practice examples such as the Fraunhofer Institutes in Germany and the TNO in the Netherlands, as innovation models that would benefit the UK. Importantly, Hauser’s (2010) report also noted the highly collaborative and networked nature of innovation in problem solving and the multiple sources that catalyse it, from external parties such as universities, customers and suppliers.

Consequently, in 2013 the Technology Strategy Board (TSB) now Innovate UK, set up ‘translational infrastructures’ in the form TICs. The first seven to be established were the Digital, Advance Manufacturing, Cell Therapy, Future Cities, Transport Systems, Satellite Applications and Renewable Energy Catapults. Concurrently, discussions on the potential of this network of technology innovation centres, also acknowledged the need for the Catapults to have the capability to use design for commercializing technology (Department for Business and Skills, 2011, Design Council 2011).

More recently a review of the Catapults’ progress notes their success in acting as ‘translational infrastructures to bridge the spectrum of activities between research and technology commercialization’ (Hauser 2014:3). This achievement, of the first Catapults, to close ‘the innovation gap with the best systems in the world’ (3), has led to date, to the further creation of eleven Catapults with a recommendation that a network of 30 centres be set up by 2030 (Hauser, 2014: 7). Yet although the Catapults are now established centres of innovation there has been little discussion to understand design’s contribution in these organisations and more importantly its broader role in TICs. To address this, in 2015 the KTN funded a six-month scoping study on the Satellite Applications and Transport Systems Catapults, to open-up discussions on design’s potential and wider adoption across these science and technology ‘translational infrastructure’ services. In this paper the Satellite Applications case study is presented to shape the understanding of design’s contribution and its activities to TICs at three different organisational levels. In addition to understand the potential of design more generally in TICs, the research early on, framed the Catapults as KIBs to reflect their catalytic role in knowledge-creation.

The Satellite Applications Catapult

The UK space industry is worth £13.7 billion (Sadler et al, 2015:1) to the economy, with the largest contribution from down stream space enabled services made possible by using satellite data (House of Commons Science and Technology Committee, 2016/17). These satellite related services broadly support the UK economy under four industry headings;

telecommunications, global navigation satellite system (GNSS), earth observation and meteorology.

Situated next to the European Space Agency on the Harwell Oxford Campus, the Satellite Applications Catapults aims to improve the understanding and take up of such satellite based services across the UK economy from large corporations to single product, early stage companies. This involves connecting to companies particularly those that are unfamiliar with space technology by exploring and identifying opportunities where space technology may assist in their business. As an emerging technology, the Satellite Applications are interested in facilitating the adoption of satellite based services for non-space industry users and to support this agenda, they have an interdisciplinary team of staff, with two thirds of the current 100 workforce being employed from non-space technology backgrounds, ranging from banking, education, insurance, agriculture and the public sector (Scoping Interviews November 2015).

The Satellite Applications has four focused programme areas that are 'Intelligent Transport, Blue Economy (for example maritime surveillance), Government services and Sustainable Living' plus two explorative areas. Within the four programme areas there are a number of threads and these are strategic area that have been identified as particular areas of technological or market interest (Satellite Applications website).

Developing a Conceptual Framework

The following sections provides a summary of some of the key literature that informed the study. In particular the work focused on understanding how different types of knowledge is used in organisations and how this contributes to their innovation capability. Further the work draws on KIBs literature to then understand what type of services the Catapults are and how can we understand design's contribution within this context.

To understand design's role in the Satellite Applications Catapult it is necessary to follow the growing interest in expanding the understanding of design beyond what Desarti et al (2014:41) refer to as the 'reductionist view of design that is a process focused on the appeal of products, to a cultural view of design that embraces unique systems of competencies, knowledge and skills that can envision innovative solutions'. Earlier work by Buchanan (2008:3) proposes that 'design could offer a new way to understand and practice management, leading to more human-centred organisations'. Recent work by Bason (2017) applies this view of design in organisational shaping, to the opportunities it affords to transform public governance. Concomitantly there is also criticism of a lack of adequate knowledge on organisational issues by design professionals (Mulgan 2013: Design Commission, 2013) and the increasing need to explore strategies to build service design capabilities within organisations (Bailey, 2012). Thus, when looking at the Satellite Applications Catapult and TICs more generally questions arose relating to what are the design practices that are being used and what is actually being designed?

Knowledge Intensive Business Services.

Looking at KIBs as a frame to better understand the role of the TIC, literature was identified that described the nature and characteristics of these particular services, to inform the thinking, relating to the activities of the Catapults. Muller et al 2009:1, describe the activity of KIBS as mainly 'focused on the provision of knowledge intensive inputs to the business process of other organisations, private as well as public sector clients'. Similarly, Miles et al, (1995: 18) describe KIBS as 'services that involve economic activities which are intended to result in the accumulation of a dissemination of knowledge'. Returning to Muller et al (2009) they see the importance of KIBs as actors of knowledge transformation in regional and national innovation systems. As services, KIBs 'perform activities in close contact with the

client and the more knowledge intensive and customised the service, the more the co-production depends critically on client participant and input' (Betterncourt et al, 2002:110). For the authors 'clients are key to creating optimal knowledge based service encounters and, for this reason providers of KIBS should take steps to proactively manage their clients co-production behaviour' (101). Thus if knowledge is the core asset of a KIB's competitive position in delivering innovation, it raises the the question on how this core asset emerges and how it is being generated? (Muller et al 2009:1).

Ways of knowing

To better understand design activities in the Satellite Applications Catapult and more specifically on knowledge creation, attention was turned to visualisation and cognition in management decision making (Eppler and Platts, 2009) as well the value of experiential learning through Doing, Using and Interacting (DUI), (Jensen et al, 2007). Visualisation through the graphic representation of data, information and knowledge offers significant advantages when dealing with the demanding task of strategic planning (Eppler and Platts, 2009:43). For the authors visualisation gives, 'multiple cognitive benefits including facilitating, elicitation and synthesis of information, enabling new perspectives for more effective recall and decision making; social benefits are also recognised such as integrating different perspectives and achieving stronger communication'(44).

The use of serious play through 'Lego and the use of metaphorical imagery in workshops – verbal, visual kinaesthetic – is a mode of representing knowledge' (Burgi, 2003:74). This form of 'multimodal imagery challenges the abstraction of organisational life so often used in strategy making and instead offers a way of deepening understanding through metaphorical image making' (76). According to Jensen et al (2007:2) 'there are two modes of knowing, one that is predicated on the Science Technology (STI) model and the other which is an experience-based mode of learning, based on DUI'. These two learning modes relate to different types of knowledge; 'the first that is tangible and codified that can be written down and the second which is tacit intangible and often localised' (9). The authors show that using a mixed strategy of these two different ways of knowing enhances product innovation. Similarly Nonaka and Konno, (2000:7) recognise two types of knowledge, one of which is 'explicit' "expressed in formal and systematic language and shared in the form of data", and tacit forms which is "deeply rooted in action, procedures, routines, commitment, ideas'.

Methodology

At the start of the work the research objectives were informed through discussions with the KTN and observations taken at Cross Catapult workshops, which were events organised to promote the up-take of design across the TICs. From these the following research objectives were formed:

- To understand the role of the Catapult as science and technology innovation services and design's role within this context.
- To identify and understand the different types of design activities currently used within the two Catapults under review and how this assists in building knowledge within each of the organisations.
- To understand how design is framed and utilised within the two Catapults and how this influences the reach and service innovation capability of the Catapults.
- To construct a framework to understand and articulate design's role and its potentiality within the two Catapults with the aim to open up discussion across

other Catapults.

A literature review informed semi-structured interviews on design's role within each of the Catapults. Twelve interviews were undertaken specifically within the Satellite Applications. The interviews focused on how design is conceived within the Catapult, its practices assimilated within the organisations and how these are supporting and shaping the innovative capacity of the organisation. In addition two projects from each Catapult were used as a base line to capture and exemplify the range and utilization of design activities in client projects. Questions also focused how design is changing the organisation and its contribution to innovation.

Participant observations were undertaken at three KTN Cross Catapult workshops, held at the Future Cities Catapult, the KTN offices and the TSC in Milton Keynes. The workshops were initiated by the design team at the Satellite Applications Catapult and supported by the KTN for knowledge exchange across the organisations. These workshops were used to observe the discussions on 'design' and its role between different Catapults and the barriers and opportunities for its up-take.

A UK research council workshop was also observed between the Satellite Applications and doctoral students from across three UK universities to encourage the participants to think about how earth observation satellite data could inform start-ups around challenges within the areas of fisheries, security, agricultural management and future cities.

The Satellite Applications Case Study.

At the very start of Satellite Applications inception in 2013, designers were employed. Starting with one designer, within three years the team has steadily grown to 5 designers and the design activities in the organisation can be categorized into five key areas: communication, user insight work, sprints and business modelling, facilitating workshops and Satellite Applications strategy formulation. These five key areas are all dynamically interlinked within the organisation and in the development of Satellite Application produced services, figure 1.



Figure 1, represents the five broad areas of design activity used in the Satellite Applications Catapult. These activities are interlinked and continuously interact with each other.

In the Catapult all the design activities have a role to play in a constant exchange and consolidation of implicit and explicit tangible knowledge. These exchanges take a number of forms but are identified as assisting the Satellite Applications in the following ways:

Communicating Ideas

At its most simple and basic level, design and the design team are valued for their visualization skills that produce engaging slides and visual narratives that can strongly communicate ideas:

“ Every time they create a visual for the Catapult to explain a very complex thing in a simple way they are creating value for us” [Chief Financial and Operating Officer and Executive Director].

Every presentation that is now produced by the Satellite Applications Catapult has a compelling visual narrative supported by infographics to explain complex problems that previously would have been communicated through numerical space data.

Constructing Understanding

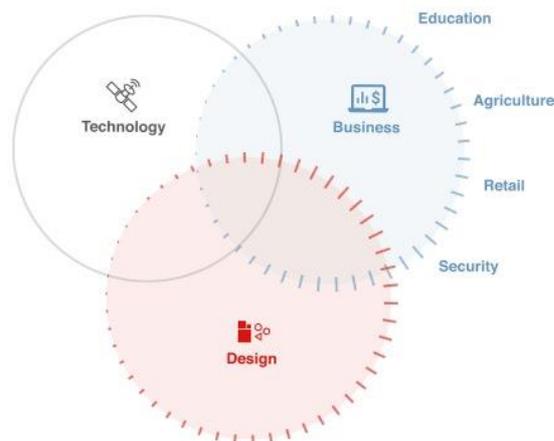
The design and business ‘sprints’ with external organisations such as SMEs, non-government organisations and businesses, supports and enables opportunities for satellite technology to be explored within specific contexts, for the organisations to experiment around the reconfiguration of their business and to reflect different users and communicate the value propositions more effectively to investors.

“design is really useable in putting in simple terms what the concept is about, how it’s going to fit with the day to day business” [New Business Development].

Knowledge Exchange

There is continuous learning and knowledge exchanges between the internal business development team and the designers at the Catapult, figure 2.

Figure 2, represents the close and dynamic interaction between the business development analysts and the design team. They are continuously learning from each other.



The designers are learning about the business model process for satellite services and the business development team appreciate the holistic view of the problem space that is articulated through the designers. Over time, the designers are increasingly interested in how an idea is developed into a viable business proposition with clients and how this activity is integral to the design process.

“Design is working with me to understand who are these people? Age, gender...it’s trying to put me in their shoes to understand the way they approach the service. This then allows me to have a smaller group to identify with, and in economic terms, I start to quantify the possible income. So it’s really moving from one stage to another” [Business Analyst].

Value in the process

Workshops run by the designers are viewed by senior management as delivering stronger ideas than those that are initiated individually. The design process enables people to take ownership of a problem and collaborate towards a solution early on. Positive feedback is given at the end of the ‘sprints’ and workshops for participants and in some cases external organisations that are collaborating, are keen to transfer the design ways of working into their own organisations.

“More importantly, and what hadn’t been appreciated is how much they enable groups of people to create ideas from nowhere, in a way that is stimulating. So they are enablers, they create lots of energy and they keep the process going, and the mechanisms they use (post-it notes, Lego) create an environment where people feel free to talk about ideas and for them to be captured. So design stimulates and captures ideas and also identifies problems and then finds solutions, designers do this in a way that is clever” [Chief Financial and Operating Officer and Executive Director].

Design as a Bridge and Catalyst

Design is seen as a bridge builder and catalyst that facilitates the translation of technology into business opportunities in the form of new products and services. The workshops are viewed as creating a different type of working environment that breaks with traditional satellite sector practices.

“It encourages openness and free thinking throughout the whole process rather than starting with something as a fixed view of what the outputs are going to be – by involving design, it challenges and tests your assumptions. [CEO and Executive Directors].

Design and Organisational Processes

Design’s focus extends beyond consolidating knowledge and its exchange both internally and externally with clients, to also incorporate the internal workings of the organisation. Early on its formation the the acronym PACE (Pioneering, Agile, Collaborative and Entrepreneurial)

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was applied, to assist in formulating the culture of the organisation but without having any processes in place. With the arrival of the lead designer, it was noted that there were multiple different systems of communication being used within the Catapult and there was an opportunity for the designers to harmonize the organisation's internal tools, to communicate projects and exchange ideas and to create seamless exchanges throughout the company. This standardization of the processes (sharing ideas, resourcing projects, the facilitation of workshops and a visual language) has speeded up the operations and enabled the Catapult to become more agile with quick iterations of ideas through prototyping and feedback.

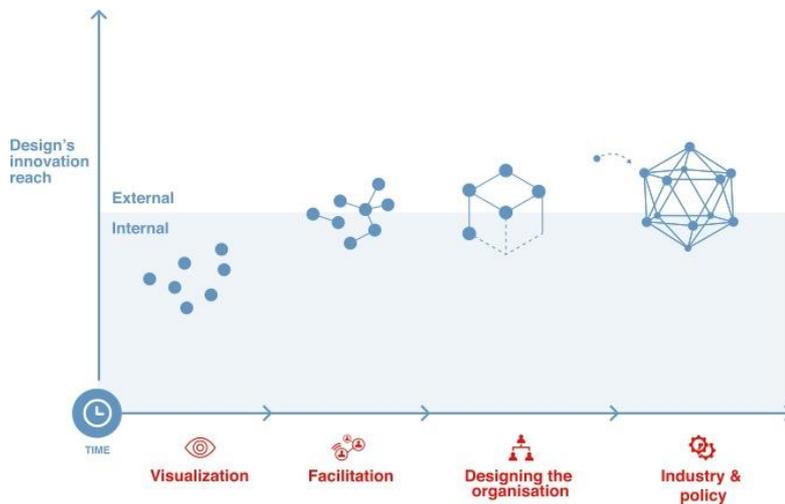
“So when we designed the space and designed all our processes now, we try to make sure they work, still staying true to those ideals (PACE). And I think that sort of carried forward and the Design Team, they've always been very at the front of ensuring that those ideals stay in all our mission”. [CEO and Executive Directors].

Many of the Satellite Application's down stream services are focused on the uptake of the technology in developing countries, so the designers have introduced design ethnographic fieldwork to the organisation's processes. This approach, now adopted as part of the Satellite Applications development process has helped it understand and overcome potential non-technological cultural and user-centred barriers, in countries such as Kenya and Brazil that may prevent the take up of satellite technology. Field work undertaken in these countries involves not only the designers but also the business analyst, exposing them all to the complexities of introducing new technologies into culturally specific environments.

Since its start, the designers have also seen their role develop, with much greater attention being given to reflecting on how the organisation works as a service for the satellite industry. This approach has developed over time with the focus shifting from individual projects to shaping organisational processes and the Catapult itself, figure 3. The aim is to break down departmental silos and make the organisation more human centred with practices that reflect this throughout the organisation. The focus for the designers is very much about processes that enable the co-creation of knowledge and to maximise how the organisation can work to create solutions.

“And what the design centred process revealed to me was a differing way of doing it. And it's about winning hearts and minds earlier on and making that investment earlier on, just changing the way that you engage with your whole community, not only the people who are going to use it but the people who are specifying the system as well, and that sort of reduces the resistance all the way through. And then you don't actually need the same change management process or all these other things which are the engineering way of dealing with it” [CEO and Executive Director].

Figure 3, represents the shifting role of design from its initially focus at the start of the Catapult on communication and visualisation through to shaping the organisation and ultimately influencing the industry more widely.



Design and Organisational Structure

Since the start of the Catapult in 2013, a number of interrelated issues have influenced the emergence of design within the organisation. Early on it was recognized that the real economic value of space technology was not in the assets in the sky but what it could do for people on the ground. In addition, key individuals at a senior management level within the Catapult visited organisations such as the Stamford D-School (USA) and the Hasso Plattner Institute (Germany) that are powerful advocates of design. In addition, the design team have a design champion, the Head of Business Innovation management who is on the executive board of the Catapult.

Initially design was not understood strategically within the organisation and was treated very much as an adjunct. Although design was given a space that allowed other people within the organisation to view the methods and processes in action, this area was separated from other activities within the Catapult. In the past four years, the value of design is better understood and this is reflected in the expansion of the design team to five members with a mix of skills and expertise including interaction, product and design thinking. This range of attributes helps inform the physical aspects of satellite services. The design team are now also involved in the five-year delivery plan which is updated annually. The two design leads also work very closely with the Head of Business Innovation who is on the executive management team at the top of the organisation so there is a high level of interest in design within the organisation. The following quote from the CEO, reflects the involvement the design team have in supporting the decision making activities and the strategic importance of design in making tangible the structures and processes that assist in the delivery of the organisation's goals:

"Lots of people want us to do lots of things but we have limited capacity and budgets. So we want a way of identifying the big goals that we could aim for, where according to some criteria, we think we have the right starting points, that we have a unique advantage in those areas and we think there's a big target to get to. And then we build up threads of activity that lead us towards that.....So you can start to map out how you are moving towards the target. So it's actually quite a difficult thing to explain and to get everyone understanding, because it's deliberately ethereal, but nonetheless it needs to have structure. And so we've been using the Design Team to try and create the right level of understanding of where the flexibility is and where the actual structure and process needs to be [CEO and Executive Director]."

This recognition for design is also reflected in the change in the physical location of the design team from its own space with a large window onto a public seated area to being situated in a prominent position in a circular arrangement in the middle of the main open plan office. This circular area has all the physical evidence of a creative space with post-it notes, workshop materials, representations of the team in Lego figures. Design is situated as being central to the organisation with its physicality prominently displayed. This consolidation of design's role although still not always clearly understood, is constantly

changing over time as its role has become more embedded and consolidated within the Catapult.

Data Analysis

The data analysis generated through interviews, observations and Catapult presentation material, locates design practices on three conceptual levels within the organisation. Mapped onto the chart in Table 1, a broad range of design activities are identified which were matched with quotes that supported design's role within the organisation. These practices unlock the intangible and tangible knowledge inside the Catapult and externally with clients. Throughout the three year life span of the organisation, the range of activities has increased and the complexity grown as design becomes more embedded at a strategic level. The table charts design's role and maps how it is being undertaken, through which activities, to enable which knowledge flows and changes to occur within the organisation.

Level 1 Design Activities

At level 1 design focuses on communication activities through infographics, visual narrative powerpoint slides, brown bag events (lunch time sharing of cases and projects) and design tools and processes. Reflective practices are also used throughout the design team to review the standardization of innovation processes and documentation. The purpose of these design activities is to consolidate a human centred design approach across the organisation and to make the Catapult more agile in its working practices.

"I think it has taken us a long time to realise we have got to embed it (design) into everything; certainly for the first year or so we probably just saw it as an adjunct 'oh well perhaps that needs some design' or we can our our power point slides better"

Level 2 Design Activities

The focus of level 2 activities can be categorized broadly as learning by doing through facilitation of sprints, co-design activities, creating playful activities involving using lab coats and Lego, internal team events and fieldwork particularly design ethnographic for projects in lower and middle income countries. This extends design practices and processes across the organisation and externally with clients to enable tacit knowledge flows across the organisation and externally with clients. These activities further enhance social networks and collaborative ways of working and reinforce a human and business centred approach to the development of satellite technology. The following quote by the CEO, describes a workshop he attended with fisheries analysts who are unfamiliar with satellite technology

"if you get somebody who isn't from a technology background but they are a user...., and if you start showing them technology too early on, and you say 'well is this what you want?',.... they never take ownership of what that solution is....In contrast the designers took all of this out.... and they ended up sitting on the floor with little bits of card and paper and just trying to work out 'well how would you like to interact with this system? What sort of information would you like to see on this bit of paper? 'OK, well these are the boats; so what information do you need to know about these boats? How can we represent this?' So you do it all on paper and card and then once you've got that, then you can build it into the technology; then they see the technology and say, 'yes, that's the system that we talked about. I recognise it now. I feel like this is my system; I'm going to try and use it'"[CEO and Executive Director].

Level 3 Design Activities

At this higher level, the designers assist the facilitation of strategy through visualisation and synthesising the Catapult projects through workshops and the development of 'threads and

narratives' of related activities. This process supports the identification of priority areas that may be market or technologically focused areas within their different projects. The process helps the Catapult to think about how to plan their business and how to organise and prioritise their work. By mapping out and visualising their strategy, the Catapult better understands its targets, not in a prescriptive way but in approaches that allow it to adapt and respond; thus design is seen to create the right level of structure and flexibility throughout the organisation.

"We have a strategy day coming up.....this time we are doing it on the Catapult's impact and again we will be driven by their (designers) suggestions for our activities and how we capture the outputs from that day. So we do enable them to have a big influence on the business" [Chief Financial and Operating Officer and Executive Director].

Table 1 shows the different design activities in the Satellite Applications Catapult. Each level is dynamically interrelated with the others.

Design's Role in the Satellite Application's Catapult

Knowledge Intensive Organizations as Service Intermediaries of Innovation

Level 1

Design's role as value added activities	How How is it being done?	What is being done?	Knowledge Tangible Knowledge Flows	Evidence What's changing within the organization?
 Communication	 Visualization	 Info-graphics	Communication material	Simplifying complexity the strength of the visual
		 Power Point	 Brown Bag events	Sharing information and processes.
		 Design tools & Processes	Use of the room & people using the white walls.	Diffusion of creative practices. Re-affirming processes.
	 Playfulness	 Lego, lab coats, furry cats.	House app challenges	Enhancing social networks and ways of working.
		 Case studies	Uniform documentation of processes & practices.	Growing and consolidating knowledge internally & externally.
	 Documentation	 Books	Design brief, stakeholder map.	Rationalizing and standardizing design led innovation practices. Internal and external facing.
 Reflective Practice	 Standardization	 Processes, Sprints and design outputs.	Knowledge transfer internally and externally. Internally organizational learning, what works and doesn't.	Changing view of design and its role.

Level 2

 Learning by doing	 Facilitation	 Sprints & co-design activities.	Breaking down silos. Collaborative working.	Adoption of practices and processes across the organisation
	 Fieldwork	 Understanding different users Unlocking tacit knowledge.	Prototyping new service solutions	Human & business centred approach to satellite technology.

Level 3

 Reflective Learning	 Strategy through design facilitation	 Development of threads and narratives.	Assisting in decision making of projects and direction of the organization. Synthesizing of strategic information Visualization and images of strategy.	Peoples' knowledge of their organization, its direction and its goals increase.
All of the above				

Discussion

The Satellite Applications sector is emerging with activities focused ‘downstream’ on developing digital services, which involve people, technology, artefacts (hand-held devices, mobile phones) and organisations to be configured in a human centred and business orientated way, to generate economic and social value. To co-ordinate this complexity, there needs to be a high level of co-creation of knowledge between different actors. The designers use creative engagement activities and design practices to consolidate and co-create knowledge flows across the organisation to embed and standardise processes and externally with clients, to identify and generate potential solutions. Through the alignment of different types of knowledge both tangible (level 1 activities) and intangible (level 2 and 3 activities) the design team are able to innovate around the organisation’s service delivery and consolidate knowledge within the organisation. Although Table 1 conceptualises design on three levels, they are all interlinked with high levels of reflection being undertaken by the design team and the organisation itself.

Conclusion

This short research project highlights design’s role in the Satellite Applications Catapult. By framing the Catapults as KIBs, design activities can be seen as enabling organisational learning at three different levels. As a scoping study the Satellite Applications Catapult demonstrates that the design activities are multi-purposed, working at different levels within the organisation. The case study also shows that design’s role within TIC is often emergent, with it initially conceived as being about visualisation and communication. However, if TICs are clearly framed as KIBs, design’s role can be more clearly articulated as facilitating and enabling the transfer, consolidation and sharing of knowledge within an organisation and externally with clients, leading to the shaping of the innovation capability of the organisation itself. If design’s contribution is to be better understood within TICs then the focus needs to be on its role in aligning and consolidating these different design practices to create a human centred organisational structure that maximises its knowledge sharing capability.

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