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A Systems Thinking Perspective

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Business Empathy: A Systems Thinking Perspective

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The strength of design is that it brings new perspectives - often referred to as 'out of the box' thinking. However, an attitudinal and methodological strength need not render the designer humble in systems-based business knowledge that improves the prospect of ideas being carried through to implementation. Systems thinking as a discipline offers designers a way to model and understand how a business works, from its processes and power structures to its people and underlying architecture. This paper proposes an incorporation of key system thinking tools including; Soft Systems Methodology, Business Architecture and Viable Systems Modelling into the design process to develop what we term *business empathy*. The paper contributes a system thinking perspective to an increasing body of literature regarding design innovation.

Keywords: Systems Thinking, Viable Business Model, Business Empathy, Holistic Thinking, Servitisation

Introduction

We begin with a scenario:

> *Company A* approaches a design firm with the challenge; assist our company to transform into a competitive force in an 'Industry 4.0' environment. The design firm sees immediate servitisation opportunities; both digital and physical adaptations to current product offerings. The design firm sets to work drafting and developing a series of changes. When the time comes to present these opportunities in a product-service blueprint; a glaring gap emerges. The people that work for the company have mixed views in determining the proposed value propositions and the best way to make the necessary changes. The company's business architecture simply won't support such a transformation, now or in the future. Further, it is difficult to visualise what incremental steps could be taken to optimise value during the business's evolution while mitigating risk associated with the cost of change. It becomes clear that the operational structures and systems within the organisation have not been factored within the design process to the detriment of both client and design firm.

Design (and design thinking) have provided a human-centric posture toward innovation enabling organisations to adapt to changing market conditions and absorb the shock of technological changes. However, the pace of change in Industry 4.0 requires greater attention to the necessary organisational structures to allow continued adoption. Industry 4.0 has been called the next industrial revolution, and is forecast to radically change the relationship between consumers and producers (Roblek, Meško & Krapež, 2016). This revolution will be driven by physical objects with embedded software, driven by the internet of things (Almada-Lobo, 2015), creating a

digitization of economies and society and a digital environment (Pozdnyakova, Golikov, Peters & Morozova, 2018). This mix provides business with the opportunity to gain continuous and real time feedback from operations (Roblek, Meško & Krapež, 2016) with the potential to customize and improve a value offering in a highly adaptive manner (Rymaszewska, Helo & Gunasekaran, 2017). Yet the development of Industry 4.0 also places new pressures on the internal infrastructure of an organisation - the business architecture - to afford self-awareness, self-predicting, self-reconfiguring and self-maintaining business systems (Lee, Kao & Yang, 2014).

Design is known to assist organisations to adapt to new value creation and capture mechanisms by testing deeply held assumptions (Liedtka, 2015). The popularity of design at this time is often constructed along the rhetorical narrative; *it is an age of uncertainty and therefore a prosperous time for design*. Yet gaps can emerge between a design proposal and the necessary business architecture changes to afford such transformation as we explored in our scenario. As we introduced in the scenario of *Company A*, not identifying how a business works can later impede the actionability of an idea or solution that emerges from the design process.

The following paper will look into systems thinking and identify particular tools which designers can incorporate into the design process during servitisation challenges in the context of Industry 4.0. The aim of the paper is to propose how these tools could be integrated into, and strengthen the design process of designers who operate within this context. We broaden the notion of empathising with users and stakeholders to deeply gather insights, to empathising with the logic underpinning existing structures and systems that allow an organisation to operate during explorative phases of the design process. The paper contributes systems thinking perspectives toward the design of product-service-systems in order to bridge the gap between disruption (innovation) and optimisation (implementation). Through this paper we seek not to lock design up in systematic tools, but rather expand the available means through which a designer operating in business can understand, create and implement change. We build toward implications for fourth order design that stem from greater attention to systems thinking, organisations and environments. The paper concludes with reflection upon design's increasing provenance with the business community.

Servitisation challenges of industry 4.0

Industry 4.0, as opposed to previous industrial revolutions, will see the absolute integration of instant communication into all production processes (Sukhodolov, 2018), fuelling the rise of servitisation. This has seen more organisations exploring advanced service offerings such as product service integrated solutions (PSS), with industry-based evidence suggesting it creates closer and more long term relationships with customers improving satisfaction and increasing sales (Hennik Research, 2017; ("Servitisation: The Changing Face of Manufacturing and Service", 2018)).

This shift from purely product-offerings requires organisations to think in terms of comprehensive systems with interdependent elements (Sukhodolov, 2018); and a change in the way they think about innovation. Whereas, 'pure product' was traditionally focused on technical expertise, service innovation requires human centred understanding as the products are not merely stand-alone solutions, but are used in the broader context of a users' life (Agarwal & Selen, 2015). This in turn changes the competitive landscape, where once businesses competed on technology, the new factor for success has become knowledge regarding experience; where the customer is the supplier, and the business the integrator (Burton-Jones, 2003).

While industry 4.0 is presenting these new opportunities for businesses, responding to these changes can be a challenge for businesses (Neely, 2014). Responding to the challenge of better understanding the relationship aspect with their customers organisations have been turning more towards design thinking with it being used as a strategic capability (Dell'Era; Verganti, 2010), as it is intrinsically based around human- centricity (Calabretta & Kleinsmann, 2017).

Design Thinking in the context of Servitisation

Design thinking is an approach for solving human- centred problems (Garrette, Phelps & Sibony, 2018) giving organisations a customer centric view, enabling them to deliver human-centred experiences, which fulfil emotional and functional needs which can be supported by business operations (Calabretta, Kleinsmann, 2017).

As a problem solving process with cognitive origins, design thinking can be seen as a form of abduction aimed at defining the 'What' and 'How' needed to identify a 'Result' (Dorst, 2011) which can be broadly defined in

four phases including: the preparation phase, the incubation phase, the illumination phase and the verification phase (Tschimmel, 2012). The design thinking process has been represented in a number of ways including; the double diamond approach, the three I model, or the Hasso Planter Institute model (Stanford/Potsdam model) as represented in Figure 1. The notable aspect of these models is they all begin with a learning phase from defined users. The learning, or empathy stage with users is viewed as a foundation of design thinking (Garrette, Phelps & Sibony, 2018) which deepens understanding into the problem situation enabling the realisation of relevant solutions (McDonagh, 2010).
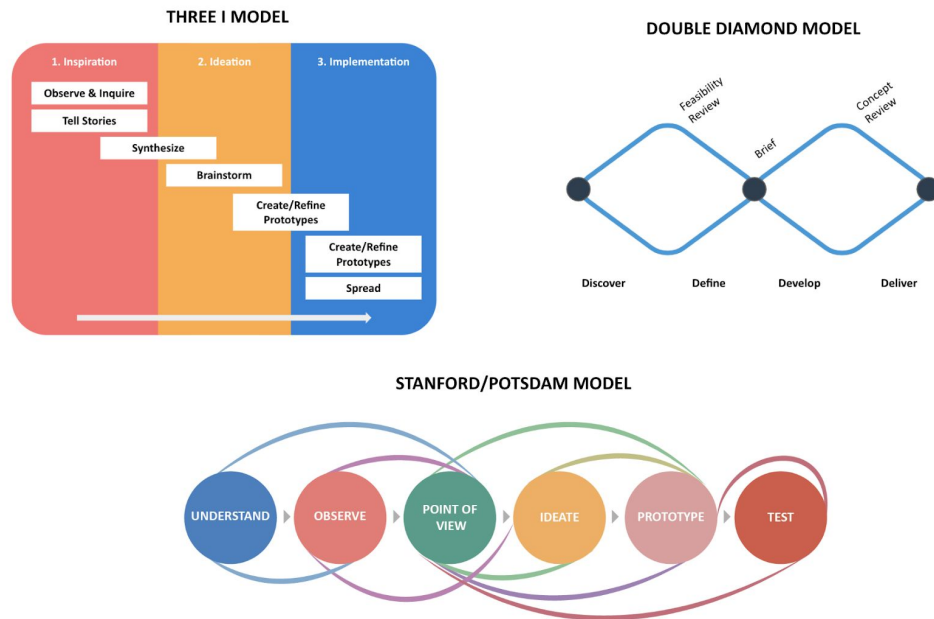
THREE I MODEL

1. Inspiration	2. Ideation	3. Implementation
Observe & Inquire		
Tell Stories		
Synthesize		
Brainstorm		
Create/Refine Prototypes		
	Create/Refine Prototypes	
	Spread	

DOUBLE DIAMOND MODEL

Feasibility Review — Brief — Concept Review

Discover — Define — Develop — Deliver

STANFORD/POTSDAM MODEL

UNDERSTAND → OBSERVE → POINT OF VIEW → IDEATE → PROTOTYPE → TEST

Figure 1: Design Thinking Process Models. Source: Tschimmel, 2012, redrawn

Empathy has been defined as 'perspective-taking' where one places themselves into someone else's position and adopting their perspective (Gasparini, 2015) and in the design process, focuses on key stakeholders namely the end user, within the context of the problem in order to understand their needs. In servitisation, this enables organisations to understand the customer perspective in turn creating a 'customer benefit package' (Goldstein, Johnston, Duffy & Rao, 2002). Through journey mapping and service safari's, designers can capture opportunities in existing processes (Howard, 2014) where improvements can be made to improve the user experience (Scherer, Kloeckner, Ribeiro, Pezzotta & Pirola, 2016). With this information designers can then describe a service in its constituent parts including: service product, process, place, physical evidence, people, productivity and quality, plus additional marketing elements (Goldstein, Johnston, Duffy & Rao, 2002). These are then organised into a process using a service blueprint, such as that shown in Figure 2. Through this designers can create a user centric business model, which visualises the different components and interrelations between stakeholders (Estañol et al., 2017).
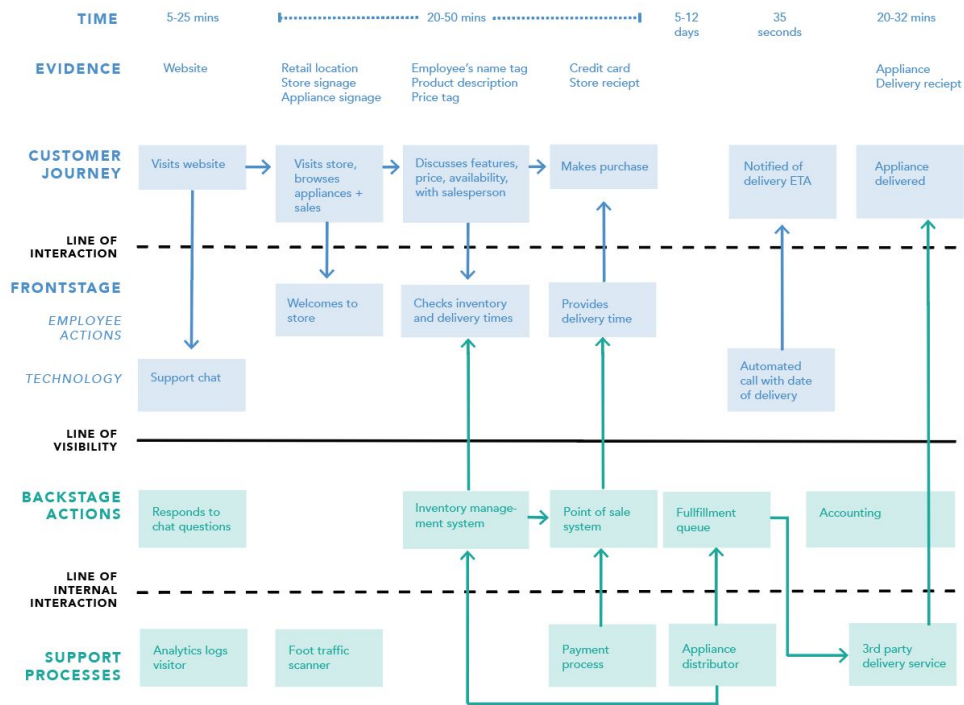
TIME | 5-25 mins | 20-50 mins | 5-12 days | 35 seconds | 20-32 mins

EVIDENCE | Website | Retail location / Store signage / Appliance signage | Employee's name tag / Product description / Price tag | Credit card / Store reciept | | | Appliance / Delivery reciept

CUSTOMER JOURNEY: Visits website → Visits store, browses appliances + sales → Discusses features, price, availability, with salesperson → Makes purchase ... Notified of delivery ETA ... Appliance delivered

LINE OF INTERACTION

FRONTSTAGE
EMPLOYEE ACTIONS: Welcomes to store / Checks inventory and delivery times / Provides delivery time
TECHNOLOGY: Support chat / Automated call with date of delivery

LINE OF VISIBILITY

BACKSTAGE ACTIONS: Responds to chat questions / Inventory management system / Point of sale system / Fullfillment queue / Accounting

LINE OF INTERNAL INTERACTION

SUPPORT PROCESSES: Analytics logs visitor / Foot traffic scanner / Payment process / Appliance distributor / 3rd party delivery service

Figure 2: Example of Service Blueprint for online shopping. Source: Nielsen Norman Group, 2017

Limitations of Design Thinking

While design thinking gathers insights to propose business opportunities, these may sometimes be at odds with the current state of the organisation (Martin, 2009). In the context of servitisation, it is important that while designers should understand the user needs, they must also have an understanding of the system which the service will operate in (Calabretta, Kleinsmann, 2017). Without considering both views, the entire picture isn't complete (Kuehn, 2018), and value cannot be delivered until there is alignment between the invention and the business system (Auerswald and Branscomb, 2003). While service blueprinting outlines the requisite components an organisation needs to deliver a service, it lacks the rigorous analytical capabilities to be used to test a service within an organisation (Estañol et al., 2017). Activities up until this point can arguably be seen as product championing, which is demonstrating a problem solution fit and desirability in the market. While this is an important part of the new product development (NPD) process, failure to consider broader ramifications results in strategic neglect which is where focus has only been on desirability and viability, but not on achievability from a business perspective.

In order to avoid neglect, this requires reflecting the concept back into the business, framing it in how it contributes and impacts the business from not only market growth but on its people, processes and structures in what is known as organisational championing (Burgelman, 1983). Strategic neglect leads to what is also known as the 'valley of death' which is the result of short fallings in the organisational capabilities as well as institutional misalignment (Auerswald and Branscomb, 2003). Failure to bridge the valley can result in organisations missing the opportunity to realise value opportunities. The valley of death, as depicted in Figure 3, provides a broad view of the structures, processes, people and resources that are involved in commercially realising a solution. On the graph the y-axis indicates resource availability against the level of development on the x-axis.
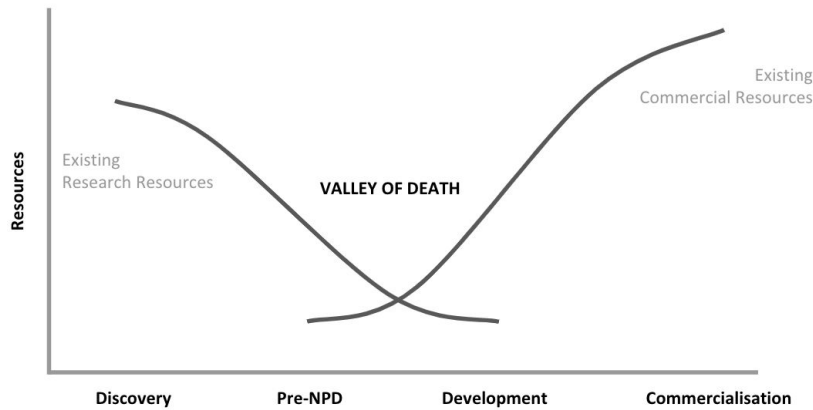
Figure 3: The Valley of Death. Source: Markham, 2002, redrawn

This gap is caused by misalignment attributed to the different perspectives which NPD professionals and organisations have (Markham, 2002). This can be seen where NPD is focused on innovation, which in its nature is disruptive; whereas a business is focused more on efficiency and stability.

Exploring Implementation Challenges in Design Practice

To better understand how this reflects in practice, exploratory interviews were conducted at a design agency currently operating in the space in assisting organisations realise the potential of industry 4.0. The agency does this by translating human insights and pairing it with technology to create new business opportunities in sectors including automotive, insurance and retail.

Interviews were conducted with 12 members of the team ranging from strategy, UX and UI design, project management and innovation consultants. Interviews, which lasted an hour and were semi-structured, asked individuals to reflect on the performance of previous projects with regards to how their work was adopted by clients; asking them to think about what was or wasn't successful. Quotes from these interviews were then coded and clustered in order to identify themes which related to why the products were or weren't adopted. It is worth noting, that the interviews only took on board the perspective of the agency, as such taking the NPD view of the valley of death. Further interviews would need to be conducted from the client side to gain an understanding from both sides of the challenge.

The projects which have been a success range from apps to physical products within a PSS and a key aspect to their success was the matching of the product to the broader context of the business. In two of these instances projects from the client were purely executional in terms of simply building the products. In these cases, the understanding as to how this would align with the organisation was already considered by the client, with pre-existing supporting business cases which gained broader organisational buy-in before development work had begun. Other successful projects had seen the agency take on a much proactive relationship with the client, where the agency had developed longer term innovation roadmaps with the client, and identified components within the business to support the agencies development work. Here the relationship with the client project sponsor in building project impetus within the business had been an important factor.

Speaking with individuals in the agency who had been involved in unsuccessful projects however, found that they viewed the client as a 'black box' and didn't fully understand the 'why' behind the projects. As such, the rationale behind projects reverted to 'common sense', from a viewpoint of what was desirable for the user, viable for the business, in terms of market fit, and what was feasible technologically. While feedback from the clients on the concepts was positive, in later feedback issues arose around business prioritisation, fit for the organisation or resource availability.

While these interviews only take into consideration the design agency perspective, the factors which affected the success or failure of these projects were related to understanding the broader context of the concept within the business. Where the broader implications of how the idea would fit into the business had been factored, either by the agency of client business, adoption and then implementation had been successful. Those projects on the other hand, without this understanding were often lost at early stages of concept and first prototype, not making it to a pilot stage.

Disciplines for Understanding Business

As discussed by Whittington (2010), there are different approaches organisations can take with regard to process activities including either more deliberate or emergent decision making. Those which take a more emergent approach, can be seen more of as opportunistic where they look to the market to dictate decisions and their behaviour. These can be seen typically as more dynamic and responsive businesses, where taking a customer centric view is likely to be sufficient in decision making. On the other hand however, businesses with a deliberate approach which are more long term planners, look more for clear rational when making decisions. This approach considers legacy aspects within the organisation in order to inform decision making, therein making it more deliberate than opportunistic.

For organisations with a more deliberate approach, the broad range of challenges revealed in the literature review and exploratory interviews related to mindset, process and integration to the business requires a more holistic approach. A discipline such as system thinking enables designers to gain such an overview (Van Ackere, Larsen & Morecroft, 1993). It has been argued that more reductionist views such as business process engineering or service blueprints, compartmentalise processes which focuses on inventing a process from afresh (Romney, 1994). This in turn provides an artificial view of how a business works, where the subtleties between people and process are ignored (Stickland, 1996). As such, a more holistic view of an organisation through systems thinking is suited where not just the business components of a business are considered, but also the interdependencies between them are explored (Ackoff, 1999), as failure to do so typically leads to failure in the implementation stage (Cao, Clarke & Lehaney, 2000).

An Introduction to Systems Thinking

Systems thinking (we will use the acronym ST from herein) finds its roots in a number of different disciplines including philosophy, communication, control engineering and biology (Checkland, 1981). The aim of ST is to understand complex phenomena by reducing it into its elementary parts (Bertalanffy, 1950), and then looking at the interactions between these parts in order to generate a systems view (Ackoff, 1999). Unlike more reductionist methods of viewing a business (or parts of it in isolation), which aim to simplify a system; ST embraces complexity by breaking it into manageable separate elements in order to understand the interdependencies between its parts (Doleski, 2015)

When attempting to understand how a system operates, we turn to cybernetics which is the science of control within ST (Ríos, 2011). Cybernetics concerns itself with the relationships between; emergence and hierarchy, as well as communication and control within a system and how these all interrelate (Ashby, 1961; Checkland, 1991). An important cybernetics principle to consider when looking at organisations is the law of prerequisite variety or Ashby's law, which governs these two relationships. Ashby's law states:

For a system to be stable, the number of states that its control mechanism is capable of attaining (its variety) must be greater than or equal to the number of states in the system being controlled. (Naughton, 2017)

This law is represented in Figure 4 and is true for any open system; whether it is biological or social (Ackoff, 1994).

When this is related to a business context for example 'a business as a system', it means that in order for a business to remain viable and deal to the variety of challenges, whether from the market or elsewhere, it must have a repertoire of responses which reflect the challenges it faces (Lockton, 2018). This variety can be seen as capabilities, information, individuals within the organisation who recognise the disruption.

Figure 5 shows how this variety is delaminated across a business system, between the external environment it operates in, the business operations and then the management of those operations. Between each of these the amount of variety differs, from the environment which has infinite variety, to the process which has less, and the management which has the least. The amount of variety is represented by the size of the 'V'. Between each of these elements exists a feedback loop which controls the communication between each element, either amplifying or reducing the message (Beer, 1990). In reality, this can be seen by senior management creating initiatives, which are amplified through the business towards the market, and then customer feedback

returning and being reduced through reporting back through the business to senior management. Between each of these entities the amount of variety which can be absorbed differs.
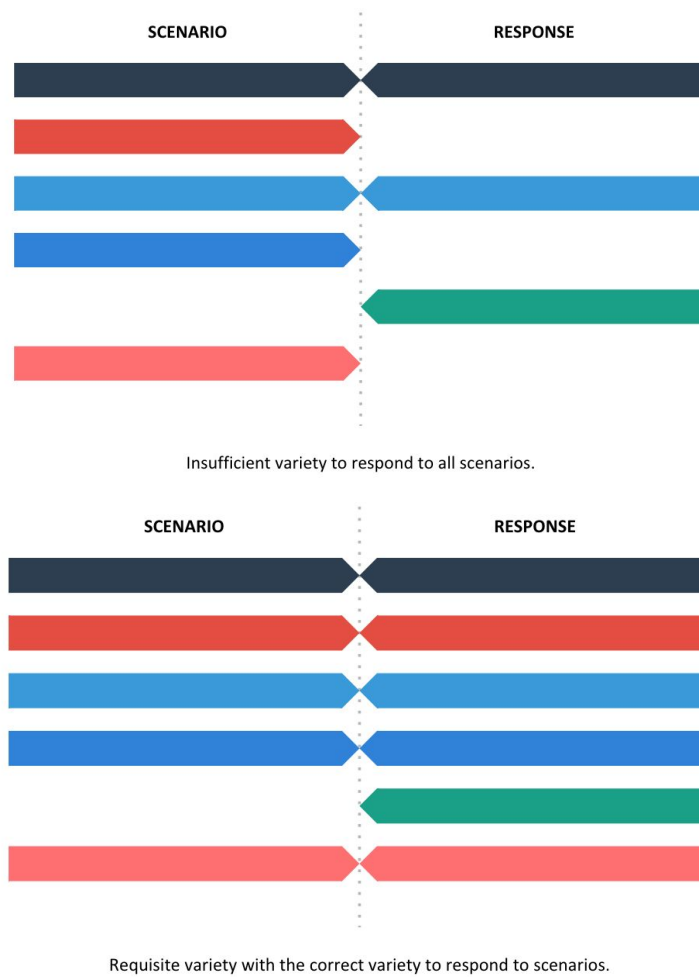

Insufficient variety to respond to all scenarios.

Requisite variety with the correct variety to respond to scenarios.

Figure 4. View of a System through Ashby's Law. Source: Lockton, 2018, redrawn
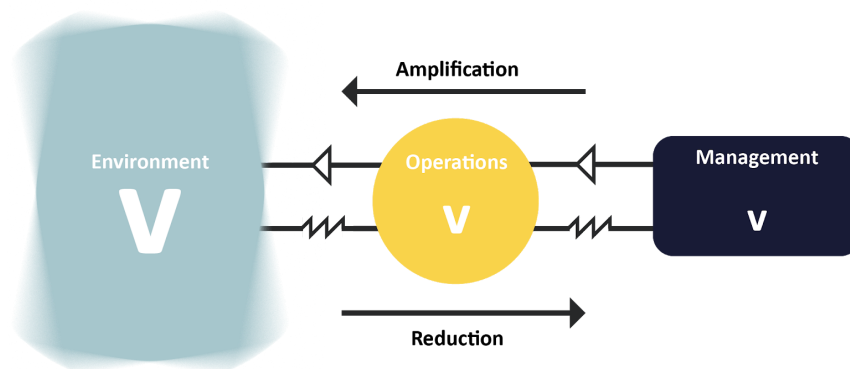

Figure 5. A View of Delamination of Variety across a Viable System. Source: Beer, 1990, redrawn

The purpose of reducing the variety is to ensure that management can focus on only what is necessary, rather than the large range of issues faced in the environment (Beer, 1990). Ashby's law states that how each part of the system, between the environment and management is able to respond to the information in the feedback loop, determines the viability and survivability of the system. In reality the external environment is perpetually

changing. Therefore, there is a constant requirement to continually monitor changes in the external environment as well as the efficacy in the management system to adapt to it.

While Ashby's law indicates how a system, such as an organisation, communicates; it doesn't provide an insight into the individuals within it, which is a critical consideration when understanding a social systems (Ackoff, 1994). As such in the discipline of system thinking a distinction in methods was created between people and processes resulting in soft and hard systems respectively. A hard system is considered something 'which has precise objectives which can be expressed in quantitative terms' (Kirk, 1995), which can be seen in disciplines such as operational research and systems engineering (Oliga, 1988). Soft system's on the other hand is related with human activities, aimed at understanding and reconciling multiple diverse and conflicting definitions of a situation; where there is no precise agreement on the objectives or outcomes (Oliga, 1988). A soft systems approach is concerned with how the system should behave, versus how it actually behaves (Kirk, 1995).

Consideration of both hard and soft perspectives in a business are important, as while a hard systems approach to a solution may appear rational to one individual, other stakeholders may have different views (Burge, 2015) which if ignored can lead to challenges.

Bringing Systems Thinking to Design Thinking

Based on this overview of aspects to consider within a business three themes have been identified which would assist a designer in understanding a business during the development of a new PSS: 1) A tool for understanding how people perceive the business; 2) A tool for understanding the capabilities which exist in an organisation; 3) A tool for understanding the interconnectivity of how a business works. These will come from hard and soft systems methodologies in addition to business architecture. The following portion of this paper will focus on a tool for each of these challenges and then how these can be incorporated into design. We will also draw on parts of the scenario in our introduction to connect to practice.

Understanding Worldviews – Soft Systems Methodology

Scenario - 'The people that work for the company have mixed views in determining the proposed value propositions and the best way to make necessary changes'

Soft systems methodology (SSM), is a modelling approach which finds its roots in philosophy and social theory (Mingers, 2000), and is used to structure problem situations by providing a holistic view from multiple stakeholders (Checkland, 2000). It is argued by Checkland (2000) that every situation can be seen as a human situation as ultimately it is people who take action within a hard system, where all stakeholders within it have their own worldview or 'weltanschauung' which ultimately affects the performance of the hard system. This is particularly a challenge when individuals unconsciously adopt a particular perspective on a situation which may be completely opposite from another person but yet is still rational causing conflict (Mingers, 2000).

SSM aims to elicit, structure and model different individual understandings of a problem situation to create a structured debate about desirable outcomes, how to get there and the success and failure criteria. In practice SSM has been broadly used over the last 30 years within government and industry; notably within the supersonic aircraft project Concorde. In what was initially considered an Engineering challenge, with the question asked, 'how can British and French engineers logistically work together?', it was soon discovered that the challenge was not simply structural, but cultural and political. Using SSM compromises were able to be found enabling the better cohesion with the team and the eventual completion of the project (Checkland, 2000). There are four main activities within SSM which are illustrated in figure 6, and also described as follows:

1. Find the problem situation including cultural and political aspects;
2. Formulate relevant activity models
3. Debate the situation using the models and debate:
    a. Changes which could improve the situation both culturally and feasably,
    b. Accommodations between the situations.
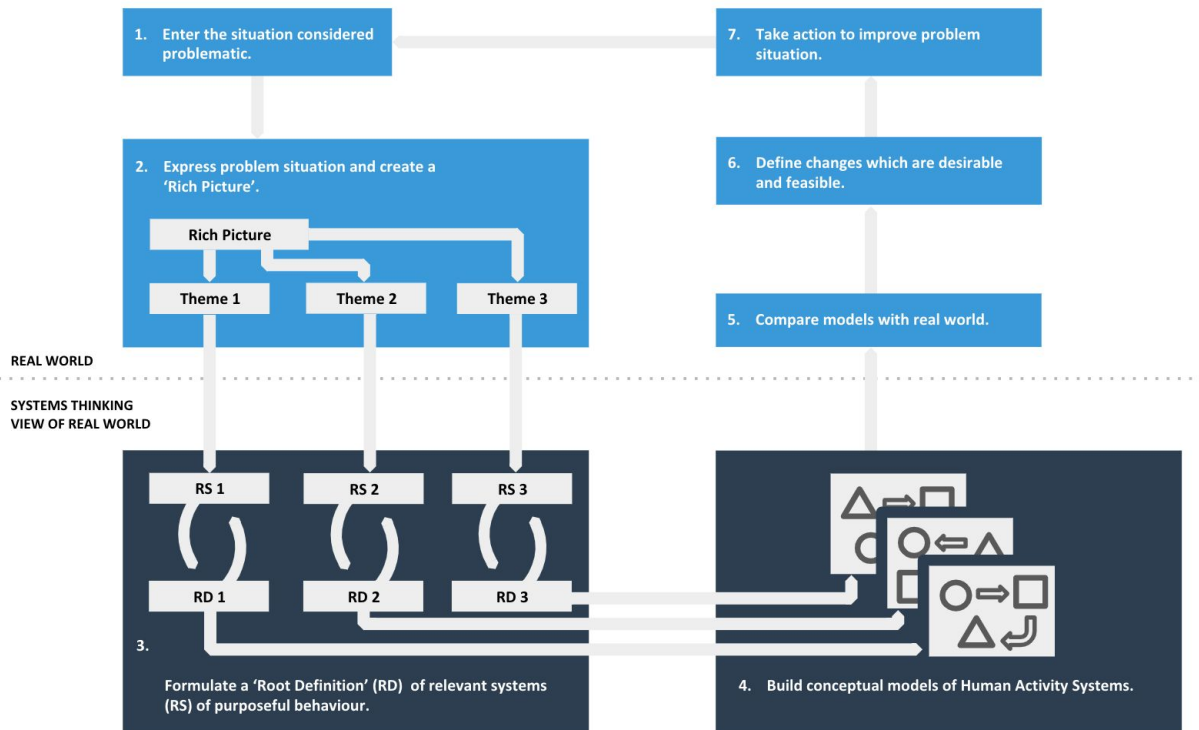4. Take action to bring around improvement to the situation.

Figure 6. Soft Systems Methodology Framework. Source: Burge, 2015, redrawn

Within this process in stage 1, an understanding of the situation is created through what is known as a 'rich picture', whereby a situation is drawn by a stakeholder in the form of a flow chart from their perspective. Multiple of these are created from various stakeholders which are then compared to create 'root definitions', or points of emergence, of a problem situation (Burge, 2015).

When developing this rich picture, the shared root definition should include the following aspects, which Checkland created using the acronym CATWOE (Burge, 2015):

- Customer: The individual(s) who receive the output from the process (Pandey, 2011).
- Actors: The individuals who are involved in the execution of the process (Pandey, 2011).
- Transformation: The process of changing and input into an output (Pandey, 2011).
  eg. Operational Process
- Weltanschauung: the bigger picture and the reason for 'why' the transformation is taking place (Pandey, 2011).
- Owner: the decision maker who is concerned with the performance of the system (Burge, 2015).
- Environmental Constraints: the key external constraints that are significant to the system (Pandey, 2011).

The aim of the CATWOE analysis is to determine the; 'What to do', 'How to do it' and 'Why do it' (Checkland, 2000), which creates the rich picture of each individual allowing points of emergence and divergence to be highlighted. It is through modelling in SSM that these points of divergence can be highlighted, enabling structured debate in an effort to bring about the desired solution for all stakeholders

The benefit of such an approach to the design process is that it aims to identify the latent needs of stakeholders within a business, identifying diverse and conflicting views with an aim to find consensus. An approach such as SSM can be seen as an addition to a designers tool set, where they set out to identify the latent needs of users.

Understanding Capabilities – Business Architecture

Scenario - 'The company's business architecture simply won't support such a transformation, now or in the future. Further, it is difficult to visualise what incremental steps could be taken to avoid the risks of inaction.'

In order for a designer to create solutions which align with the business they must understand and gain a cross sectional view of the business from its capabilities to internal value streams (Gharajedaghi, 2011; Kuehn, 2018). This can be achieved through business architecture which aims to create a multidimensional blueprint of a business from its structures to its capabilities. The aim of this is to create an objective view of the business to assist in realising strategy (Winter & Fischer, 2006), which is used as a communication tool between stakeholders to turn value propositions into actionable initiatives (Kuehn, 2018). Through this, internal capabilities can be matched to emerging market opportunities (Gharajedaghi, 2011), as illustrated in figure 7.
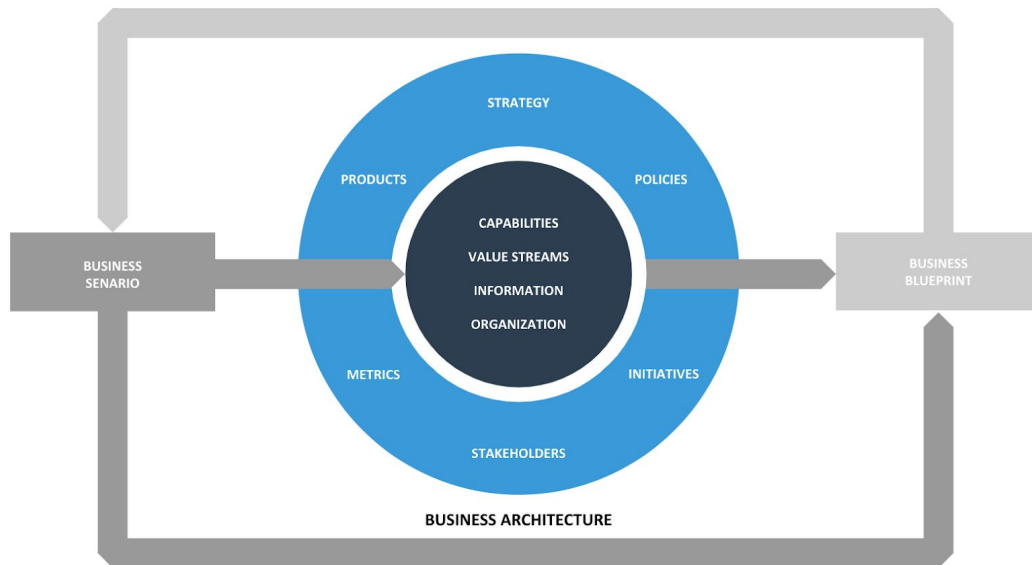

Figure 7. Business architecture flow chart. Source: Kuehn, 2018, redrawn

When the capabilities of a business are connected together through a particular value stream it is possible to understand how stakeholder value (whether internal or customer) can be delivered (Kuehn, 2018). Business architecture takes this view of a business, rather than structure as shown in Figure 8, which does not show internal relationships within the business. Instead business architecture divides these capabilities into four functions of a business including input, output, market access and control capabilities, as shown in Figure 9.
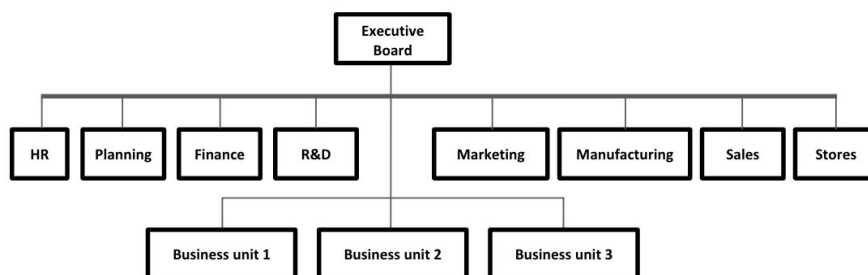

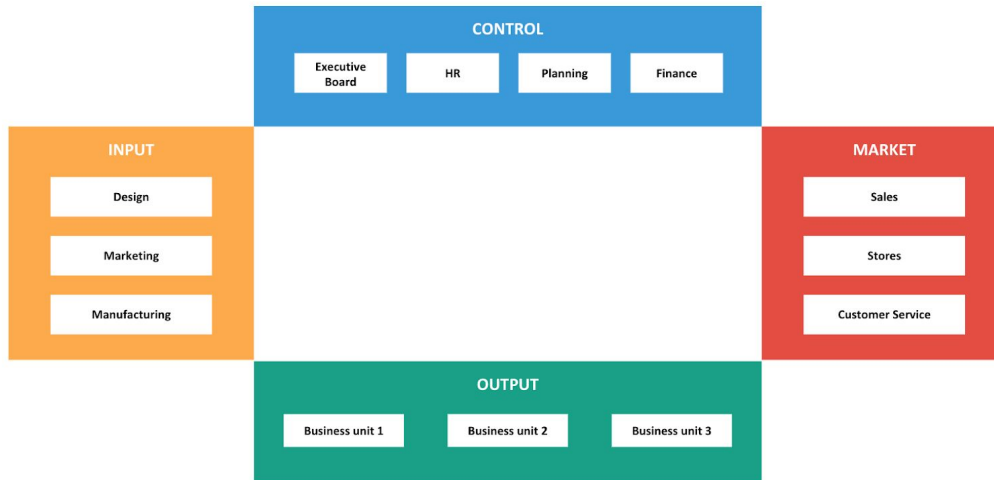*Figure 8. Structural Business Model. Source: Gharajedaghi, 2011, redrawn*

Figure 9. View of Business through capabilities. Source: Gharajedaghi, 2011, redrawn

Through identifying the various capabilities across the different spectrums, they can begin to be connected to create value streams which show the business capabilities required to deliver value as shown in figure 10. Through mapping the business this way, it allows the relationships between peer to peer groups to be seen, from input, to output to market access, allowing the necessary interfaces between capabilities to be highlighted (Gharajedaghi, 2011; Kuehn, 2018).
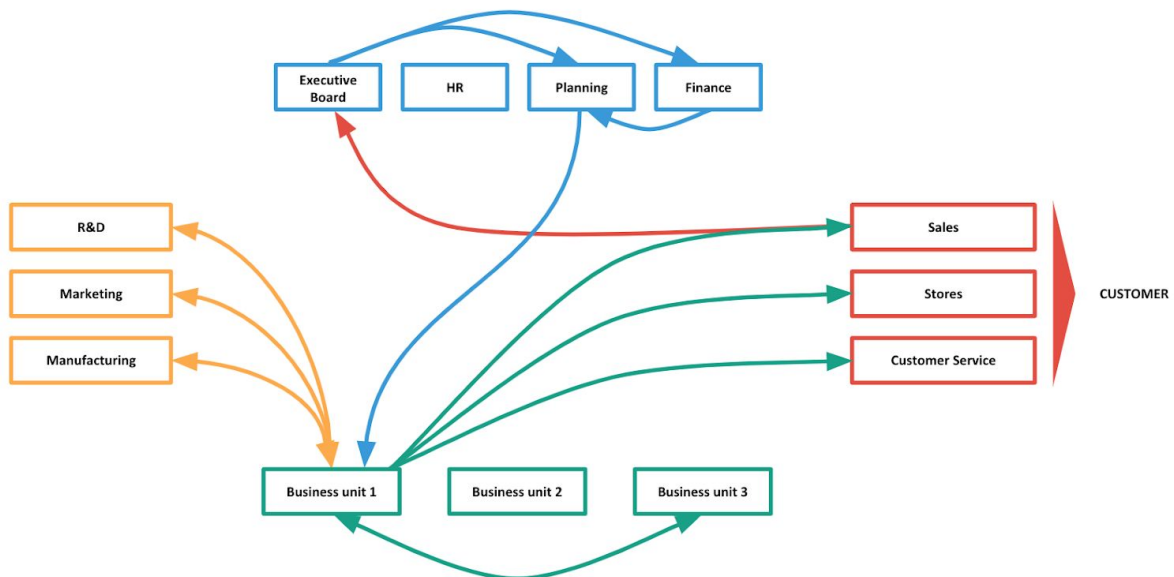

Figure 10. Example of value streams within a business. Source: Gharajedaghi, 2011, redrawn

The aim when identifying capabilities is to remain objective when defining them, as they constitute the basic DNA of a business. By remaining objective, and not tying a capability to a particular outcome, it enables designers and the organisation to reconfigure itself for any given context (Kuehn, 2018).

The benefit for designers, when developing a service blueprint for an organisation, is it allows for an objective view of the business and enables a new service proposition to be compared to existing business capabilities within the organisation. As such for a new service, a designer can propose not only a customer centric business model, but explain this within the current limitations of the organisation and also propose which capabilities will require investment, thus strengthening a service proposal.

Understanding the Workings – Viable Systems Modelling

Scenario - 'It becomes clear that the existing operational structures and systems within the organisation and how these interdepend and interact with each other have not been factored within the design process'

Once a designer has developed a business model through business architecture, they can use viable systems modelling (VSM) which is an integrated business modeling tool (Wehinger and Herrmann, 2012) to identify deficiencies in existing business system and highlight changes which may need to be made (Hildbrand & Bodhanya, 2015). Unlike more common business models tools, which reduce complexity, an integrated model such as VSM provides a comprehensive framework that breaks down the dynamic aspect of complexity into manageable separate elements (Doleski, 2015).

This integrated business model approach breaks this down by describing all management activities through three lenses that include; Normative, Strategic and Operational management functions. These can be described as follows: Normative is described as the management of general business activities, expectations, values which steers the behaviour of the organisation; Strategic, which is based on normative aspects but steers the focus of the organisation and finally; Operational which focuses on the execution of the day to day tasks. These should all be considered concurrently rather than in isolation, in terms of how they relate to each other (Doleski, 2015).

Based on this aspect, VSM models how each of these functions behave across an organisation through five subsystems which come together to create a viable business which are noted in table 1. The definitions of these systems are identified through qualitative interviews with key stakeholders within the organisation (Hildbrand & Bodhanya, 2015). These all interact as shown in figure 11, which shows the interrelated aspects of VSM, which is essence is an extrapolation of figure 5.

Insufficient performance, missing components or issues in feedback loops between any of these aspects ultimately endangers the viability of the organisation (Hildbrand & Bodhanya, 2015). As such VSM may be applied within the context of analysis, used to run and test scenarios (such as the introduction of a new service) through a system to identify issues in a how an organisation responds. Once these issues have been identified, it enables designers to appreciate potential incompatibilities either within the design of the service or the ability of the organisation to address the requirements for the service to function.

Table 1: Systems required in a Viable Systems Model

Name	Function	What is asks of the Business
System 1 (Including S1.O (Operation) & S1.M (Management))	Operational unit activities with their direct Management, which are essential duties of an organisation. eg Sales, Logistics, Procurement etc (Hildbrand & Bodhanya, 2015).	What is happening here and now?' (Wehinger and Herrmann, 2012)
System 2 (S2)	Co-ordination of System 1 activities, limiting the principle freedom, to manage each output.	Are optimal standards being exploited for the overall system to work without constraining innovation in system 1 activities and outputs? (Lamb, 2017)
System 3 (S3)	Operational Management, Monitoring and Auditing - Ensures output from all system 1's are coordinated to deliver on broader mission of the organisation. Is responsible for optimizing resource allocation. (Wehinger and Herrmann, 2012)	'What is happening on the short term basis in operative business framework?' (Wehinger and Herrmann, 2012)
System 4 (S4)	Strategic Managment - Makes organisation aware of the current and future environment both in	'What could happen next in the environment or internally in the

|	and out the organisation (Wehinger and Herrmann, 2012).	system?' (Wehinger and Herrmann, 2012)
System 5 (S5)	Normative Management - Makes decisions on policy, standards and organisational focus (Wehinger and Herrmann, 2012). Defines the mission and goals and manages the conflict of resource allocation between Systems 3 and 4.	'What should happen in the future based on all the knowledge present in the system?' (Wehinger and Herrmann, 2012)
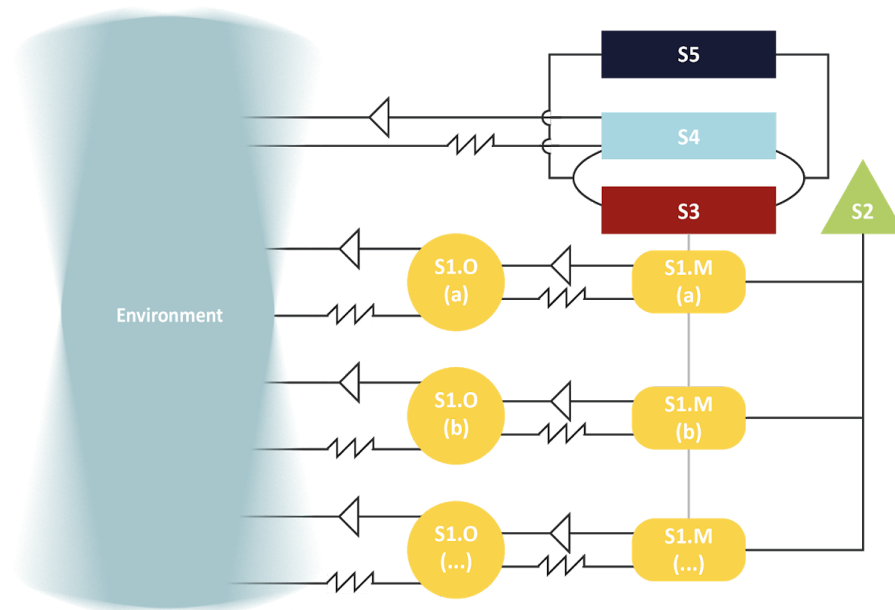
Figure 11: Viable Systems Model. Source: Beer, 1990, redrawn

VSM enables designers to gain a view of the structural recursion of command and control actions within an organisation (Espejo, 2003). Such a view enables designers to model and observe the behaviour of how an organisation reacts the environment it operates in. With such a model it enables designers to identify bottlenecks within the organisation which could limit the implementation of a new PSS solution, enabling discussion about proposed enabling solutions.

Developing Business Empathy

Through this paper we have discussed the importance of acknowledging the various complexities within a business which should be considered when developing and introduction a new PSS. While design thinking provides an insight for businesses into customer behaviour which can be translated into new value propositions, the tools which designers have to understand and articulate these overly simplify the view of a business causing challenges in adoption and subsequent adoption. In order to understand this aspect we propose designers develop what we describe as business empathy. Based on the exploration above this means taking the perspective of the business in terms of the people, processes and structures within a firm which are relevant for the implementation of a new value proposition.

The purpose of business empathy is to allow designers' to pair the knowledge of the current state of the business to a customer centric value proposition. With this information a designer can propose a minimal achievable product, from a business perspective and propose a broader program of projects which move from pure business centricity to more customer centric, or from incremental to more radical design solutions.

The ST tools outlined in table 2, aim to complement the existing tools in the designers toolbox by enabling them to populate service blueprints or business model canvases in a more considered way which reflects the current state of the business. The use of SSM, BA and VSM would enable designers to understand from the businesses perspective; the situation from the internal stakeholders perspective, the existing resources at the disposal of the business, and how the business is managed and is able to respond to new solutions/situations.

Considering how this would be used in practice, we envisage business empathy as opening the black box of how a business works, to aide designers in developing solutions which acknowledge dependencies surrounding implementation. In the case of the design agency interviewed, for projects which require organisational championing; designers would start by using SSM to gain an understanding of the expectations stakeholders had behind the project. Here designers would understand the 'why' and understand the underlying values motivating the project. This would then aide in the shaping of the idea as well as how designers would eventually articulate the value within the business.

When considering how a service would be constructed, designers would consider both the customer and business perspectives. Starting with a service blueprint approach designers would assert the core logic behind the delivery of value to the user. Using BA, designers would then reflect on the actual resources available within the firm to support the delivery of value. With this the designer would compare the customer centric service blueprint and the business centric blueprint. Comparing the two perspectives, the designer would then shape a number of options which scale between complete customer or business centricity. In doing so they create a number of options from a minimal achievable product to a completely customer centred solution. The application of VSM enables designers to take a deeper look at the organisation in terms of the monitoring or communication in order to reflect how the introduction of the new value proposition would impact the organisations processes. Again here designers are able to propose either changes to the business, or incremental solutions which will allow the business to adopt the minimal achievable proposal and adjust according.

Through the application of these tools, business empathy enables designers to discuss value propositions beyond what is simply desirable for the customer in the product championing phase, but discuss their ideas at a higher level within the business through organisational championing.

Table 2. Tools for Business Empathy

Tool	What it does	When to use it
Soft Systems Methodology	Provides a method of analysis to interpret multiple stakeholders views of situation, such that they can be objectively compared and discussed with said stakeholders.	In order to understand the expectations of a new project from multiple stakeholders (the people within the business), and identify either points of emergence of divergence. The aim here being to create a shared vision.
Business Architecture	Provides an objective view of an organisation's capabilities and value streams.	In order to gain a view of a business's capabilities to shape what supporting activities are required from the business for the value proposition.
Viable Systems Modelling	Reveals interactions and linkages of managerial regulations across an organisation as a whole.	In order to gain an understanding of the communication channels and monitoring activities within a business which the new value proposition will exist in or need to shape proposals how a system can be redesigned to absorb such new proposals.

Conclusion

As design's provenance within management continues to grow, many organisations' are looking become more customer centric. Spurned on at the eve of Industry 4.0 and the potential which IOT brings, companies are finding their old ways of working are being challenged as feedback loops between customer and business move into real-time. These challenges raise questions as to the limitations of the design process, where tools are aimed at customer experience and unpacking technological possibility, ignoring the current state of the organisation. In order to overcome this we propose business empathy as a means of understanding what happens in a business with regards to people, processes, power dynamics and capabilities. By incorporating the established tools discussed in this paper with existing design tools such as the service blueprint or the business model canvas, designers would be able to propose holistic solutions.

The addition of these tools to a designer's tool set builds on the notion that design thinking is user centric and aims to understand the customer, but now frames business as a network of stakeholders including the customer. With designers having the skill set to gain insight on user behaviour at a time when industry 4.0 brings businesses closer to their customers, the organisations who approach this also need to be understood as they will become the user of operating models proposed by designers. By using tools to empathise with businesses, it transforms the role of designers and enables them to develop a mature value proposal aiding them in bridging the valley of death. The use of these tools leads designers to a holistic view of all stakeholders engaged in the product lifecycle and service solutions, replacing prescriptive customer centric business models with a more considered joint business and stakeholder/customer centric solutions.

In order to remain sustainable, organisations' must repeatedly interpret their own operational boundaries, products and services, the environment they choose to work in and how they work within it. As Industry 4.0 has no boundaries, It will be up to organisation's to interpret what value they choose to create around this industrial evolution. Design thinking enables organisations to exploit human centric opportunities, and working with designers who have a holistic approach, will ensure the creation of solutions which reflect the specific and unique challenges of that organisation even during a volatile transition to Industry 4.0.

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