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Unlocking Design Thinking's Potential

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Abstract: Firms can be inhospitable environments for attempts to promote a mindset for sustained innovation. Consequently, efforts to adopt design thinking as a methodology for driving innovation and an agent of mindset change are often unsuccessful and results are seldom sustained over time. There is little guidance available on optimising design thinking's adoption and diffusion within an organisation. This paper proposes a design thinking paradigm and process that act as a beacon for new and infrequent practitioners and thereby help them transcend the plethora of methods employed. The new process positions reframing as a central pivot or gateway between old and new. The new paradigm introduces *strategic suitability*, of a project in respect of a firm, as a key project attribute. Strategic suitability must be a design consideration for every project at all stages of progress, so that the project's innovation is ready for the firm where it is to be adopted, and vice versa.

Keywords: design thinking; innovation; innovation process; innovation adoption; strategic suitability; reframing, mindset change.

1 Introduction

The trouble with trying to broaden adoption of any new framework, set of principles, methods or processes aimed at improving business practice is that early formulations and conceptions inevitably break down under contact with operational realities outside of the early contexts. Amendments, adjustments, customisations, tweaks and changed perspectives are always necessary for a new way of working to be accepted, diffused and

embedded. So it was with quality through the 1970s and 1980s (Liedtka, 2015). Equally, just-in-time inventory control took almost two decades up to the new millennium before it was widely adopted outside Japan.

Design Thinking (DT) is hardly new. But, its widespread application as a driving force or as an agent of facilitation of innovation within firms is still in early days. DT has achieved a modest level of name recognition and interest among business managers (Kolko, 2015). Many of these have been persuaded by its promise of growth mindset cultivation, innovation excellence and human-centred differentiation, and they are curious to know how they might put it to good use in the business. Few managers, and fewer CEOs, have been able to diffuse a DT approach to innovation throughout their divisions or firms (Kupp et al. 2017; Schmiedgen et al. 2015). They don't know what to do in order to ensure that the good practices of DT, once introduced, will be sustained. Some expressed thoughts are: *DT feels like it should be good*; *it has some great elements that we can use occasionally*; *it helps to shift towards growth mindsets*; but, it also feels too slippery and vaguely defined to satisfy the hard edged imperatives of business innovation projects' planning. It's clear that business managers who are responsible for driving innovation need guidance on how to better enable and integrate the practice of design thinking methodology within the business. This paper will be of value to Innovation Managers, Engineering Managers, Marketing Managers and CEOs who have responsibility for innovation in their organisations.

Over the last five years, we have gained good insights into common causes of firms' inability to achieve widespread diffusion of DT and to sustain this over time as a best practice approach to innovation, and we have learned which approaches are most successful in overcoming this tendency to failure. We share these here. During this period, we have trained and coached over 300 individuals from over 100 firms in DT methodology applied either to business problem solving or to exploring promising innovation opportunities.

As we worked with project teams, we tackled some difficult business problems where we helped clients achieve productive and innovative solutions. We also encountered some great business opportunities where our clients generated radically innovative product concepts, some of which progressed to profitable implementation. Many concepts, however, became stuck somewhere between early concept stage and final investment-ready proposal.

As we observed a pattern over many instances of projects not achieving their full potential we heard many excuses:

> "These are first-time design thinking exercises for the firm. It'll take time for the new approach to be appreciated and embedded."

Yet, in our hearts, from experience and from the literature, we knew that the surest way to build acceptance is with project success exemplars, however small.

> "This project is different, and especially complex"

Yet, we knew that all innovation projects worth doing are difficult and special, viewed from the inside. And, anyway, design thinking is especially suited to complex scenarios.

> "We've done our research, but the only solution option still is …"
>
> "If only they (senior management) could see what we can see"
>
> "If only they had faith in the process …"
>
> "If only they had faith in us …"
>
> "If only …"

One of the interesting things about understanding design thinking as a creative and user-empathic methodology is that neophyte (in particular) practitioners can be most creative in finding excuses, and least empathic in understanding the point of view of those non-believers in their own organisation!

Over the years, we found that those organisations that failed to diffuse or sustain an innovation mindset generally suffered from not seeing the wood for the trees. For various reasons, DT was viewed as a collection of methods to provide a "sizzle" to the innovation project while the substance of the "steak" was to be found elsewhere in more traditional marketing or engineering practices. One identified reason for this is the large number of methods and techniques that are often associated with DT, for example in ethnographic research, data synthesis and creative conceptualisation (Chasanidou 2015). These techniques, viewed in isolation, were regarded as optional and nice-to-have rather than being core to business requirements. It seemed that the richness and variety of methods distracted from, and served to relegate to irrelevance, the reasons why these methods existed or were being used in the first place. Engagement with them was transactional and short lived in nature rather than their being integrated as a standard practice or subsumed under a common philosophy of ways of doing things.

In response to these findings we evolved a process that sought to weave a unitary narrative of the DT innovation journey from research and insights discovery, through the paradigm shift of problem reframing, to ideation and concepts validation ending in deployment. We called this the *ARRIVE* process, and we describe it in detail later in the paper. Significantly, we noted that the advantages of a DT process impacted further than a single project. Process encourages repetitive behaviour, and good repetitive behaviours change mindsets and culture for the better (Lehman et al 2004).

For the innovation teams, the fragmentation of DT into myriad methods served to make them lose their way and, being lost, to rush prematurely towards more familiar ground of solution development before properly considering discoveries gained from research. Recognition of insights requires a creative and intuitive leap, just as choosing a solution frame requires a judgement based on those insights (Kolko 2011). To convince sometimes sceptical peers and bosses of the rationale for such reframing requires a confidence and clarity of thought that comes naturally only with experience. And yet it is hard to overstate the importance of reframing. It is reframing of perspective on a problem, especially when the reframing is based on solid research insights, that is the pivotal action in enabling a radically new and differentiated solution (Dorst 2015). In addition, the range of possible solutions is constrained by the problem framing. Hence, we put *reframing* at the centre of the process and highlight its essential role.

The perception of transactional engagement was worsened in the case of senior managers who could not see clear lines of connection between DT practices and more hard-nosed

traditional business requirements such as strategy alignment or financial performance projections. Design thinking's early stage emphasis on the human factors is sometimes mistaken for an abandonment of other considerations. This is harmful to the prospects of a project being accepted and eventually deployed. Of course, we invoked the well-known triplet of desirable project attributes, viz. Desirability, Viability and Feasibility (Brown 2009). But, even these are not enough, because they don't explicitly take into account many strategic considerations in the business that are critical to a project's eventual adoption or abandonment. Hence, we evolved a process of considering *strategic suitability* as a fourth key design attribute for all projects, to be actively designed into each project from an early stage. Strategic suitability is a design parameter that merits validation in the same way as others.

We elaborate on these issues throughout the paper.

2 When it goes wrong

John is a Senior Lead Product Developer with an Irish subsidiary of a major US multinational technology firm. The remit of the subsidiary development group has been traditionally about incremental innovation, adding new features and line extensions. However, the winds of progress in the company meant that John's local site would experience a devolution of more responsibility and the local marketing and engineering teams would be authorised to undertake more radical innovations, extending to new product categories and business models, where appropriate. We worked with John on his first substantial project, to help him develop a new range of products for the Chinese market, where existing products had not performed well up to now. We facilitated design thinking based workshops where we explored and practised the principles and practice of ethnographic methods, journey maps, empathy maps, data synthesis, extracting insights and concept generation. John and his team took up the design thinking baton with gusto. John and two other team members travelled to China for a three-week period to study users in many contexts and to speak with stakeholders of the business, within and outside the sister firm. On their return to base, they reviewed their data and findings with other team members and, after many iterations of data analysis, ideating, prototyping and concept testing, they eventually homed in on and refined a final concept. This final concept was based on clear insights from the field research. It would be a clear leader in the global market, not just in China, and seemed a natural addition to the firm's portfolio. Everyone who saw the concept was enthused.

That was over 4 years ago. But in the intervening period the project has not moved. With staff moving around and out of the firm, critical familiarity with the research work done has been diluted. It is highly unlikely that the project will ever hit the market.

In our view, this project was a complete failure. We see no point in carrying out a project with all its time, personnel and budget commitments unless there is a tangible output. Normally, this output should be a successfully deployed innovative product or service. If this doesn't happen, at least we should understand why it didn't happen so as to do better the next time. In John's case, there was no clearly identified reason.

In another case, one among many similar instances, we worked with a small domestic attic installation business. This firm was over fifty years old, employed over 40 people, and had

recently appointed new management from within its own employee ranks. The new management was interested to explore avenues for diversification and growth, having barely survived the severe economic downturn 2008-2011. They worked enthusiastically with us to research possible new innovations within homes that would be adjacent to their existing business. We uncovered many opportunities, arising from changing lifestyles and living patterns in the home markets of Ireland and Britain. More people are living in multi-storey apartments with no attic space, and hence no long term storage space. An aging population makes access to attic problematic for more households. Simple digital technology could be applied to provide clear inventory data for once dark, impenetrable and unknowable attic spaces. The possibilities appeared endless, and relatively easily achievable. We developed rich concept descriptions and visual demonstrations, and provided positive user feedback data to some of these. However, despite early enthusiasm, the firm's management spurned the opportunities one-by-one. If we invoke the well-established design thinking attributes, the concepts scored high on desirability, viability and feasibility. Yet, they didn't proceed. We chalked this up as another failure.

There were other failures.

We helped a prospective entrepreneur develop understanding of her target market, only to abandon the venture shortly before launch. It just didn't suit the entrepreneur's life circumstances at that time.

We provided a programme of training to staff in a public service organisation, only to learn one year later that its internal diffusion and deployment had been scuppered by second tier management with a "don't rock the boat" philosophy.

We provided problem analysis, insight and ideation workshops to support a university's strategy development. Great enthusiasm in the days and weeks following the workshops got diluted to inaction by the swamp of bureaucracy that had to be traversed for deployment.

There were other failures. By failures, we mean instances where investments were made with no useful outcome or deployment, not even productive learning. In the words of Amy Edmondson (2011) these are blameworthy failures. Of course, these were not just design thinking failures; they were failures to innovate where even a design thinking methodology couldn't bring improvement.

It's appropriate to mention at this stage that we have also had many successes as we brought the principles of design thinking to our many clients, partners and students over the past five years in particular; even more so as we incorporated lessons learned along the way, some of which are elaborated in this paper.

We have not been alone in finding it difficult to get successful outputs from client innovation projects, no matter what methodology is espoused or practised. Reports of innovation project failures have been widespread for decades and failure rates are quoted from 50% to 90% (Heidenreich and Spieth 2013; Cooper 2011). And we're not just concerned with project failures but also about the failure to diffuse and sustain a mindset for transformative innovation throughout many firms, large and small.

3 Strategic Suitability

We've reviewed John's case together with many other radically innovative projects from our experience over the years to discover the effect of the surrounding environment on a project's development. Many of those we deemed to have failed by not getting to launch seem, nevertheless, to satisfy admirably the three attributes of desirability, viability, feasibility (DVF). That is, clearly the project's outcomes are desired by and have a compelling value proposition for a significant sector of prospective users; they have a business model and financial structure that makes sustainable viability a good prospect; and, they are technologically feasible for development and deployment by the companies or individuals considering to execute them. In essence, they are 'good' projects, when viewed objectively. But, from our review of projects that have been successful and those projects that fail to complete to deployment, we conclude that a 'good' project by this definition is not enough. It must also be located in a supportive environment, which is essential for the ultimate success of the project.

We refer to this attribute, through which an innovative project is nurtured by a willing organisational environment, as ***strategic suitability***. It is so necessary for success of an innovation project that it ranks at least equal to the three better known attributes, DVF. It might be considered that *strategic suitability* considerations are already partially encompassed by the *viability* or *feasibility* terms above, but this is not borne out in our experience, where they have been more often ignored or overlooked in practice. Additionally, neglecting to make *strategic suitability* explicit serves only to dilute the meaning and value of the *desirability*, *viability*, *feasibility* categories.

Every innovation project has a context of origin, an environment where it is rooted and is expected to develop and grow. It may be a particular business or a business division where the vision for innovation has come from structured boundary scanning and strategic analyses and decisions (deBrentani and Reid 2012). Or, it may be a start-up enterprise where the vision is defined by the individual experience, passion, resources and milieu of an entrepreneur (Blank and Dorf 2012). In any case, once envisioned, few projects are so unfettered that they are free to seek out and situate in an ideally prepared context for development and deployment. In real life, the proposed project must be nurtured, massaged, promoted, planned and supported in amenable internal and external environments where it can find its feet and grow. It must be capable of being put into deployment in and from this environment - it must be practicable and *suitable* for the environment! In the same way as a healthy oak sapling in fertile soil may be desirable, viable, and feasible its development is practicable only when situated in a suitable environment, with the right climate, where the land-owner is prepared to nurture it and allow it grow to its full potential.

Of course, everything about a business impacts on the prospects for success or failure of a new project, e.g. organisational structure, culture, leadership and management, strategic development, dynamic capabilities and much more. However, some particular questions loom large with new radical innovation projects. These are:

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- *Is there a mindset for growth*, with the necessary aptitude and intellectual energy for exploration and learning that will allow the project to seed and grow?
- *Is there a will to proceed with the right energy?* Is the leadership and general membership psychologically ready to take on a project of this nature? It may be too ambitious. Morale may be low after a long period of disappointing performance and huge survival effort. Or, there may be a sense of complacency after a prolonged period of easy and profitable growth. Very often a radical innovation project needs a champion who has power and influence to bring about a sufficient level of enthusiasm and support in the organisation.
- *Is the business leadership fully behind the project*, supporting and managing the necessary and sometimes profound changes that must be brought about? Or, or are there pockets of resistance waiting for a chance to torpedo it?
- Are the *necessary resources* available or accessible, with sufficient priority relative to other projects?
- Is there *alignment* with the high level strategic intent of the business?
- Does the organisation's capability for *timescale-to-deployment* fit the project's requirements?

The Four Dimensions of Design Innovation

Adding the fourth dimension to the prescription for a radical innovation allows a nicely balanced narrative that describes a successful innovation. According to this narrative, for business innovation practitioners, innovation is always a new value proposition that is:

put to use by a	… **user**	… because it is	… **desirable**
delivered to a	… **market**	… in a business model that is	… **viable**
enabled by a	... **technology**	… that makes it	… **feasible**
provided by a	… **firm**	… because it is	… **strategically suitable.**

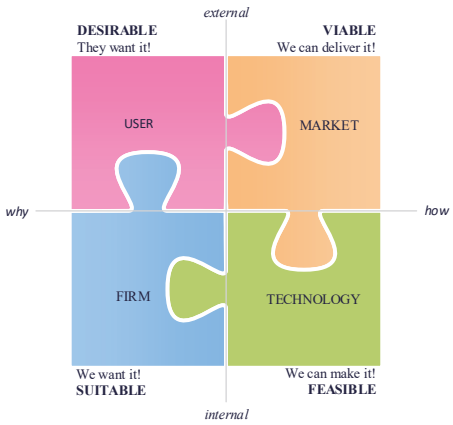

Figure 1 The four dimension of design innovation

The four dimensions of design innovation are represented in figure 1. You can see that USER and MARKET are externally facing, in the sense that they describe how the organisation interacts with the external world. In contrast, the FIRM and TECHNOLOGY dimensions are focused on internal strategic and technological capabilities.

On the other hand, USER and FIRM dimensions are concerned with 'why'; why would the prospective user want the innovation and why is it an interesting project for the firm? In contrast, the Market and Technology factors are concerned with how the innovation is to be realised and sustained, in respect of scalable business model and technological configuration respectively.

4 Insights and Reframing

A second compelling observation we've made is that early stage contextual research is often superficial or, when the research is well done, the resulting insights may be ignored or diluted when it comes to concept development, project specification and implementation. There is a disconnect between research outcomes and the subsequent concept development. There is no doubt that design thinking's strong focus on human values, user needs and jobs-to-be-done during early stage research is persuasive to most project participants so long as they engage properly with it and spend time to discover the hitherto unknown or unappreciated insights that it can produce. But it is difficult to persuade teams and project leaders to spend the time required, in the face of everyday work pressures and colleagues' scepticism. Additionally, the more numerate and technological professions such as Engineers, Software Developers, Project Managers and Accountants, for example, are often not so adept at processing or leveraging early-stage qualitative research insights. Marketers and creative Product Designers are naturally and by training more proficient at this but they are often outnumbered and more remote from decisions as the project progresses to development stage.

We've seen good research ignored for many reasons. Sometimes the team or leadership simply don't have the skills to process all the research outputs into tangible, actionable insights. Many managers with quantitative backgrounds from science, engineering or finance are unfamiliar with qualitative data processing. Some also are inherently suspicious of its value given the apparently subjective and partly intuitive processing that it involves.

We've found it necessary repeatedly to tackle this scepticism head on and to re-emphasise a holistic perspective on the design thinking process. Not only does design thinking concern itself holistically with the four dimensions DVFS as above, it also requires a complete end-to-end approach. For example, insights provide direction and inspiration for creative leaps to new solution concepts. Contrary to what many novices seem to assume, they don't provide proof that future actions will be successful. Proof is provided by the validation of prototyping and experimentation that comes after.

Traditional analytical minds envisage a sequence where data provides proof directly, as in figure 2(a).

In the design thinking sequence, data provides inspiration for creativity, and proof is provided by prototyping and user test, as in figure 2(b).

(a) traditional deductive logic

(b) design thinking logic

Figure 2 From research to proof with deductive logic and design thinking logic

This is not new to anyone familiar with design thinking but it proves difficult to assimilate for those steeped in different traditions.

So, we've developed a model that addresses this dilemma with clear emphasis and process, by identifying *reframing* as its pivotal centre. Reframing is a strategically creative re-positioning of the problem and re-imagining of what the improved future might look like. The new frame becomes the guide as well as the constraint for subsequent ideation and concept development.

By making the role of insights and reframing more visible and tangible in the context of the whole process, we have found greater levels of understanding, acceptance, hence adherence to good practice and ultimately better outcomes.

5 ARRIVE

The ARRIVE model describes a process operating in two distinct paradigms – problematic present and improved future – connected by a pivotal reframing vision, as in Figure 3.

Of the four dimensions in each paradigm, design thinking gives primary emphasis to the human values or USER dimension for which a desirable product concept (or solution concept) is proposed. Of course, market viability, technology feasibility and firm suitability must be optimised also, throughout the project.

The earlier stages of the ARRIVE process provide the pathway for the innovation team to become embedded in and get a deeper understanding of the target environment. The later stages guide the project from ideation that is focused on a clear vision to stakeholder validation and eventually to exploitation through deployment. Each of the six steps is described in more detail in the following.

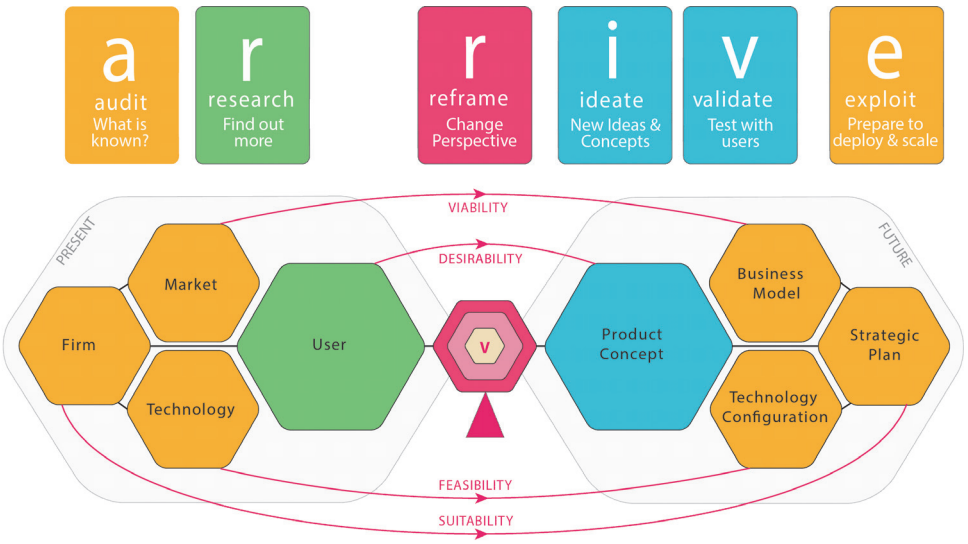

Figure 3 Two paradigms and ARRIVE process with reframing as the pivot.

A design innovation project starts with an acknowledgement that innovation opportunities always occur within a context that has multiple actors, structural complexities and legacy momentum (i.e. the business has already taken some action, however minor, to scope this possible opportunity). The innovator's starting point must be to find out as much as possible about this environment, much of which will have been already studied and reported by others. Probably, the project team has some knowledge, even expertise in the subject area, but it's rare that a fresh broad review of up to date information doesn't add value. A lot is achieved by diligent desk research alone, accessing public information about the target markets, industry sector and key players. Specialist market reports, socio-economic trend and foresight reports are complemented by speaking with experts and generally accessing other sources that may be available.

In considering innovation opportunities, it's appropriate to investigate the status of the 4 innovation dimensions: user, market, technology and firm. For the latter three dimensions, traditional business strategy has a host of tools and techniques to achieve this, and these are what we focus on in the AUDIT phase to set the scene, so to speak. Among such tools are: SWOT analysis, Force Field analysis, Porter's Five Forces of competition.

When all available existing information about the firm and the market is mined, assembled and interpreted, the project team is better informed. But the chances are it is not yet ready to create a breakthrough innovation. Some ideas with potential may be possible, but such innovation ideas are based on data that are mostly available to others. It's really hard to be distinctive and differentiated in the market when working from the same knowledge base as competitors, in particular concerning the most important dimension and central focus, the user.

The users and other stakeholders must be identified, their behaviours and aspirations for deeper fulfilment and better outcomes for the jobs they are trying to do must be very well understood. The team must search deeply for hidden nuggets of understanding, new insights that it can leverage to create a distinctive innovation offering.

Reframing is the *secret sauce* of design innovation. The innovator looks at the innovation environment with a new perspective, or worldview, that is formed and informed by the deeper understanding and insights learned from research. Through such intimacy, the innovator develops the insights and capacity to envision a future that will deliver significantly improved experiences for the users. While the deeper understanding of the context and its actors helps shape the new frame, so too the new frame defines a new scope for the upcoming conceptualisation and development of the innovation. Reframing becomes possible only after a period of deep research, understanding and recognition of patterns of data that lead to new insights.

An innovation can't be all things to all men. The frame chosen after research must be the one most likely to provide a compelling solution for the main users, which addresses the key issues experienced by them and offers greatest impact and return potential.

When Philips, the consumer electronics company, introduced the ambilight TV in 2004 (Philips 2017), the concept came from rejecting the traditional perspective that a TV is just a viewing screen in most people's homes, to be hidden away when not in use. Instead, the ambilight applies a new frame where the TV is offered as a central piece of furniture, lighting and mood setting for the whole living room, which is the room where the main TV is located in most homes. The innovation was to create a TV that could act as a lighting source to set the mood of the whole room in sympathy with or even independent of its programme delivery function. The Ambilight is still a leader after 13 years.

Sometimes, the vision is generated independently by an entrepreneur, individual domain expert or senior leadership of an incumbent company (Blank 2012), and there is little appetite from them for the project team to fundamentally re-evaluate it. The team's job is to act upon it and implement it. In these circumstances, there is little possibility for the team to carry out its own research, which would likely be criticised or ignored. Though imperfect from the team's perspective, this marks the starting point for some innovation projects.

In any case, before embarking on further work, the team should endeavour to have a good understanding of the vision being acted upon and the insights upon which it is based. Of course, the vision that accompanies the frame won't stay fixed. It is always likely to be modified and updated with new learning from the ideation and validation work that follows the main reframing.

Armed with fresh insights and a reframed vision of the problem, new solution ideas can now be sought with a clear focus and purpose. There is no shortage of idea generation methods and every team will have its favourites, although these should be rotated from time to time to avoid becoming stale.

Transitioning from a great number of ideas to a selected one or two concepts involves filtering, evaluating, fleshing out, prototyping and testing with users. A concept describes the essence of the proposal and should not be obscured by the finer implementation details, which are for later. The objective is to determine clearly what the core value proposition to the user is and the critical attributes that must be in place for it to succeed.

The outcome of the ideation stage is one or two strategically outlined concepts together with identified assumptions behind their case for success. It is these assumptions (together with others) that require validation – or correction – before proceeding to further development.

Up to this stage, with design innovation's human centred approach, priority attention has been given to the user dimension of the innovation and to verifying the desirability attributes of your selected final concepts.

Now, instead of talking about a *concept* (a term mostly used in connection with desirability), we talk about a full *business proposal*, encompassing all four dimensions of user, technology, market and firm and the corresponding attributes of *desirability*, *viability*, *feasibility* and *viability*. The business proposal elaborates on all key factors required for success of the project. Many of these success factors are in the form of assumptions that add to the desirability assumptions of the basic concept.

The objective of the validation phase is to test and confirm – or alternatively alter, replace or abandon – these critical assumptions. As they become more solidly founded, everyone's confidence grows that the concept really will reach expectations after it has been fully developed and deployed, which is the focus of the exploit phase.

During the later stages of the Ideation phase and the Validation phase it is likely that several concepts have been considered, evaluated, iterated and many discarded. A preferred concept has emerged and has been extended into a complete business proposal. Many assumptions have been prototyped and tested and the project is nearing readiness to exploit the investment of time and money in research, reframing and prototyping.

But, before full scale production and launch, many questions remain about how the complete offering will perform in the heat of battle. What is the initial product configuration (minimum viable product) to be offered? What is the optimum business model that will sustainably deliver the innovation to the customer? Is the strategic alignment of the project with the organisation clarified and are the strategic actions that are necessary for deployment clear and prepared? Perhaps the proposed technology is found to enable some new, potentially interesting features or instead provides some adverse limitations on what had been proposed; if so, what should be the responce? Has the use context evolved from what was researched months ago and should the concept and proposal be updated accordingly?

All of these questions should have been considered earlier, even superficially, throughout the innovation process, but now it's time to test them in real life with real, paying customer, albeit at a limited scale that allows rapid adjustment where necessary and limits costs. The objective at this stage is not to earn revenue but to prove revenue-earning capacity. This is also a stage where substantial pressures are experienced by the innovator, both self-imposed and from the broader organisation and bosses. The innovator and others in the organisation are likely to be getting impatient. They have been excited by the prospects of the new proposal, and are anxious to get it quickly into scale in the market.

6 A process for changing mindsets

Whereas the direct influence of the ARRIVE process is reflected in project outcomes, there is an equally important longer term outcome that is observed in the mindset and culture change of the organisation. These arise from constant practice of the beneficial behaviours and repeatedly seeing their association with positive outcomes.

In many ways, firms are naturally inhospitable environments for design thinking, or indeed for any attempt at sustained innovation. That's because organisations and their sub-divisions have a default setting of conservatism and self-protection. The late Chris Argyris, co-founder of the science of organisational development and expert in organisational learning, called this default setting a Defensive Mindset (Argyris 2004; Christensen 2008). His theories explain how people have underlying governing values that cause them to act in ways and with consequences that persist. He described two opposing mindsets within organisations, viz defensive mindsets and productive mindsets, and he identified that the default state for many is the defensive mindset. The governing values for a defensive mindset, which are default values for most people, are:

- To be in control of one's environment
- To seek to win and not lose
- To suppress negative feelings, and
- To be as rational as possible

In contrast, a Productive Mindset leads to growth and has governing values:

- To obtain valid information
- To create conditions for free and informed choices, and
- To accept personal responsibility for one's actions.

These (Productive Mindset) governing values give rise to action strategies such as:

- Inquiry
- Public testing
- Collaboration
- Reflection
- Self-correction

In a separate domain of Child Psychology, Carol Dweck has identified that individuals may adopt either a growth mindset or a fixed mindset in regard to understanding and acting upon

their own abilities (Dweck 2006). In a business where a growth mindset flourishes, Dweck describes characteristic behaviours as eagerness to

- experiment and learn
- collaborate
- consult widely
- openly dissent and argue around a proposal

She also says that when a growth mindset is dominant in a firm, it supports successful business outcomes in the longer term and also leads to a happier workplace.

Clearly the productive mindset of Argyris and the growth mindset of Dweck are closely related and describe characteristics of organisations likely to be more innovative. It's interesting, and no coincidence, that these behaviours also align well with the behaviours that are distinctive of design thinking, viz. *visualising*, *deep enquiry/observation*, *collaborating, creating options* and *prototyping* & *experimenting* (Ryan and Devitt 2014). See figure 4.

Productive Mindset (Argyris)	Growth Mindset (Dweck)	Design Thinking
		Visualisation
Public testing	Consult widely	Deep enquiry
Collaboration	Collaborate	Collaboration
Inquiry	Experiment and learn	Prototyping & experimenting
Reflection & Self-correction	Openly dissent and argue around a proposal	Creating options

Figure 4 Characteristic behaviours of Productive Mindsets, Growth Mindsets and Design Thinking.

Further, both Dweck and Argyris refer to an internal reinforcing loop connecting mindset, values and actions. When that reinforcing loop is spiralling in the negative (defensive or fixed) direction, design thinking can be a powerful intervention into the cycle, which serves to change its orientation towards productivity and growth. See figure 5. The mindset-changing power of design thinking particularly comes from its characteristic behaviours listed above, all of which are positive externalised actions that over time directly influence values and indirectly impact the mindset. Individuals, through their repeated actions, become habituated to the positive growth orientation and the mindset is gradually reprogrammed. In turn, changes to individual mindsets gradually bring about cultural change in the whole organisation (Lehman et al 2004).

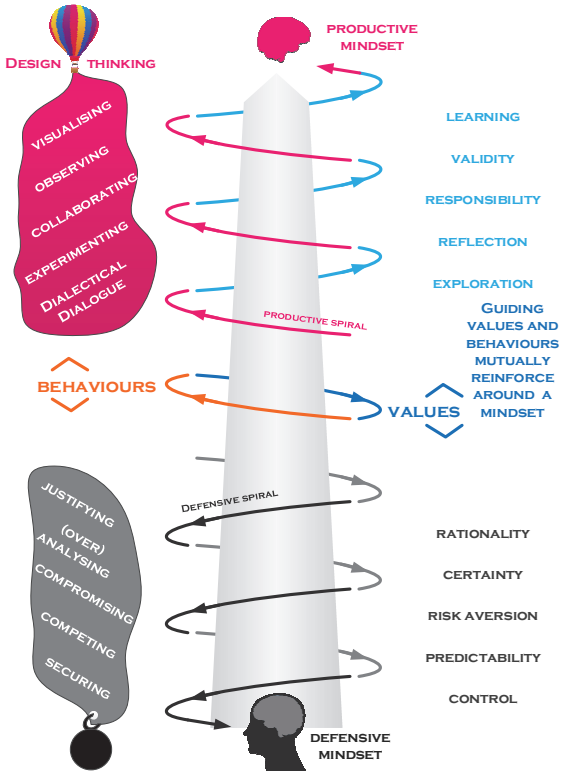

Figure 5 Design Thinking introduces positive behaviours and values, and thereby re-orients the mindset of individuals and organisations.

Behaviours have consequences, good and bad! Repeated good behaviours do more than provide immediately positive results. They also serve to embed skills and mindsets and form a momentum towards positive cultural shift. The strategic value of a clearly elaborated design thinking process lies in the pathway it provides for countering the drift towards defensive mindset and sustaining a positive momentum.

7 Discussion

Design Thinking needs a Process

Some authors disparagingly refer to DT as being little more than a collection of methods for creative idea generation and prototype building. Of course, we strongly disagree with this, but we have come to understand why it can be seen this way. As we referenced at the start of this paper, we have seen too many projects fail, and many of the failures are due to incomplete process execution. For example, good research may be inadequately synthesised into actionable insights. Ideation may be attempted without adequate direction through a vision or problem statement derived from research. Alternatively, there may be a weak connection between a problem statement and the reality of the problem space.

If DT is viewed only as a collection of methods to be accessed randomly, then it will never live up to its potential, nor will it endure over time within the operational fabric of organisations, because it will have no higher purpose or output formed from the sum of the disparate parts. The higher benefit of DT lies in the way it envisions and plots a course of creative exploration, discovery and validation, and provides a complete pathway for how to change from an unsatisfactory present to an improved future. Change such as this is not easy, and it doesn't come fast; it needs perseverance and confidence or, at least, faith. All organisations and project team members, except perhaps the rare experts, need to be able to see the high level picture of what is unfolding while they are immersed in the swamps of disorganised, indeterminate data and at the same time surrounded by pressures of peer scepticism, conservatism, expediency and reluctance to change that can characterise so many established organisations.

Some years ago, Lindberg et al (2008) presented an interesting paper exploring the trade-offs between having a prescribed design thinking process and a more flexible and adaptable approach to design workflows. The paper was entitled "Is there a need for a design thinking process?", and the authors' answer to the title question was more towards the negative. In contrast, we have found that indeed there is such a need, notwithstanding the dangers of reduced flexibility that Lindberg et al suggest our answer might imply. We accept that an individual expert designer may prefer to work in a way that allows maximum freedom to follow his/her refined instinct. Of course, that expert's instinct effectively follows a personal process that has been honed from years of professional practice. But, organisations are different. They are multifunctional and have requirements to coordinate across functions and to perform consistently. Their natural ways of doing things are usually process based (Schmiedgen et al 2015). Hence, organisations that wish to bring on board the benefits of design thinking in order to stimulate and sustain innovation need a design thinking process to provide a choreography for the various methods and behaviours that make up DT.

The good design thinking process must clarify the pathway and purpose of the paradigm transformation being undertaken, while allowing enough adaptability to accommodate itself to different problem types and existing organisational processes. But, the most important role of the process is to channel activities towards an effective and productive reframing of the problem. Reframing must be actively sought out, clearly derived from insights based on research, and provide a platform for new concept generation and development. It is the secret sauce of all great innovations and often can seem too nebulous as a concept to be addressed by project teams unless it is expressly called out in the process.

We believe the ARRIVE process achieves this twin aim of guidance and flexibility, while placing reframing in the pivotal position for the project.

As well as being a project pathway, the ARRIVE process also gradually embeds an innovation-friendly desirable mindset in the organisation. Repeated practice of behaviours and recognition of values that are conducive to developing a growth mindset (Dweck) or productive mindset (Argyris) eventually changes mindsets and the practised behaviours become 'the way things are done around here', which is the objective for a sustained innovation capacity in an organisation.

8 When it goes right!

We started this paper by describing situations where projects went wrong. We finish with an example of where things have gone right, in particular through the commitment of senior staff and alignment of the innovation programme, based on design thinking, with strategic company direction.

In October 2017, Ash Technologies Ltd. was awarded the prestigious Irish Times Innovation Award for Manufacturing. The awards aim to showcase and reward excellence in innovation across a range of products and services.

Ash Technologies is a medium sized enterprise based in Ireland since 1994 and now exports over 90% of its digital inspection and measurement solutions to over 35 countries around the world (Ash 2017).

Earlier in 2017, the company's latest disruptive product, the Omni digital microscope and measurement system, won the international design competition, Red Dot, distinction. Before that, in 2016, Ash was declared winner of the Innovator of the Year 2016 from the Small Firms Association of Ireland. Also, separately, it was named the Most Innovative Company 2016 from the Irish national body for enterprise support, Enterprise Ireland, and Deloitte.

Ash is a highly innovative company that attributes its innovation success to Design Thinking. Ash CEO and Founder, Hugh Maguire, says:

> "We use creative Design Thinking to actively empathize with our customers to understand their real unmet needs and jobs-to-be-done. We seek meaningful engagement and co-creation with our end users so we can develop the best possible solutions and services in the quality assurance industry, which results in cost savings, reduced test time, waste reduction and an overall improved quality process."

The success story started in earnest in Summer 2014 when Hugh decided to accelerate a transformation of the business from its traditional B2C markets towards B2B, following initial successes in the latter especially in the digital visual inspection arena. Hugh encouraged Ash's then Engineering Manager, Martin Cahill, to pursue a part-time MSc in Design Innovation at Maynooth University. Over two years, Martin learned the skills, methods and philosophy of design thinking and practised these by researching a new product line, which eventually became the Omni. At the end of two years Martin had his MSc and the company had a well-researched concept ready for development.

With Hugh's backing Martin, now Chief Operations Officer, has continued to propagate the methodology of design thinking throughout the company and today it is an embedded approach to innovation that continues to drive sustained innovation output from the company, which is recognised in the market and by the growing number of awards in the company's display cabinet. As part of the commitment to the design thinking approach to Innovation, Ash has hired a full time Customer and Market Researcher, Jane Nolan, to continue deep customer engagement and understanding of their needs through design thinking research. Jane is also a graduate of the MSc in Design Innovation and has a complementary broader role to facilitate and develop Ash's innovation programme.

Martin says "Design thinking brought us to a new level of awareness of customer and user requirements. It gives our development activities a clear target to aim for and keeps everyone focused on it without compromise. We're committed to design thinking as the best way to keep driving our innovation forward."

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