Designing Disruption – Linking Participatory Design and Design Thinking in Technology Orientated Industries

Carl Behrendorff, Sam Bucolo and Evonne Miller
Queensland University of Technology, School of Design
Brisbane, QLD, Australia
c.behrendorff@qut.edu.au, s.bucolo@qut.edu.au, e.miller@qut.edu.au

ABSTRACT
A vast proportion of companies nowadays are looking to design and are focusing on the end users as a means of driving new projects. However still many companies are drawn to technological improvements which drive innovation within their industry context. The Australian livestock industry is no different. To date the adoption of new products and services within the livestock industry has been documented as being quite slow. This paper investigates how disruptive innovation should be a priority for these technologically focused companies and demonstrates how the use of design led innovation can bring about a higher quality engagement between end user and company alike. A case study linking participatory design and design thinking is presented. Within this, a conceptual model of presenting future scenarios to internal and external stakeholders is applied to the livestock industry; assisting companies to apply strategy, culture and advancement in meaningful product offerings to consumers.

Keywords

1. Introduction
Design Led innovation establishes a different way of thinking strategic business management. Using the strategy of Design Led innovation enables companies to further take advantage of various methods (Bucolo & Matthews, 2011). Throughout this paper the terms Design Thinking (DT) and Participatory Design (PD) are referred to in this context; being methods of the strategic implantation of Design Led innovation.
The contribution of this paper is in the novel application of design led innovation within an Australian livestock industry context. In order to accomplish this, a collaborating company from within this industry has been engaged in the research. Moreover this paper examines methods to bridge design research into a technology focused company through the integration of a Participatory approaches and Design Thinking; effectively finding a mid-ground for companies to engage end users from multiple perspectives, typically across user needs, business requirements and technology demands (Bucolo & Matthews, 2011).

To date the adoption of new products and services within the Australian livestock industry has been quite slow. The industry is not recognised as being a heavily design orientated one, instead the industry is quite technology focused in its approach to innovation. This focus on utilising technology to fill latent user needs has traditionally brought about incremental innovation solutions. Hence innovations throughout this industry are predominately ‘value adding’ in nature (Boland, 2009). Boland (2009) summarises this value adding process to be a developing or transforming of a product/service from an original condition to a more valuable state. Furthering this, Parcell (2009) describes five manners for the industry to value add innovations:

- Producing and marketing a real or perceived quality/premium attributes (or characteristics).
- Reducing transaction costs.
- Bundling products.
- Producing and marketing a commodity that improves operating efficiency somewhere up the supply chain.
- Producers owning assets somewhere up the supply chain for further commodity processing.

However the industries end users (farmers) are not credited with being keen to adopt new and innovative processes. Conventionally this has been attributed to the deep rooted traditions of the industry; which so far has been a troublesome issue for innovating companies to address.

Also compounding this issue is that these companies need to create a product/service that is able to comply with the sociological structures of this ‘traditional industry’. Historically to address this sociological determinant companies have used the classical diffusion model (Guerin, 2000; Rogers, 1995) and targeted opinion leaders to communicate their novel solutions in the market.

However the livestock industry is different to others in that the opinion leaders are not the end users (farmers), but individuals called ‘sales agents’. This group services the industry with a range of value added products. As part of their role, this group of stakeholders provide marketing support and financial and technical services for the primary producers described above. However these stakeholders have not proven successful in the communication of disruptive technologies.

Historically the adoption of innovations has been slow to diffuse in the industry, due to the fact that this industry is very much focused on merely technology application. The Australian livestock industry can
now learn from other companies within other technology fields, through the adoption of Design Led
innovation strategies.

2. RESISTANCE TO TECHNOLOGY WITHIN THE INDUSTRY

As mentioned above, the Australian livestock industry maintains a prominent technology focus. Many companies in the industry aim to design value adding technologies and transfer these into targeted services. Nevertheless this user centred approach has only produced incremental innovations and have recorded poor uptake so far. Therefore this paper poses the potential for design led innovation to better integrate more disruptive technological solutions. To best understand how previous technological innovation occurs in the livestock industry, two examples are presented below.

2.1 RFID Tagging

This technology is currently being used in the Australian livestock industry (and the global cattle industry) (Ribeiro, Scavarda, & Batalha, 2010) as a means for identification and tracking of livestock. From the outside it appears that the technology fits perfectly into the programs of the Australian end users, where more information about stock is generated and automation now has become a real possibility for other programs. Indeed literature has identified this RFID technology as a plausible and lucrative however at least in the Australian context, end users have attached negative associations to the technology (ABC Premium News, 2005). This technology continues to flounder in the marketplace because there is no value proposition for the end users (i.e. the business model does not work). Ultimately the use of this technology has not seen a rise in end prices of livestock; therefore as the farmer invests money in this technology, they do not a return on their investment. Thus the innovation is not diffusing into the marketplace as well or as fast as researchers might have predicted.

2.2 Online Auctions

The Australian livestock industry has seen an introduced of online based electronic sales markets for livestock (Driedonks, Gregor, Wassenaar, & VanHeck, 2005; Rolfe, Gregor, & Menzies, 2003). But historically the attitudes held by end users in the industry towards the use of computers and the internet have been documented as being negative (Frank, 1997). In recent times the industry has begun to adopt computers in ‘on farm contexts’. In 2001 the proportion of farms using the Internet rose to 58%, from 40% in 1998 (Rolfe, et al., 2003). Since this period the industry has seen a steady growth of this percentage, rising to 66% of farms using the internet and a computer (Australian Bureau of Statistics, 2008).
It is widely recognised that agricultural e-markets make commercial business sense with reduced overheads. However attempts to create an Australian livestock e-market have not proven successful (although it continues to operate). Authors suggest that the system failed due to the “inadequacies or immaturity of the technologies” Gengatharn (2006 p.25).

Driedonks explains that “The experts believed that usage of online e-markets was just below or ‘on the edge’ of critical mass” (2005 p.63) where literature has previously found is needed to sustain an operational business (Grieger, 2003).

It was found that online auctions did not adequately meet the social experience offered by saleyards (the traditional selling mode) (Driedonks, et al., 2005). Therefore this example also shows that the livestock industry has failed to design these systems in ways that an end user can easily see the value potential of their use.

2.3 Failure of Traditional Technology Extension Practice – Diffusion of Innovations

The contemporary Australian livestock market has and is currently proceeding through a period of technological change. As the remainder of urban society continues to embrace technology, the livestock industry is faced with a choice to remain loyal to their traditional past processes or embrace novel approaches. The trouble is that these tasks have been performed, typically the majority of their lives. Therefore designing for this end user requires a different attitude than traditional diffusion of innovations offers.

Innovations are documented to be ideas, products/systems or novel processes that are presented to a user in a novel manner (Pease & Rowe, 2005; Rogers, 1995). Following on from this definition, Rogers defines diffusion as “the process in which an innovation is communicated through certain channels over time among the members of a social system” (1995 p.5). However it is seen that this system does not aid the company in engaging their end users. For a company to label their end users and sell to early adopters letting products diffuse into the market has proven to not work in the livestock industry of Australia. However much research into why Australian livestock end users do not typically embrace novel innovation has been documented.

Frank (Frank, 1997) argues that companies who try to introduce innovations in the livestock industry do so because they believe that stakeholders will respond to innovations in order to save or make money. However Frank (1997) questions this understanding and points toward a better use of socio-cultural diffusion theories. Through his study, Frank (1997) surmised that livestock stakeholders are more likely to try to maintain a satisfying ‘way of life’, over/instead of becoming more productive and/or efficient. Frank’s (1997) study found that north Queensland livestock stakeholders perceived that adopting new
technology to become more productive would ultimately lead to more work to perform, therefore having to do more work would take away the farmers way of life that they enjoyed.

“Adoption behaviour in the north Queensland study was consistent with the concept of appropriate technology for appropriate needs, rather than an orientation towards high profitability” (Frank, 1997).

Frank (1997) summarises several primary assumptions to the non-adoption of technology by Australian cattlemen and condenses these points into three main statements:

- “Research has been based on values which are scientific and oriented towards profit.”
- “Technologists have assumed that practices are desirable and suitable for adoption.”
- “A new practice does not require modification of an individual’s self image, personality and/or social environment.”

Hence the failure of the companies’ innovation of new value adding products and services can be attributed to a multitude of reasons. The obvious reason is that these companies did not consider the end user in their strategic design directions. With more large and SME’s realising the advantage that design can bring to their company, the advantage is now that designers can shift the focus of the company towards the end users of the project. Something of which Frank (1997) was able to document thoroughly.

Frank (1997) and Guerin (2000) point toward the proper consideration of end users in the Australian livestock industry; moreover establishing an intimate understanding of the end user through a participatory means. This intimate appreciation may therefore lead to the identification of new value propositions.

3. Potential for Participatory Design

PD began within the Scandinavian countries as an approach to engage end users early on within the human-computer interface (HCI) body of research. Recently the application of this HCI approach has moved into other fields, for example design research. However the use of a Participatory Design approach within the livestock industry had not been widely explored (Frank, 1997; Guerin, 2000). The advantages of the PD method are that researchers (or designers) can associate more closely with real stakeholders (end users) at an early stage of design exploration. Importantly, due to the nature of the PD method, this allows rapid realisation of social meanings and attitudes of innovations held by stakeholder participants.

Depending on the PD methodology, it may not differ from traditional UCD tools, in that designers still focus squarely on the user needs alone, as opposed to the business needs as well. These distinctive UCD tools, such as observations, focus on the subsequent evaluation of product features or incremental user needs (Bucolo & Matthews, 2011). Ultimately the main limitation of PD is that it takes more than simply engaging end users to design a novel, successful product which has potential to ‘change the game’. Design
led innovation therefore has the potential to drive disruptive innovations and lead companies towards the creation of new markets.

4. DISRUPTIVE INNOVATION

A disruptive innovation falls within the breakthrough category of a novel process or innovation. However a disruptive innovation differs to other segments within the breakthrough category as a disruptive innovation has no market to sell into. More accurately these innovations typically hold no perceived value in a mainstream market in which they are applied. In fact Christensen (1997) describes a disruptive innovation as performing worse with little or no competitive reason to be used by the mass market (refer to figure 1). However a disruptive innovation is targeted at the least demanding user within a given market. These end users are happy to use the first generation of a novel technology and do not require it to fulfil every need in their industry. Alternatively Daneels provides a good definition of disruptive innovation as:

“A technology that changes the bases of competition by changing the performance metrics along which firms compete...” (2004 p.249)

Obviously it is smart for companies to invest in disruptive innovations, to become the market leader within the industry. However due to the theoretical nature of disruptive innovations it is difficult for these companies to use a UCD (User Centred Design) approach to design the system - “Since the new technology may be viewed objectively as crude, it leads to the belief that it will find only limited application” (Sainio & Puimalainen, 2007 p.1327).

![Figure 1: Disruption of Market Needs](image-url)
Therefore the problem for SMEs and large companies is two-fold. Firstly, the enterprises wish to engage their end users more effectively, this is currently occurring through the use of design. However on the other hand, companies need to look towards implementing disruptive innovations to lead their growth into the future.

Where design can be applied within the context of disruptive innovation is that designers have the ability to conceive a range of future solutions to a given problem. Design brings a different way of tacking problems to generate novel solutions. A more accurate labelling of this process is Design Thinking. Where not only users needs are evaluated (UCD/PD) and where not only technology capacity is focused upon (Disruptive Innovation). Design thinking combines a third dimension to this equation; where value propositions are fully exploited through meaningful business opportunities. Designers must communicate this to the companies they work with from the outset of a new project, but more importantly, designers must do this visually – through the use of future scenarios detailing all three above mentioned standpoints.

5. **POTENTIAL OF DESIGN THINKING**

Design thinking is an approach which looks to marriage the gap between business strategy and designers. Brown proposes that “Design thinking is a discipline that uses the designer sensibility and methods to match people needs with what is technologically feasible and what a viable business strategy can concert into customer value and market opportunity” (2008).

Traditionally design has been treated as a downstream development process, what design thinking embraces is engaging the designer on the project from the outset. This design driven innovation strategy is the essence of design thinking.

Brown (2008) discusses that the advantage of this approach is strategic, where compared to the traditional use of designers; design thinking creates dramatic new forms of value to the end users. This is able to occur because at the earliest stage of the project, designers must collaborate with the end users of the product or service. Hence the advantage of design thinking is that it can suggest creative alternatives to the assumptions made in developed societies/markets. Design thinking is a tool for imagining these experiences as well as giving them a desirable form. But before a company (or a designer) can add form to potential user experiences, they must consider the meaning behind what a potential design solution may be for the end user. As Verganti (Verganti, 2008) explains, this is the essence of design driven innovation.
5.1 Design Driven Innovation

Focusing on the associated meaning of a product is a theory explained by Verganti (2008) documented in a design-driven strategy. This strategy suggests designers should not only think about the role a new technology plays in novel innovations, but also that the attached meaning is quite important to its overall success. Hence innovations that radically redefine what a product means for a customer are therefore likely to be more successful as they are differentiated from the competition.

Unfortunately this design-driven approach cannot be found through users’ insights. “The socio-cultural context in which they (consumers) are currently immersed makes them inclined to interpretations that are in line with what is happening today. Radical changes in meanings instead ask for radical changes in socio-cultural models, and this is something that might be understood (and affected) only by looking at long-term phenomena with a broader perspective.” (Verganti, 2008 p.438)

Verganti (2008) suggests that “a reason why design-driven innovation has largely remained unexplored is that its processes are hard to detect when one applies the typical methods of scientific investigation in product development, such as analyses of phases, organisational structures, or problem-solving tools” (p.438). These typical methods of scientific approach are depicted in figure 2 as a “market pull approach”, i.e. Listening to exactly what consumers ask for, or traditional UCD. Figure 2 also displays radical improvement based on technological gains, which is heavily associated with disruptive innovation (Christensen, 1997).

However it is seen that design-driven innovation strategies focus on the meaning of the novel system as the market driver, over the technological components of the project. This paper poses that the innovation must sit in the right hand side (the grey semi-circle) of the graph. Design driven innovation however does not discount the end user; but simply considers more than the end users perceived needs. More accurately what companies can take away from design-driven, design thinking, is that there needs to be consideration from a number of different sources when designing for end users; namely consideration of technology, user needs and business viability/value (refer to figure 3).

Up until now this paper has presented literature on differing design and business theories. However the premise of this paper is to link both PD and Design Thinking through a disruptive technological form. Figure 3 depicts the overlap of three considerations which designers should exploit in a design of any novel product. Design driven innovations therefore exist within the triangular overlap of all three standpoints. Where as one standpoint changes, consideration to the effect on the others is also given. Where companies gain from using this approach is that design can do this very early on in a project. Therefore saving time/money etc but more importantly being able to drive the project, not from one of these standpoints, but from all three simultaneously. Therefore the final design solution is not presented as an artefact in isolation,
but as an integrated product/service which anticipates future user needs, builds future proposals and encourages feedback (Bucolo & Matthews, 2011).

![Figure 2: Innovation strategies (Verganti, 2008)](image)

**Figure 2: Innovation strategies (Verganti, 2008)**

![Figure 3: Three considerations to disruptive design-driven innovation (Bucolo & Matthews, 2011)](image)

**Figure 3: Three considerations to disruptive design-driven innovation (Bucolo & Matthews, 2011)**

What figure 3 allows is for a company to use design thinking more effectively by targeting each of these three factors. Typically a company will obtain a piece of technology first, or indeed identify a latent user need (then look for a technology to service that need). However what design thinking argues is that it is dangerous to simply combine any two of these factors (as has been documented in the Australian Livestock industry with slow diffusion levels). Designers and companies must also consider a value proposition in
terms of a business strategy. The most notable example of a company doing this is Apples IPod/ITunes system or Nikes fitness pedometer being linked to an internet service catering the value needs of their end users (runners wanting an add-on service from their exercise equipment).

The major point of this conceptual model is the co-development of these future scenarios (visually) which is informed and indeed facilitated with all stakeholders of the system. Significantly it is the engaging of internal (design, engineering, marketing, management) and external (existing users, future customers, supply chain workers, manufacturing etc…) stakeholders – to deliver success in this process. Hence the outcome is that all stakeholder conversations/workshops are grounded through the use of a common visual language (Bucolo & Matthews, 2011).

The value of design is in its ability to create and construct novel ideas and approaches to innovative solutions. Design thinking (Brown, 2008) offers techniques that enable participants to view alternative ‘new’ futures. One of these techniques is described throughout the case study of the Australian livestock industry was the use of novel product/business scenarios, later presented in a case study in this paper. Building upon Verganti’s (2008) design driven model and the tri-consideration of technology, user needs and viable business alternatives; the case study presents the tools used for a large Australian agribusiness to engage with end users in manners which have not previously been tested in the industry.

6. CASE STUDY
This case study explains the use of Design Thinking and Participatory Design in the Australian livestock industry by a large domestic agribusiness. As noted earlier, the livestock sector has not been known to use design as a tool to develop novel technologies/systems. Instead, companies have typically innovated for innovations sake, focusing heavily on technology alone. Subsequently adoption rates of innovations have been typically slow.

6.1 Design Thinking Method
This study was founded through design thinking to engage stakeholders. However in itself, using PD alone in the development of a disruptive innovation is not enough to design a complete product. Instead this case study used an integrated PD/DT mixed method. Looking to focus on Technology, Business and user needs as noted in figure 3 above.

The Australian livestock industry presented a different view on technology adoption; in that acceptance and final implementation of products are very much dependant on cultural factors of the subjective norm (Pease & Rowe, 2005). Obtaining an understanding of the social meanings of innovations throughout the industry
was crucial to developing a disruptive technology, as Verganti (2008) argues will lead to higher success of products. Therefore to achieve this, the use of a mixed UCD method was needed. The case study was carried out through a multi-staged format as described in table 1.

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<tr>
<th>Stage 1</th>
<th>Semi-structured interviews / observations</th>
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<tr>
<td>Stage 2</td>
<td>Co-design</td>
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<tr>
<td>Stage 3</td>
<td>Workshops</td>
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### 6.2 Innovating through Business Model Identification – Stage 1

Before the creation of a future proposal was designed, the initial stage of the case study drew upon semi-structured interviews of key stakeholders amid the industries value chain. With a mixed UCD and PD approach in this first stage, attitudes and other cultural understandings (meanings) were found and documented. In order for the designer to gather the required knowledge for accurate representation and communication of novel ideas, further field observations were performed (refer to figure 4). These observations allowed the designer to understand the socio-cultural underpinnings of the industry. By immersing one’s self or becoming a participant observer (Sasha, Michael, Tyler, Kurt, & Markeda, 2004), the designer could understand in deeper knowledge the implications of what was to be proposed. Indeed Sasha (2004) explains that the design of an artefact that ostensibly changes the industries normal occurrences might be naive and even arrogant.
Building upon this knowledge, researchers designed a system that took advantage of the proposed technology and its industry wide implications. The major finding of the first stage supported the notion that the proposed technology did not currently meet the mainstream market needs of the industry; however the perceived value proposition of the technology was of particular interest to most stakeholders. Figure 5 graphically depicts these findings in a disruptive sense.

![Figure 4: Observation of end users: identifying latent needs](image)

![Figure 5: Disruptive positioning of proposed technology in a marketing of livestock context](image)
6.3 Creating Future Proposals – Stage 2

The development of the future scenarios was grounded in the learning’s derived from the first stage. Essentially the scenarios became a prototype of the proposed design solutions. Even so, these scenarios were still only an external response to the first stage learning’s. Carroll maintains that;

“The mediator (in this case the designer) role has been criticised on grounds that mediators may have too little knowledge to represent users and developers adequately to one another.” (1996 p.288)

Therefore the need to further present the scenarios firstly to internal stakeholders was required. Subsequently a co-design of these scenarios was held and hence a ‘formative evaluation and redesign of prototypes’ (Carroll, 1996) occurred. An example of two slides (from 3 differing scenarios) is presented in figure 6.

The scenarios were designed and evaluated through the exploration of user needs, review of technology and business models. In this way no part of the proposal was over looked and the collaborating company could see exactly how the future scenarios could fit within their value propositions to customers. Importantly the three scenarios developed the same characters and took the reader on a journey throughout the entire proposal, explaining all three standpoints as presented in figure 6.

![Figure 6: Scenario excerpt of a proposed technology within a business model](image)

6.4 Extracting Meaning through Future Scenarios – Stage 3

The future scenarios were advantageous to the case study for the fact that stakeholders to quickly related and understood each proposal. Using visuals as a common language helps to assist in the comprehension of
the future proposal, and allows stakeholders to explore deep concepts more easily (Bucolo & Matthews, 2011).

For the purpose of determining the social impact of disruptive innovations (which this case study is concerned); the proposals were created to provoke an engagement within the research participants (Bucolo & Matthews, 2010). Bucolo and Matthews (2011) explain the advantage of triggering stakeholders in relation to challenging social patterns/innovations is that end users will quickly identify issues that are ‘against the norm’. Further to this, stakeholders can easily comment on the proposals and offer implications to how each slide would affect them on a personal level, but also in a sector wide manner. The design proposals specifically drew out cultural barriers to market and practical concerns of the innovation.

### 6.5 Findings and Implications of Case Study

The majority of stakeholders in the Australian livestock sector have traditionally been documented in literature to be unwilling to adopt novel innovations. Given this, talking to these stakeholders about change and disruptive innovation initially seemed a difficult and daunting task. Pleasingly the results of the design driven, PD approach employed in this case study contradicted this broad assessment. The third stage of data collection involved the use of workshops, populated with stakeholders from particular sectors of the industry.

As initially expected, external stakeholders were intrigued/perplexed by the proposals. Most end users immediately attached sceptical judgments of the future scenario before completely understanding the design solution. Anticipating this to occur (through lessons learnt in stage 1 & 2), the characters in the stories also attached sceptical judgements to technologies. By using characters in the design narrative that demonstrated a scepticism to all technology presented to them, the stakeholders were able to relate more easily to them. Therefore when the proposals progressed and the value of the technology took shape, the characters presented made positive connections to the technology. Through this change of attitude in the scenarios (by the characters) the designers could therefore test the responsiveness of the end users. Interestingly, as the characters made positive acceptance of the disruptive technology, so did many of the end users who participated in the study.

For most of the stakeholders this worked well to extract cultural/social issues surrounding the adoption of innovations within the livestock industry. Major themes of education, communication, practicality and a culture of trial-ability of technology were identified. The PD method allowed designers to engage with stakeholders in a way that allowed both positive and negative opinions to be voiced.

It should be noted that the perceived scepticism did still occur but the major outcome of the design thinking process was that the partner company was able to find this out. More importantly the designers were able to
critically evaluate the positioning of the technology, the needs of the user and the value proposition of the business model. Hence the process of using DT/PD worked in this case study as the company involved was able to communicate to end users about disruptive innovations, quickly and successfully, where usually only incremental innovations have been able to be explored in the past.

Lessons Learnt by Partner Company

It is often too easy to get carried away with running a national business with managers etc getting lost in internal processes, rather than looking forward and understanding stakeholders needs. “(Initially)...When the designers first started working with us, at first it was hard to see the value of the project, or even where it would lead. After learning about disruptive innovations and participating in design led workshops, we became more excited with the project and seeing new, non-traditional markets appear was quite encouraging”. The partner company was therefore able to experience the value of design and how driving a project with a Design Led strategy can actually be of value to the company.

6.6 Evaluating the Combination of Participatory Design and Design Thinking

Many authors have argued that innovating through Design thinking is advantageous to companies looking to become design orientated (Brown, 2008; Bucolo & Matthews, 2011; Verganti, 2008). Furthering these points, this paper suggests that using a participatory methodology not only compliments this approach, but also encourages closer engagement between companies and end users. Using the tools of design thinking and testing the design outcomes through the process of constructing visual ‘future scenarios’ has proven to be a successful tool for companies to innovate disruptive innovations. Table 2 compares the benefits of the combination of these design approaches.
Table 2: Evaluating PD & DT

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<th>Value of PD</th>
<th>Value of DT</th>
<th>Combination</th>
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<tr>
<td>○ Facilitated close engagement of stakeholders</td>
<td>○ Considers business/technology/</td>
<td>○ Business can engage end users in meaningful ways</td>
</tr>
<tr>
<td>○ Allowed qualitative concerns to be expressed (meanings)</td>
<td>○ end-users</td>
<td>○ Quickly relate to social implications of proposed innovations</td>
</tr>
<tr>
<td>○ Facilitated a complete understanding of internal/external stakeholders</td>
<td>○ Possible to create better future proposals</td>
<td>○ Companies are able to be confident with moving projects forward to market</td>
</tr>
<tr>
<td></td>
<td>○ Holistic approach to design</td>
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Importantly in the evaluation of the PD approach, it is not only the end users who gain from the experience. Both the designers in this case study where able to gain more knowledge from interacting with end users on the ground. Hence the use of a PD approach is mutually beneficial to all stakeholders including the implementing company.

Limitations of the process

Stakeholders were encouraged to think ‘twenty’ years into the future, but for some, the constraints of contemporary technologies restricted the overall ‘innovative thinking’ of the group. Until this was established, the value of the proposed design could not be discussed. Some participants could not even begin to consider the end value proposition, before understanding the actual process of how the technology would work.

For the higher percentage of the stakeholders who participated, they showed immediate ability to think about the future in terms of innovation and technology. As the group’s discussion moved forward, the scenario worked to challenge the traditional value exchange within the industry. This ‘provoking’ of the group was intended to create debate amongst the group of stakeholders. This worked best with larger groups. Unfortunately given the rural constraints of the industry (time/travel constraints etc), some focus groups were only conducted with 1-2 participants, and the same level of discussion was not recorded.
7. CONCLUSIONS AND CONTRIBUTION TO DESIGN COMMUNITY

The overall contribution of this paper and case study is in the applicable resource of design thinking processes to other industries where technology is the focus of the industry. In these industries, technology companies’ produce and work towards technology orientated research goals. Through the investigation of the Australian livestock industry, companies within the industry are primarily focused on filling market needs with technologies alone. In order to address this problem traditional UCD and PD methodologies will not work to alter this either. These processes typically lead to the development of incremental innovations. The point of this paper however is not to discount the development of these incremental innovations; indeed business’ should maintain a diversified product family to be successful. However in industries such as the Australian livestock one, where technologists continue to cycle through incrementally inspired innovations, sometimes there is a need to disrupt the industry; to move into new pathways. However the current tools in which business managers and designers have are not conducive to the development of these disruptive technologies and business models; let alone engaging with end users who typically find it hard to comment on such ‘far fetched’ proposals.

As used in the case study and elsewhere (Bucolo & Matthews, 2010) the use of design led innovation strategies, such as design thinking should be at the forefront of SMEs and CEOs minds in order to create and establish new and value driven product offerings and consumer markets. The integrated approach outlined in figure 3 effectively facilitates grounded design thinking which extends to the use of future scenarios in the earliest possible stages of new projects. This strategic approach however is only as useful as the stakeholder (both internal and external) engagement entered into by companies practicing a design driven innovation strategy. For companies to appropriately engage with these stakeholders, the use of a PD method can be used and facilitated through the use of future scenarios.

The PD approach allowed high-quality stakeholder engagement in the context of the agricultural industry. This was found to be of high value, as the designers could extract cultural issues relating to the adoption of innovation, with the livestock sector. Focusing more on this issue than the technology itself will mean that, further R&D efforts can be more specifically positioned in the value chain. As the proposed technology posed disruptive attributes, establishing this understanding is vital to the development of the proposed system and hence the partner company strongly embraced the process.

The contribution of this work highlights that innovators in the agricultural field need to understand that the industry is indeed a traditional one, but also that it is also certainly innovative. These two terms have previously been confused. The understanding that the industry is a traditional one is not completely representative, because it assumes that stakeholders are purely non-adopters. More accurately livestock
stakeholders need to consider more issues than in other consumer markets, before adopting new innovations.

**Implication to Design Research**

The use of future scenarios, as documented through the case study earlier in this paper proved to be an excellent example for large and SME’s to engage with their end users. As the product scenarios are fluid in nature, these become effective prototypes for extracting not only opinions of end users, but allowing the end users to actively co-design the system is fundamental to its success. As these are cost effective and easily created/re-designed, the use of future scenarios is highly recommended as a tool to test value propositions in terms of technology, user needs and business models.

8. **ACKNOWLEDGEMENTS**

The authors of this paper would like to acknowledge the industry partner Landmark. Without the support and application of resources this case study would not have been possible. As with any design proposal of this nature it took trust and good will from Landmark and we appreciate the readiness shown to trial and test the above mentioned design thinking strategies in their company.

9. **Reference List**

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