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Putting Resilient Sustainability into Strategy Decisions - case studies

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Structured Abstract:**Purpose**

The purpose of this paper is to report the results of testing a new approach to strategic sustainability and resilience, SuReSDS™.

Design/methodology/approach

The approach was developed and tested using action-research case studies at industrial companies. It successfully allowed participants to capture different types of value affected by their choices, optimise each strategy's resilience against different future scenarios and compare the results to find a "best" option.

Findings

SuReSDS™ enabled a novel integration of environmental and social sustainability into strategy by considering significant risks or opportunities for an enhanced group of stakeholders. It assisted users to identify and manage risks

from different kinds of sustainability-related uncertainty by applying resilience techniques. Users incorporated insights into real-world strategy.

Research limitations

Since the case studies and test organisations are limited in number, generalisation from the results is difficult and requires further research.

Practical implications

The approach enables companies to utilise in-house and external experts more effectively to develop sustainable and resilient strategies.

Originality/value

The research described develops theories linking sustainability and resilience for organisations, particularly for strategy, to provide a new consistent, rigorous and flexible approach for applying these theories. The approach has been tested successfully and benefited real world strategy decisions.

Keywords:

Sustainability, resilient strategy, scenario use, decision-support, risk management, opportunity hunting, case studies

Article Classification:

Research

1 Introduction

This research aims to develop a new generic, holistic approach for comparing strategic choices, to assist decision-makers in improving the sustainability and resilience of company strategies. This approach is for use within strategy formation from alternative business models to products-and-services design. The combined approach was christened SuReSDS™, for Sustainable Resilient Strategic Decision-Support (Winnard et al., 2014a, 2014b). It is novel as there are no fully-realised openly available approaches for resilient sustainability (see Bocken et al., 2013, Winnard et al., 2014b). SuReSDS™ enables decision-makers and strategy analysts to integrate new sustainability and resilience information into decisions. It also produces metrics for assessing implications and impacts of different strategic options. It was developed and tested successfully at two industrial organisations using a case study approach.

This paper is organised as follows: key aspects of theory are summarised, followed by the outline of the research methodology, then come the discussion of case study results and conclusions are reported at the end.

2 Literature review

This paper builds on theoretical and field research detailed in Winnard *et al.* (2014a, 2014b) which explored how to improve the strategic sustainability and resilience of organisations as complex adaptive systems. Organisational resilience was defined as combining:-

- capacity to continue functioning when disrupted
- capacity to recover from disruption
- adaptive capacity for developing new abilities and resources, ideally proactively

Organisational sustainability seeks to:-

- reduce negative and improve positive impacts of activities, restore natural capital, enhance human and maintain ethical capitals.

By

- reducing resource extraction and pollution
- identifying unsustainability risks/opportunities, prioritising and mitigating/exploiting the most key ones

- maintaining economic capital to operate long term

(Simplified from Winnard et al., 2014b)

Sustainability and resilience are related concepts but focus on different areas; both are required (along with other qualities) for organisations to flourish. *“If improved sustainability must be the ultimate and always moving goal defining the direction of travel, then resilience is the ability not to be pushed off course along the way”* (Winnard et al., 2014b). Sustainable organisations can improve their resilience by finding and managing or exploiting new sustainability risks and opportunities, proactively adapting to short- and long-term change. Conversely improved resilience supports sustainability over time should business conditions shift (*ibid.*).

To clarify this blend of properties we can consider the different types of uncertainty and thus risk the blend addresses. Figure 1 shows the relationship between “knowns and unknowns”, where “uncertainty” refers to aleatory (randomness) uncertainty and “access” refers to epistemological (knowledge-based) uncertainty. This is a simplification of modern theories on uncertainty and chaos in strategy (see particularly Kurtz and Snowden, 2003).

Figure 1- interaction of uncertainties in strategic risk (modified from Winnard et al., 2014a)

By accessing and acting on information about its (un)sustainability, an organisation improves its handling of risks and opportunities, especially new ones. Epistemological uncertainty is reduced by using more of the available information. This maintains its competitive advantage, especially if competitors do the same. Recent evidence also shows the enhanced long-term success of more sustainable companies (Eccles et al., 2012). By utilising resilience-building techniques on its products, services, and strategies, the organisation reduces its irresilience, so better withstands disruption from unpredictable random events (Burnard and Bhamra, 2011, Taleb et al., 2009), i.e. aleatory uncertainty. These effects are shown in Figure 2.

Figure 2- effects of SuReSDS™ on strategic uncertainties

Drawing from other sectors and specialisms (internalising “unknown knowns” the company has previously ignored), in particular broader social, environmental and economic sustainability, should allow an organisation to develop new capabilities and close the performance gap with more proactive competitors (Winnard et al., 2014a). Importing resilience techniques improves on rational cognitive decision-making styles (Mintzberg et al., 2009) by including some chaotic uncertainty (“known unknowns”) common to modern complex business contexts (Kurtz and Snowden, 2003).

Due to the lack of suitable approaches identified in earlier work (Winnard et al., 2014b) SuReSDS™ combines the most appropriate elements of existing processes; Porter and Kramer's Creating Shared Value (CSV, 2011), Krumdieck's Transition Engineering (TE, Krumdieck, 2013a, Krumdieck, 2013b), and Taguchi's Robustness Engineering (RE, FMC, 2011). This is covered in detail in the research work of Winnard *et al.* (2014a). Essentially CSV provides a business-strategy framework based in sustainable value. TE, as a sustainability strategy technique for complex systems, provides structured processes to "flesh out" CSV. RE, a design technique for complex systems engineering, enables a generic analysis of resilience of available strategy choices in different future scenarios.

This synthesis uses a Product-Service System viewpoint from Design for Sustainability techniques (UNEP and TUDelft, 2009), which concentrates on functions of products and systems to innovate sustainable solutions (see e.g. Williams, 2007). Figure 3 shows the process.

Within SuReSDS™ the sustainability and resilience of strategies are analysed via their effects on social, environmental and economic capitals for significantly-affected stakeholders. This follows Triple Bottom Line assessment methods, chosen as being relatively widespread and understood amongst businesses (Winnard et al., 2014a).

3 Research methodology

An action research approach was selected since intervention in real companies was required (Bell, 2010), via case studies which were determined as the best way to test the new approach in specific strategic decisions at selected organisations (Yin, 2009). Data were collected from 2011 to 2014 by qualitative interviews, observations and analyses in accordance with case study best practice as laid out by Bell (2010) and the seminal author in case studies, Yin (2009). Participants were recruited from teams conducting strategy studies for senior staff, identified as the most appropriate intervention point. The principal author occupied various roles within case studies (see Table 1). The research was iterative and interpretivist, using reflection by participants to inform new case studies (Mason, 2002).

The first stage used grounded theory (Creswell, 2009) to establish the baseline of existing practices in strategic sustainability and resilience, via interviews at each test organisation, external interviews and publically available data. Interviews used an open question set from which strengths and weakness emerged for each organisation, compared to best

practice. The second stage synthesised methods chosen from literature and field searches (see section 2) into a coherent whole, using pilot case studies. The final stage applied SuReSDS™ in further studies, testing and improving its processes. Results were cross-checked, compared and interpreted according to case-study best practice (Yin, 2009) to draw robust conclusions. Since results were qualitative and the number of case studies small these cannot be tested for statistical significance.

3.1 Organisation 1

Ford Motor Company manufactures passenger vehicles and light trucks (FMC, 2010). The automotive industry suffers low profit margins, increasing costs, market volatility, and heavy dependence on steel and fossil fuels (Wells, 2010). A significant contributor to global economic wealth, climate change and air pollution, the sector receives many policy interventions. It is also exposed to significant demographic, technical and cultural shifts affecting future car ownership, products and the fundamental nature of mobility (KPMG, 2012). For example Jaguar Land Rover recently moved to produce only electric and hybrid vehicles from 2020, probably responding to future combustion-engines bans by national Governments, and competition from disrupters such as Tesla (Vaughan, 2017). All these factors affect Ford's resilience, its environmental, social and economic sustainability, and drive intense sectoral change.

The Sustainability Planning function of the Powertrain Product Development division of Ford of Britain hosted and part-funded the research. Strategic decision-making was the context as the department fulfils a sustainability-oriented role in developing strategies for management. Existing processes lacked a way to handle the challenges of increasingly complex sustainability issues affecting decisions. The purpose of SuReSDS™ was to assist in identifying and managing risks and opportunities arising from these issues. The research needed to investigate the link between strategic resilience and sustainability, since resilience can be viewed as resistance to disruption (Bhamra et al., 2011), and turbulent business conditions made this of organisational interest. The two concepts were also suspected to be related, with resilience a possible route for translating sustainability into practical decisions.

3.2 Organisation 2

Butyl Products Ltd were utilised to ensure full testing of SuReSDS™, as other strategic stakeholders were active than for Ford, requiring a different balance of social, environmental and economic outcomes. Butyl is a medium-sized UK manufacturer and supplier of specialist

fuel and water storage, sanitation and distribution equipment. It serves many sectors internationally, including aid and development, and oil and gas exploration.

Case studies were conducted with Business Development and Sales staff, senior managers and external experts, who create strategy within Butyl. Projects within the Aid and Development division were chosen as this work focuses on the societal benefits for customer Non-Governmental Organisations (NGOs), who increasingly request environmental information. Resilience was considered at two levels; product design since aid products are often used in extreme conditions; and the business case analysing strategic resilience for a new product launch. Butyl has limited resource for business development, so must carefully pick which strategies to pursue or products to develop.

4 Results

4.1 Interviews

In total 15 initial interviews found Ford management and specialists operate as a “database” of expertise and decision-making fora. Strategy arises from top-down planning and bottom-up issue or opportunity discovery. The decision flow is not standardised and is discussion-based, flexible, iterative, and moderately consensus-driven. This aligns with cognitive models of decision-making (Mintzberg et al., 2009) particularly sense-making by organisational groups (Brown et al., 2015) and iterative learning (Lindblom, 1959). The company uses few formal methods to compare or generate strategic options, preferring to develop its own tools, and experiences difficulty “importing” approaches. Metrics used vary according to decision-makers’ preferences and the decision context. Some sustainability and resilience approaches exist, but are not generally employed within strategy analyses, and most were unsuitable for adaptation for SuReSDS™.

Two interviews at Butyl revealed some similarities. Fewer resources are devoted to product development, there is less strategic development activity, and decision processes are simpler, involving only a few key individuals and business metrics. Strategy formation is however similarly discursive and flexible, using few formal methods, and not overtly considering sustainability or resilience. The main difference is Butyl lacks specialised resource to develop complex new approaches, and is more open to using existing external ones.

In total 11 interviews at different non-test organisations showed some similarities between their decision-making processes and the test organisations’, all using strategic sense-

making to reduce uncertainty (Pandza and Thorpe, 2009) and enable organisational learning (Senge, 1990). Best-practice approaches for sustainability and resilience exist in a few places only, possibly because applying rigour to such complex emergent issues successfully via Critical Thinking (Higgins and Freedman, 2013) and non-traditional learning/adaption techniques (Kurtz and Snowden, 2003) is difficult. Many organisations appear not to integrate these matters into strategy, whilst the strategic metrics mentioned varied. Some organisations encourage proactive social and environmental sustainability, including the use of wider criteria for strategy decisions. This seems to be a competitive differentiator and may be an early-adopter response to market changes. Significantly, two interviewees who are sustainability strategy specialists independently reported developing their own approaches, supporting clients to practice resilient and/or sustainable strategy. Each included a subset of the elements already identified for use within SuReSDS™. Altogether the interviews combined with academic and grey literature searches confirmed the chosen research methodology and strategic techniques as suitable for developing the new approach.

4.1 Case studies

The case studies are shown on Table 1. They occurred in three phases; pilots which used the initial approach (1 and 2), full studies with a fully developed process (3 and 4), and a full study with a revised process (5).

Case study	1A	1B	2	3	4	5
Location & topic	Ford; Fleet CO ₂ strategy, simple historical model	Ford; Fleet CO ₂ strategy, new future model	Butyl; New female hygiene kit, design & business case analysis	Ford; New safety feature, robustness and pilot test study	Ford; New parking feature, test and robustness study	Butyl ; New anaerobic digester kit launch strategy
Study type:						
Qualitative		✓	✓	✓	✓	✓
Quantitative	✓	✓				
Strategic level of study	Corporate Technology/ Product Service System	Corporate Technology / Product Service System	Product Service System	Corporate Technology / Product Service System	Corporate Technology / Product Service System	Business model/ launch strategy
Facilitator's Role	Offline Analyst	Offline Analyst	Team member in analysis	Trainer: support for live study team	Trainer; support for live study team	Support for live study team
SuReSDS™ version	Incomplete pilot version	Complete pilot version	Incomplete pilot version	Complete 1 st version	Complete 1 st version	Complete final version
Significant Findings	Verified quantitative systems modelling, resilience analysis and optimising performance against disruptions	Showed can include full social & ecological capitals, map stakeholders' value flows & find multi-criteria solutions	Suitable for qualitative analyses & other sector with different social stakeholders; test organisaiton used output for new business development	Can identify issues in strategy/ system design, analysis gaps, identify solutions; outputs used in real-world project	Can identify capitals trade-off between stakeholders affecting system desirability; outputs used in real-world project	Can analyse business context scenarios; results used to choose real world launch strategy

Table 1- summary of case studies

Figure 3 shows the final SuReSDS™ process. This is simplified, as iterative loops can occur anywhere. Iteration fits with common styles of decision-making within both test organisations. SuReSDS™ participants were supported by detailed instructions, used as a reference manual and updated for each case study phase. The process works best when it starts from 1 (scoping) onwards but can also analyse ongoing strategy decisions, to identify relevant information and allow the SuReSDS™ process to “catch up”. This flexibility is necessary, as real-world strategy studies encountered were already partly completed and could not be reworked.

Figure 3- the final SuReSDS™ process flow (modified from Winnard et al., 2014a)

4.1.1 Case study 5 - illustrated example

This study shows how the full process operates (other studies are summarised later). Butyl Products' management were facilitated to analyse a business-model decision using SuReSDS™ on their own strategic information in a half-day workshop. The facilitator also provided external expertise on sustainability and resilience issues.

The decision concerned the market launch strategy for a new anaerobic digester kit the Flexigester® (Plate 1) which Butyl had designed and tested successfully. The brief was “How should we launch our new product?”

Plate 1- Flexigester® trial in Malawi (source: Butyl Products Ltd).

The scoping step concentrated on social, environmental and economic functions of the product. It was unclear what strategic options might exist so this phase was left incomplete and stakeholder Value-Flow mapping undertaken to help identify those options. The product was intended for two markets, Aid and Agriculture. The Value-Flow mapping results for Aid are shown in Figure 4. Each arrow represents a flow of some value (capital) between different stakeholders, which are grouped as “economy”, “society” or “environment” and enabled by the product’s sale and use. The Aid NGO customers drove introduction of a fourth stakeholder type, “social economy”, as these NGOs are commercial but aim to address social issues, not make profits. Figure 4 includes flows created by the Flexigester® as a Product-Service System, whereas its impacts compared to a situation without the product are shown in Figure 5. Boxes with heavy borders and (+) symbols indicate positive effects, boxes with dotted borders and (-) symbols indicate negative effects, in a Pugh-style qualitative assessment (ASQ, 2004). To

reflect relative scales of impact, (+ +) indicates a very positive impact, whilst (+) indicates only a moderate positive impact; this is mirrored for (-) negative ones.

Figure 4- Stakeholder Value-Flow map for Flexigester®

Figure 5- Value-Flow map for introducing Flexigester® with impacts

The Flexigester® takes in sewage and crop waste to produce sterilised fertiliser plus biogas which is vented, or burnt as fuel. It was designed in a response to NGOs' need to address sewage contamination of groundwater in developing-nation communities, or during emergencies where refugee camps are used. It can also address "wicked problems" in nations such as Malawi, where heavy subsistence cropping and monocultures have impoverished the soil, reducing yields and thus economic and social wellbeing of local communities. This hinders sustainable development even with NGO assistance. These design aims are reflected in the positive impacts in Figure 5. There are trade-offs with new negative impacts as can be seen, but these are judged by most of the stakeholders after research and trials to be less significant than the original problems. The overall analysis found the product could produce useful value for many different stakeholders, while areas for further quantitative work were identified during the SuReSDS™ analysis, such as lifecycle environmental impacts of different modes of use, and which benefits require user training to deliver.

Normally within SuReSDS™ the system or strategy is analysed next using a Parameter Diagram, identifying which sources of disruption it must be resilient or adapt to. Here the product design was finished. The system size might vary but the value flows associated with it would not alter in type and number, so further analysis would not add new information.

Instead Figure 6 shows another Parameter Diagram (Case Study 2's aid product) illustrating typical outputs from this step. The central box describes the system's functions, the design of which may be alterable. The Control Factors box describes factors that the decision-maker can alter (by strategy choice) to affect the system. Desirable and undesirable outputs are self-explanatory, corresponding to Value-Flows generated previously. Some flows feedback directly or indirectly to create noises and signals. These inputs also arise from external sources. The system should respond to signals appropriately, whereas it should be resilient to noises. Sustainability equates to the balance between wanted and unwanted outputs, whilst resilience is the ability to maintain the desired balance when disruptive inputs occur (Winnard et al., 2014b). Figure 6 indicates the impacts of introducing the new product, again with Pugh-style notation. For qualitative analyses this can simply be another way of considering the same flows as previously, to create further insights.

Figure 6- typical Parameter Diagram – impacts of female hygiene kit

In the Flexigester® study the strategy options were still missing. Further discussion identified the true underlying strategy decision; whether to launch the product first in an existing marketplace (Aid and Development), a new one (developing country Agriculture) or both. The management team felt they had insufficient detail about their business context to analyse it as a complex system so a full new iteration of the SuReSDS™ process could not be done. Instead, referring to the SuReSDS™ process results showed that the three launch strategies constituted the strategic options. The effects of conditions in each market on the product and company represented the signals and noises to which the chosen strategy would have to be resilient. The key aspects of each market were then analysed to identify suitable scenarios for testing any strategy options against; grouped into types as in Table 2.

Any scenario created might affect the sustainability of the system being analysed. Here the product produced mostly beneficial effects overall, was likely be deployed in an area experiencing sewerage problems, but not in large numbers (NGO projects are generally far apart). There would likely be a linear relationship between the number of products in use and the number of communities benefitting from them. The sustainability impacts would thus be closely related to the company's ability to deliver

the product launch well without negatively impacting its other capabilities (e.g. delivering existing products and remaining healthy as a company). The decision was about optimising the resilience of a sustainability-oriented product launch, rather than the sustainability of a resilient product.

	Aid and development market	Developing nation Agriculture market
Commercial factors	NGOs not users buy the Flexigester®; NGOs not all interested in all system outputs so other hardware/ partners not needed; Larger margins; Synergy with existing Butyl kits; Specialist sector.	Customers buy via agents for their own use; Interest by users in all outputs so may need partner e.g. biogas stove company; Smaller margins; No existing Butyl business; More open competitive sector.
Speed of market take-up	Random and slower; partly depends on disasters/funding	Consumer market, so faster if contact networks developed
Total sales potential and growth pattern	Medium, variable volume; First sales will be largest as systems are stocked into regional NGO warehouses ready for deployment.	Large to very large (global); volumes linked to regional economies; Rising sales as distribution channels develop.

Table 2- key aspects for the two main Flexigester® launch markets

Simple scenarios were now created: each market could have either a high or low demand for the product, giving four scenarios in all. Each launch strategy was analysed for resilience against each scenario. The team chose to consider initial sales, effort involved in the launch, how sales volumes might develop and whether Butyl could capture the market value adequately; see Table 3. “Aid” and “Agri” are shortened names for the markets.

Demand Scenario	Strategy A: Launch in aid	Strategy B: Launch in agricultural	Strategy C: Launch in both
1 Agri high Aid high	High initial sales Low launch effort Volume trails off (+ +) Medium value captured Launch risk low	Medium initial sales High launch effort Rising volumes (+ +) Large value captured Launch risk moderate	Very high initial sales Very high launch effort Good volumes over time (+) Highest value captured Launch risk very high
2 Agri high Aid low	Low initial sales Low/Med launch effort Low/slow volume rise (-) Most value missed Launch risk low	Medium initial sales High launch effort Medium rising volumes (+ +) Large value captured Launch risk moderate	Med/high initial sales Very high launch effort Medium rising volumes 0 Large value captured Launch risk very high
3 Agri low Aid high	High initial sales Low launch effort Volume trails off (+ +) Medium value captured Launch risk low	Medium rising volumes Very high launch effort Low/slow volume rise (- -) Most value uncaptured Wasted effort/risk	High initial sales Very high launch effort Volume trails off (0/-) Medium value captured High wasted effort/risk
4 Agri low Aid low	Low initial sales Low/Med launch effort Low volumes (-) Little value captured Launch risk moderate	Low initial sales Very high launch effort Low volumes (- -) Little value captured Launch risk high	Low initial sales Extremely high effort Low volumes (!!) Little value captured Launch risk very high

Table 3- comparison grid for launch strategies against scenarios

The level of value captured indicates the relative level of profit within each market. Each box of the grid is a multi-criteria assessment and comparison is complex. Therefore each box was given an overall qualitative assessment, indicated by the symbols in brackets. These are Pugh-type as before but with (0) indicating a net neutral result and (!!) indicating high-risk outcomes to be avoided. Strategy A (launch in Aid) shows the least large risks and a reasonable balance of effort and reward. It also has the least uncertainty, using the existing market where the company has expertise. This might seem obvious, yet the team had been struggling to articulate these risks and opportunities.

The participants reported the process enabled them to manage a previously difficult, complex analysis. Its outcomes were immediately useful, since the results gave them more confidence and they adopted strategy A. The exercise also generated other information, and identified further analysis needs, which had not been visible before. This included assessing lifecycle environmental impacts of manufacturing the product plus its co-products, to ensure no poor sustainability trade-offs for stakeholders, rather than assuming the new product was always better. The company stated they could reuse both the results and the process in other decisions.

The other case studies are summarised below and in Table 1.

4.1.2 Case Study 1A and 1B

This was a theoretical study of technical strategies for compliance of vehicle product-fleet CO₂ emissions to EU law, when planning Ford's European product range and sales mix. This exercise tested whether the approach could produce valid quantitative models and identify more sustainable and resilient strategies. Models of fleet emissions were built using a recent Ford technology strategy study (1A), and checked for mathematical validity. These were then populated with surrogate public data and future scenarios derived for both fleet technology mix and sales to explore different strategies (1B). A sensitivity analysis identified which options were most robust to sales variations "noise" whilst a comparison against simple energy/fuel cost scenarios identified the strategy with best resilience to these signals.

Ford experts reviewed the results and deemed the approach suitable for identifying and integrating sustainability and resilience issues within strategic studies, stating that SuReSDS™ produced meaningful, logical, quantitative results. They also considered it rigorous and useful for handling complex issues. They attributed this to sustainability providing a wider definition of system performance than conventionally used, and the approach using engineering methods to improve robustness and resilience of system strategies. The approach's ability to handle qualitative information was also felt necessary for strategy discussions.

4.1.3 Case Study 2

This analysed the design of a new feminine hygiene kit for Butyl Product Ltd's Aid and Development clients. A detailed account of the analysis is given in Winnard *et al.* (2014a). The results were reviewed by the company expert and senior management. Their opinion was the approach improved their product development process structure, added insight and created useful commercial information. These results were used afterwards to drive real-world strategy decisions and successfully attract client funding for prototypes and field trials.

4.1.4 Case Studies 3 and 4

These case studies tested the fully-developed approach, whether it could be taught to users at Ford and what level of facilitation they required to use it. Two engineers within Ford agreed to be trained and participate in separate full case studies on real world projects they chose, working in parallel with their normal project work. It became clear that they needed support to use the new approach, especially expert

sustainability or resilience design information, which lay outside their expertise. This was provided by the lead author.

Case Study 3 analysed a potential safety-oriented vehicle feature to improve driver behaviour and ensure affordable insurance pricing. The analysis concentrated on how to conduct resilient field testing of the feature. An incorrect test could lead to unidentified business risks or opportunities affecting more senior strategy decision makers. The SuReSDS™ analysis revealed how the system design influenced how tests could be chosen and made resilient to different driver behaviours. It also defined how to tell whether the design was successful. The participant used these insights in changing aspects of the real world test and product design.

Case Study 4 was similar but analysed a potential parking-related vehicle feature. This provided insight into how market penetration and driver decision-making could affect the product's success according to the criteria of the consortium of organisations involved. The participant used this information to change how the product could manage driver behaviour and be tested.

A further result from comparing these studies is the ability discovered of SuReSDS™ to distinguish different sustainability impacts in technically similar systems. The safety-oriented feature was collaborative, since safer drivers benefit wider society, and more users generate more safety. The parking-related system however was competitive, with users better able to park than non-users, who lose out increasingly with rising user numbers. This trade-off created an unclear overall benefit and unclear product success, needing further investigation. The products were similar in cost and technical content and existing analysis missed this difference, whereas the new approach showed which product was likely to benefit the Value-Flows of more stakeholders. It would make commercial sense to choose the more beneficial product to ensure better market success via more satisfied stakeholders.

The results were reviewed by participants and their manager, who reported SuReSDS™ had enabled analysis of new issues around different aspects of sustainability. It allowed them to identify information they had missed, provided useful insights and created guidance they incorporated into real projects.

5 Discussion

According to users, the SuReSDS™ approach demonstrated improved rigour compared to existing practice when analysing the sustainability and resilience of different strategies. It enabled users to manage complex new information, capture tacit expertise and draw on experts to create new strategic solutions in different strategy

contexts. This seems most similar to the “what if” simple narrative scenario analysis needed for complex strategy contexts identified by Kurtz and Snowden (2003). “Offline” results were useful enough to be incorporated back into existing activities and decisions. The new approach thus provided additional value to users beyond existing processes, by combining rational and emergent strategy techniques appropriately (Etzioni, 1986) and lowering the “deliberation cost” (Conlisk, 1996) of doing so.

The use of the full process was not possible due to time or decision-phase issues, except in Study 1. However all participants were exposed to the majority of the process, and reported benefits from individual elements as well as the overall approach. Future improvements requested varied from more complexity to fit with existing detailed technical processes, to more simplicity for quick business strategy exercises. This indicates different users may need to customise the level of detail involved, to render SuReSDS™ culturally acceptable and most beneficial.

None of the existing approaches blended to create SuReSDS™ could have delivered the same outcomes. Robustness Engineering tackles engineering design and lacks ways to incorporate externalities, commercial information or strategic contexts effectively (FMC, 2011). A mature technique, it did not change significantly whilst SuReSDS™ was developed.

Creating Shared Value is about sustainable business strategy but stays close to classical economics, meaning conflicts around stakeholder values tend to revert to mainstream business practice (Beschoner, 2014). It is good at presenting externalities to traditional decision-makers under enlightened self-interest (*ibid.*). CSV remains more an informing ethos. Tools available online are generic elements of management consulting (FSG, 2017) not CSV-specific, whilst published examples of CSV application present it as successful in its own terms only (e.g. see Christiansen, 2014).

Transition Engineering was developed to drive paradigm shifts in engineering, especially urban transport infrastructure and incorporates full-spectrum sustainability (Krumdieck, 2013a). However it lacks a method for creating system models. It can involve resource-intensive data-gathering or modelling, and lacks the evolutionary approach sometimes needed within business. It is still rooted in its original field with no significant updates published since 2013.

SuReSDS™ was seen by users at both companies as a way to utilise new information and techniques to manage sustainability-related risks and opportunities, which reflects that it was designed to raise awareness of these and support users to

include them. However it cannot replace the use of sustainability experts, or techniques such as environmental or social analyses.

6 Conclusions

The small sample size and richly contextual, qualitative feedback cannot easily demonstrate a wider significance of the outcomes to other organisations. However the results are consistent and provide primary evidence for the success of SuReSDS™. Although case-study results were incorporated into real decisions, any effects on organisational performance were not apparent within the research timeframe. Ford takes several years to move from strategy to launched products with tangible effects on the business. Butyl has shorter but still multi-year development cycles. Nonetheless other evidence exists (see, for example, Eccles et al., 2012, Bocken et al., 2013), that strategic sustainability creates long-term benefits to reputation and financial performance.

The other limitation of SuReSDS™ users identified was difficulty in focussing on less conventional (in business terms) environmental aspects of the strategies. This is likely due to participants' unfamiliarity with this area. In some cases this was countered by the SuReSDS™ facilitator or company expert's contribution. Otherwise the need for more information, and the possibility of further influencing decisions, could only be noted. Users also experienced difficulty including newly identified strategies or sustainability information within their real-world recommendations. This seems related to the lower importance sustainability factors were assigned in the projects studied, flowing from senior management priorities.

The only comparable approach found in the literature is Value Mapping, developed separately but simultaneously with SuReSDS™ (Bocken et al., 2013). This comprises two simple tools suited to short workshops. While using similar Shared Value and stakeholder mapping concepts to SuReSDS™ it cannot handle in-depth analysis, nor incorporate alternate scenarios to test resilience. It approximates to the Value-Flow mapping step in SuReSDS™ and lacks other processes necessary to support a complete cycle of strategic activity, to identify the "best" strategy.

Therefore SuReSDS™ is novel in three ways; it was developed from new theoretical work, into a novel approach based on best practice, which has been successfully tested. It supported organisations seeking better synergies between the economic, social and environmental value they deliver to stakeholders, who were previously unable to achieve this and helped them integrate sustainability into resilient strategies. It was developed for a manufacturing context. Due to the internalising of

externalities within strategy decisions, SuReSDS™ could be applied in other settings such as policy. Its suitability for use in other organisations, sectors and its effects on long-term performance offer areas for future research.

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