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D. 1.4: DETERMINATION OF USE SCENARIO FOR G.EN.ESI PLATFORM

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ACRONYMS AND ABBREVIATIONS

Acronym/Abbreviation	Description
SADT	Structured Analysis and Design Technique
IDEF0	Integration Definition for Function Modeling
FMEA	Failure Mode and Effects Analysis

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EXECUTIVE SUMMARY

Within this deliverable, the scenarios of use for the G.EN.ESI platform are determined.

Use scenarios were studied from three viewpoints. In the first perspective, existing eco-design examples are discussed and used to understand the strategic organisational scenarios taking place within eco-design. While, in the second perspective, the scenarios of use for the supplier web portal are examined, highlighting the issues that must be addressed to make this area of the platform perform as intended In the third perspective, the Granta methodology is used to provide the individual user perspectives, helping the reader understand the specific software requirements for the G.EN.ESI platform.

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1 INTRODUCTION

Within product or software development, scenarios of use provide a valuable insight into the user perspective. For the development team, generating these scenarios helps visualise the user and can highlight requirements that might otherwise be missed (Rolland, Souveyet and Ben Achour 1998). For this reason user scenarios are intrinsically linked to projects goals. If we take the definition of a scenario as being "*composed of one or several actions, the combination of [which] describes a unique path leading from initial to final states*" (Rolland et al 1998), and define a goal as the desire to reach this final state, this link becomes very clear.

The first purpose of this work is to shed some light on the potential scenarios of use for the G.EN.ESI platform, and through doing so, help to further define and clarify the project goals. To achieve this, user scenarios have been developed from three perspectives, each represented in separate parts. In the first perspective, existing eco-design examples are discussed and used to understand the strategic organisational scenarios within eco-design is taking place. In the second perspective, the scenarios of use for the supplier web portal are examined, highlighting the issues that must be addressed to make this area of the platform perform as intended. In the third perspective, the Granta methodology is used to provide the individual user perspectives, helping the reader understand the specific software requirements for the G.EN.ESI platform.

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2 ENVIRONMENTAL DESIGN OBJECTIVES: BUSINESS STRATEGY SCENARIOS THAT PROMOTE ECO-DESIGN

2.1 Business Objectives and Eco-design

As documented by many authors (Lindahl 2006, Lofthouse 2006, Dewulf and Duflou 2004, Poole et al. 1999) commercial examples of eco-design occur less frequently than hoped. One reason commonly given for this, is a lack of understanding by tool developers and eco-design promoters in relation to the wider context within which eco-design takes place (White et al. 2008, Lofthouse 2006).

To help avoid this within the G.EN.ESI project, this chapter looks at the scenarios of use for eco-design from an organisational perspective; examining the interaction between business drivers, organisational goals and eco-design activities.

This has been achieved through documenting the business context of 30 eco-design examples found in literature. From this literature review four common business objectives for eco-design have been identified and the role the G.EN.ESI platform would play in each is posited. The results of this are then used to generate recommendations for the future development of the platform.

For a full description of the literature review and categorisation, as well as some additional findings of interest please see section appendix.

2.2 Identification of Business Objectives

The primary goal of this study is to understand the business objectives that promote eco-design and the impact this has on the activities undertaken and outcomes achieved.

In order to understand the business motivation for existing eco-design, 30 examples were reviewed and their stated business objectives were document (see appendix 1). This resulted in the identification of four common business objectives and associated eco-design activities:

1) Environmental Benchmark – Company wishes to perform an environmental assessment of an existing product or product range, in order to better

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understand the environmental performance of their products or compare them to their competitors.

2) Legislative Compliance – Due to legislation or an ever tighter legislative environment, a company decides to conduct a small re-design project focusing on compliance.
3) Competitive Differentiation – Perceiving potential cost savings or sales increases, a company decides to try and incorporate environmental design thinking into its design process. This often starts out with a pilot but can also results in the re-design of an existing product.
4) New Market Appeal – Perceiving sales increases through improved reputation or new market appeal, a company decides to develop a new product, strategy or business model that will define them as an environmentally proactive company.

The author would like to note at this stage that these titles have been used to help exemplify typical objectives for certain eco-design activities and should not be viewed as definitive.

Several characteristics were found to separate these objectives, however the most prominent and significant was the level of company engagement required to support them. To exemplify this feature two examples have been selected from the literature. The first is the environmental assessment of two chairs, manufactured by Formway. This assessment was completed to help the company understand the environmental impacts associated with each design (Gamage et al. 2008). To achieve this objective that company worked with a research institution, providing them with product information to complete a streamlined LCA. This study was part funded by government bodies and required the input of four people, only two of whom were employed by the company. In contrast is the example of Herman Miller, who was keen to develop a reputation for environmental design. To achieve this objective they set up a Design for Environment department who reviewed existing products and developed new products. These were then promoted on their environmental credentials. In addition to this improvements have been made in their manufacturing and delivery processes. This example documents companywide engagement and environmental improvements throughout their business in order to meet objectives (Bhamra and Lofthouse 2007).

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2.3 Business Objectives and the G.EN.ESI Platform

The following section describes the four organisational objectives in more detail with the aim of improving understanding of the organisational scenarios within which this platform may be used. This takes the form of a brief description of each objective, and the characterising features, followed by discussion of the role the G.EN.ESI platform can play in each. This latter part is achieved through the application of a technique known as 'The 5 W's'. Most commonly used in marketing, this technique involve the development of, and response to, five questions that help contextualise the use of a product or service; who, what, why, where and when (Apte and Shah 2001, Goldstein 2008).

The following five questions have been developed for the G.EN.ESI platform and used below to help fully describe the scenarios of use for each of the four strategies.

1) WHO is using the platform?
2) WHAT is the G.EN.ESI platform providing to the user?
3) WHY does the user need the G.EN.ESI platform? WHY is the users, using it?
4) WHERE is the user when operating the platform?
5) WHEN in the design process is the platform being used?

2.3.1 Objective One – Environmental Benchmarking

Company wishes to perform an environmental assessment of an existing product or product range, in order to better understand the environmental performance of their products (Gamage et al. 2008, UNEP 2001) or compare them against their competitors (van de Velde 2005).

This assessment typically takes place following a request by management or sometimes due to a customer's request for information and is not intrinsically linked to environmental design improvements.

As the company does not have any fixed plans for design changes or process improvements, management involvement is typically low and company engagement is contained to one individual or one department. From the case studies we can see this engagement tends to take the form of communication with a research institution. In a commercially independent scenario, the responsibility for this assessment may lie with one individual (Prendeville et al. 2011) or be sourced to a consultancy.

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2.3.1.1 G.EN.ESI Scenario of Use within Companies Pursuing Objective One

1) Who is using the platform?
The platform would be primarily used by a designer or member of the R&D team. For the G.EN.ESI platform to have a role in this scenario, the company would have to have chosen to conduct this environmental assessment in-house.

2) What does the G.EN.ESI platform provide to the user?
The G.EN.ESI platform enables a sLCA of an existing product quickly and easily. To do this the platform must be able to take data from existing CAD models and company databases, and be able to access the required information through the supplier web portal. This will rely heavily on company databases being kept up to date and suppliers providing the information required (see Supplier Web Portal - Scenarios of Use in Section 4).

3) Why does the user use the G.EN.ESI platform?
The G.EN.ESI platform is used to remove the need for outside assistance in completing assessments, saving associated costs. The platform offers this by distributing the burden of data collection throughout the company and supply chain enabling the flow of timely information to the design team.

4) Where is the user when using the platform?
Those performing the assessment will be at a computer and will be based in the responsible department (H&S, R&D, or design). Those inputting the data required to perform the assessment may be company and supply chain wide, dependent on the nature of information required (in use data from marketing, transportation data from purchasing, materials data from suppliers etc.)

5) When is the platform used within the design process?
This assessment is typically performed separately to the design process and does not directly impact design activities. In small companies this may involve the removal of a designer from their typical duties in order to complete this assessment. Speed and accuracy are therefore vital to ensure commercial appeal.

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2.3.1.2 General Comments Relating to G.EN.ESI and Objective One

- Within these design examples the LCA's were largely conducted by those outside the design department (or outside the company completely). This removes the task of data collection from designers, and enables them instead, to act on the results (eco-design). Indeed some authors argue that this is the only productive use of LCA, as it does not over burden designers, allows them to continue doing their jobs whilst ensuring the required supply of environmental information (Millet et al. 2007). The goal of the G.EN.ESI project is to streamline this process by bringing LCA into the domain of designers. This places significant data collection demands on them and we must ensure that this level of burden is carefully checked as the project progresses.

- A company who works towards and meets this objective is unlikely to achieve significant environmental improvements. However some of the examples showed that company objectives often developed and engagement increased, as results were obtained and commercial confidence grew (van de Velde 2005, UNEP 2001). This illustrates an interesting scenario of progression that should be carefully considered by the G.EN.ESI team.

2.3.2 Objective Two – Legislative Compliance

In light of new legislation that directly impacts operations; a company decides to conduct a small re-design project focusing on compliance.

In this scenario a company is keen to remove hazardous material content (RoHS), improve recyclability (WEEE), reduce in-use energy consumption (ErP) and/or reduce waste generated during the production process (The Landfill Directive), as well as comply with any future regulation.

Due to the varied requests contained within legislation, this scenario can involve several actors within a company, but is characterised by the minimum levels of company engagement needed to ensure compliance (Gottberg et al. 2006).

From the examples we can see that legislative compliance can result in varying design changes, dependent upon the product and company in question. This means that while (Gottberg et al. 2006) observed minimal change in the European lighting

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sector, legislative compliance in an El Salvadorian milk factory resulted in one of the few examples of new design development (UNEP 1999a).

2.3.2.1 G.EN.ESI Scenario of Use within Companies Pursuing Objective Two

1) Who is using the platform?
In this scenario the platform is used by a designer. However the successful use of the platform will rely heavily on the accessibility of up to date and relevant data. This data would be input by relevant company departments or suppliers. Other departments may also be required to meet this objective so platform use would need to synchronise with this activity.

2) What does the G.EN.ESI platform provide to the user?
This objective demands two things from the platform. The first is guidance and information relating to the legal compliance of a product; the second is support for the activities required to secure compliance. As these activities can be varied, this signifies a significant challenge to the G.EN.ESI platform.

3) Why does the user use the platform?
To check a design, or design change, against current legislation and find guidance and information relating to the compliance activities.

4) Where is the user when using the platform?
The primary user is at a computer within the R&D or design development department. Information providers may be located throughout the company or supply chain.

5) When in the design process is this platform used?
The initial compliance assessment would take place at the beginning of the design process, however dependent upon follow up activities the G.EN.ESI platform may be needed for further design guidance and information throughout the re-design project.

2.3.2.2 General Comments relating to G.EN.ESI and Objective Two

- The process of complying to, and acting upon, legislative demands will vary greatly for product to product. While many compliance issues are dealt with

through the regulations listed in the objective description above, it would be difficult to confidently claim full compliance guidance for any one product. As such this tool will need to rely on internally maintained databases. Again we must be careful where this burden lies and ensure that designers still have time to design.

- The use of the platform in meeting this objective would also require the experience and knowledge typically demanded of designers when translating legislative demands into design solutions.
- As with objective one, examples of growth, both in terms of organisational goals and company engagement were found (UNEP 1999a), again suggesting that with the right commercial flexibility and support significant environmental improvements can develop from this starting point.

2.3.3 Objective Three – Competitive Differentiation

Perceiving potential cost savings, sales increases and a legislative environment that promotes environmental behaviour, a company decides to try and incorporate environmental design thinking into its design process. This is initially done through the completion of a pilot, or commercial, re-design of an existing product.

This objective typically comes about as a company believes that environmental action will offer a competitive advantage, or because competitors have already made moves in this area. This is often combined with a legislative environment that is seen to be 'closing in' on the industry.

The eco-design activities which characterise the pursuit of this objective can be varied. It often includes those activities described in objectives one and two, starting with an environmental assessment to identify hotspots and requiring legal compliance to be commercially acceptable (Andræ 2005, De Langhe, Criel and Ceuterick 1998, Schneider et al. 2008).

To support this objective much greater company engagement is required and is likely to involve input from the entire product development team. This represents a variety of actors and departments. As a result of this higher company engagement this objective more often leads to embedded and long term environmental improvements

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within the design process itself (Quella and Ieee Computer 2001, UNEP 2007, UNEP 1999b, Andræ 2005).

2.3.3.1 G.EN.ESI Scenario of Use in Companies Pursuing Objective Three

1) Who is using the platform?
The primary user in this scenario is a designer in R&D or design development, although it should be noted that design activities would need to be supported by wider company involvement to meet this objective. Data input user may be distributed throughout the company and supply chain.

2) What does the G.EN.ESI platform provide to the user?
The G.EN.ESI platform allows the user to perform a sLCA of an existing product and LCA feedback on design iterations. This would be supported by environmental design guidance, advice and information relating to potential improvement techniques and legislative compliance. In order to offer this service the G.EN.ESI databases would need to be continuously updated to ensure relevance and again this burden must be carefully allocated.

3) Why does the user use the G.EN.ESI platform?
The platform is used to inform designers involved in an environmental re-design project and support activities throughout the process, reducing research time and streamlining the eco-design process.

4) Where is the user when using the platform?
The primary user is at a computer within the R&D or design development department. Dependent upon the company structure it is likely that a single design project may move from one department to the next (from concept design to detailed design) so multiple primary users must be considered, although the G.EN.ESI methodology promotes a more concurrent approach. Information providers will be located throughout the company or supply chain and their input and engagement with the platform would be vital in achieving this objective.

5) When in the design is the platform used?
In this scenario the platform is designed to support the entire eco-design process, from initial assessment of an existing product, to the identification relevant eco-

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design activities, through to support for material, component selection and product life cycle design.

2.3.3.2 General Comments relating to G.EN.ESI and Objective Three

- Meeting this objective would require more company activity that we could reasonably expect from a single piece of software, so the interaction between these activities and the platform should be carefully considered. The additional input from people with environmental expertise may also be required.
- It is unlikely for a company to achieve significant environmental reductions (such as those stated in the FP7 call), without the level of company engagement documented in this objective. As documented in the other objectives this can develop over time; however this level is seen as a requirement and provides a clear goal for the project.

2.3.4 Objective Four – New Market Appeal

Perceiving sales increases through improved reputation or through appealing to new markets, a company decides to develop a new product or adapt its business structure in order to build a reputation for environmental activities (Bhamra and Lofthouse 2007, da Silva et al. 2008).

This objective is typically pursued because a company believes that environmental action will offer a competitive advantage, because competitors have already made moves in this area or because they are losing market share to competitors. This objective is also often initiated by a legislative environment that encourages innovative change.

Companywide engagement is required to meet this objective, with R&D and/or conceptual design departments, as well as purchasing, marketing and sales, contributing far more than the previous scenarios. Supply chain engagement is also vital and a working relationship with suppliers will be needed to help inform the team about their options.

It should also be noted that, in this scenario, a large number of activities will be outside the scope of the G.EN.ESI platform. It is important for the team to

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understand these activities to ensure that the platform works in conjunction with them.

2.3.4.1 G.EN.ESI Scenario of Use in Companies Pursuing Objective Four

1) Who is using the platform?
The primary user in this scenario is a designer in R&D or design development; however it is important to note that meeting this objective will require large amounts of new information, so the scenario of data input becomes particularly relevant. The secondary users are therefore likely to include actors from across the company and throughout the supply chain and will require continued effort from these people to ensure information is accurate and up to date.

2) What does the G.EN.ESI platform provide to the user?
The platform offers environmental design guidance, information and advice that is relevant to the product development activity. It guides the design team through the project, offering material and technology data and the ability to get life cycle feedback on design concepts during the early stages and detailed design iterations later on.

3) Why does the user use the G.EN.ESI platform?
The platform is used to enable and support the design activities within an environmental design project. This reduces research time required and streamlines the eco-design process.

4) Where is the user when using the platform?
The primary user is at a computer within the R&D or design development department. This project may move from one department to the next, as design development takes place, so multiple primary users must be considered. Information providers will be located throughout the company or supply chain.

5) When is the platform used within the design process?
In this scenario the platform is designed to support the eco-design process, from providing information relating to existing solutions, to the identification relevant eco-design activities, through to support for design development in all life cycle stages. It

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will not however support companywide activities that will be taking place in other departments.

2.3.4.2 General Comments Relating to G.EN.ESI and Objective Four

- Those companies pursuing objective four need high levels of engagement with the project, from management, down. These wider organisational activities and the environmental knowledge required to pursue this strategy, should be seen as outside the scope of a software platform and would require additional help and support.
- This level of company engagement is most likely to achieve the FP7 targets but may also be seen as too demanding or too daunting to companies who have limited eco-design knowledge. Within G.EN.ESI we must therefore attempt to provide a methodology and platform that supports this objective whilst being mindful that others may wish to start small and progress as results become apparent.

2.4 Summary and Discussion

2.4.1 Interaction between Company and Platform

Reviewing the platform requirements associated with each of these objectives, it can be seen that they only vary slightly. What instead differentiates these objectives is the level of additional company engagement required to meet them. This interaction has been visualised in Figure 1.

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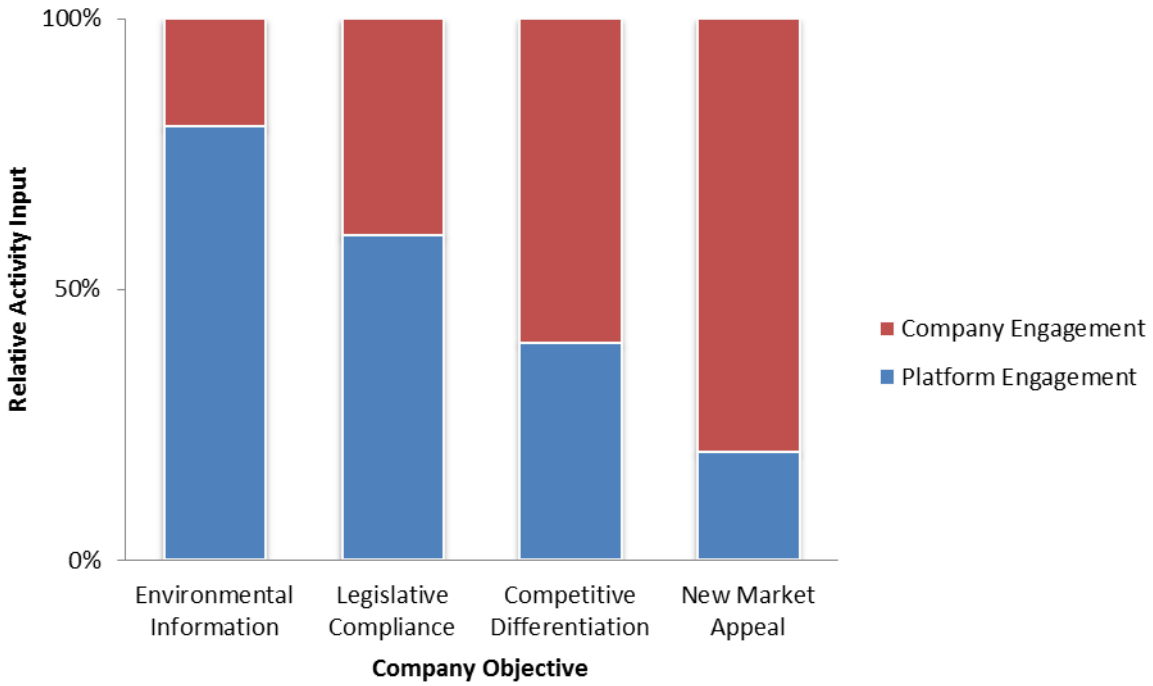

Figure 1: Relative relationship between company and platform engagement required to meet organisational objectives.

This table exemplifies that for companies pursuing objective one, only limited additional company engagement would be needed above the use of the platform (as it currently stands). This activity may be limited to one department or individual. However for those objectives that aim to make significant environmental changes (the kind requested by the FP7 call) a high degree of additional activity is required. This means that to achieve EC targets we must ensure careful co-ordination between the methodology and the platform, ensuring that they work in unison to support environmental knowledge dissemination and awareness and promote companywide engagement.

2.4.2 Objective Transitioning

Within the literature a number of the examples achieved more or less than they had originally intended. To investigate the relationship between organisational objectives and design outcomes further these features were plotted against one another. The results are shown in Table 1.

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Table 1: Design outcomes and organisational objectives

	Design Outcome	Assessment and Recommendations	Partial Product Improvement	Product and Process Improvement	Functional Change	System Change
Organisational Objective						
Environmental Benchmark		8	1	2		1
Legislative Compliance		2		1		1
Competitive Differentiation		2	8	6		4
New Market Appeal		1	1			

This table shows that in a number of the examples the design outcomes did not reflect the original objective. This indicates a degree of flexibility within these companies, as their objectives were able to alter as the project progressed. As 50% of the projects who began with benchmarking or compliance objectives achieved much greater product or business change, this organisational flexibility becomes important. Indeed it was more common for companies to develop their objective towards greater change than to scale them back.

As previously mentioned those that achieved more than they had set out to, appeared to do so as a result of greater understanding of eco-design issues, greater awareness of the changes they could make and greater confidence in their ability to do so. This signifies that a company's ability to adapt and act on new information is equally important as their organisational goals.

This finding highlights the importance of the interaction between the G.EN.ESI methodology, which requires system change, and the platform, which focus more on operational change, and the need to carefully consider the introduction of each on a case by case basis. For some companies taking on a new methodology may signify a level of adaptation that they are initially uncomfortable with. These companies may prefer instead to integrate elements of the platform into their existing design process. The design of the platform and methodology should seek to support growth from this point. Conversely for those companies willing to take on methodological and

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software change, the methodology and platform should work together to support this adaptation.

2.5 Conclusions

The goal of this study was to look at potential scenarios of use for the G.EN.ESI platform from an organisational perspective. This perspective was then used to examine the relationship between objectives, activities and outcomes to help understand more about the organisational environment within which the platform will be used.

Four main findings have resulted from this study in relation to the development of the G.EN.ESI platform and methodology.

1) Despite the objectives of the company the platform has a role to play and can promote eco-design activities dependent upon careful mapping to the organisational circumstances.

2) Life cycle assessments are often completed outside the design process removing the burden on data collection from designers. Incorporating this assessment within the design process, will therefore require data collection support throughout the company and supply chain to help ensure applicability of this tool.

3) Organisational objectives do not directly correlate to design outcomes. We must therefore aim to build a methodology and platform that supports gradual learning, development and sophistication. Indeed this may be the best way to achieve long term and significant improvements.

4) Despite the limited correlation between objectives and outcomes, company engagement and design outcomes were found to correlate strongly. Distributed interaction with the platform and a methodology that encourages multi-disciplinary engagement would therefore be advised if EC calls are to be met.

Before submitting and develop the different user stories of the G.EN.ESI platform, the next part will details the features of the supplier web portal, a tool of the G.EN.ESI platform that will ensure an accurate and reliable flow of eco-information between a company and its suppliers.

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3 ENVIRONMENTAL DESIGN INFORMATION: USING A SUPPLIER WEB PORTAL TO INFORM ECO-DESIGN

3.1 Introduction

Following the dot com boom, internet communication technologies (ICTs) gained popularity as a means of simplifying business to business (B2B) communications and were seen to have an impact on logistics process performance, purchase process efficiency and supplier relationships (Baglieri et al., 2007). As dictated by general consensus, business exchanges can be viewed as being embedded in a network distinguished by stable and interactive long term relationships (Haakansson, 1982, Haakansson and Snehota, 1995, Gadde and Haakansson, 2001, Tuten and Urban, 2001, Leek et al., 2003a, Leek et al., 2003b). In a bid intended to realise the benefits of moving from arms-length dealings to partnering (Araujo et al., 1999) and from adversarial to relational exchange (Kalafatis, 2002), industrial focus shifted from purchasing management to supplier relationship management (Gadde and Snehota, 2000). Through the facilitation of both an increase in disintermediation and new forms of relationships fostered from their innovative use, ICTs have had a profound impact on business relationships (Naudè and Holland, 1996).

One such innovative use of ICTs resulted in the formation of supplier web portals in a bid to improve efficiency in transactions with the supplier base and to improve logistics flows between buyer and suppliers. Supplier portals were found to promote information sharing and coordination of operational flows (McIvor and McHugh, 2000), support supplier management and create a sense of community among buyers and suppliers; all the while increasing the stability of relationships and suppliers' loyalty to their customers (Roberts, 1999). Moreover, web portals can tangibly sustain the creation and persistence collaborative practices with suppliers over time (Dyer, 2000, Tang et al., 2001, Li et al., 2005). It is this collaborative potential within supplier web portals that the G.E.N.E.S.I. project is looking to harness. For the successful integration of the G.E.N.E.S.I. platform and tools into CAD software, it is paramount to ensure that there is an accurate and reliable flow of information from parts and component suppliers to the software. The G.E.N.E.S.I. project is proposing the use of a supplier web portal as a form of fostering collaboration in product development through the exchange of eco-information, as

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opposed to its more traditional form of use as an e-procurement and purchasing tool, with particular focus on the kitchen appliance manufacturing industry.

3.2 Integration With Business Strategy

Following the actions of Ferrari, who were able to align the functional requirements of their supplier portal with their strategic goals (Baglieri et al., 2007), the G.E.N.E.S.I. project will aim to align the functional requirements of its supplier web portal with the strategic implications it would have on the buyers and suppliers using it. Defining the strategic goals of the portal is important as it has a strong and direct impact on the success of the portal's implementation. Through the provision of strong support and maintenance by top management during the implementation phase, supplier involvement can be encouraged, aiding in the attainment of any supplier relationship building and management strategic goals. The technique of scenario planning was used to determine various strategic scenarios of use concurring to the supplier web portal based on the corporate strategies detailed in Section 2.

3.3 Scenario Planning

Scenario planning is a futures technique that is used to generate different scenarios that represent possible futures associated with different trends and events to help develop policies and strategies that are robust, resilient, flexible and innovative (Foresight, 2009, JISC).

In this case, scenario planning was undertaken to determine the following:

- The best way to structure the supplier portal,
- Strategic implications its structure would have on buying,
- Supplying firms that decide to use it and how the portal is used varies depending on the strategy implemented.

When carrying out the scenario planning, it was essential to assign equal weighting to the supplier and buyer perspectives. Both perspectives in the buyer-supplier dyad are complementary and focusing on both offered a holistic and more realistic view of the use of the web portal allowing for the creation of a more robust portal.

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3.3.1 Key Question

What is the best and most viable way of structuring a web based supplier portal to facilitate eco-information sharing between suppliers and their buyers as they use the G.E.N.E.S.I. platform and tools?

3.3.2 Main Drivers and Polarities

Based on research and analysis of past and existing supplier portals, the following list of drivers and polarities (Table 2) were generated and used as the basis of the scenario generation:

Table 2: List of drivers and polarities

Drivers	
Impact on eco-product development process	Alignment with strategic focus
Impact on financial performance	Buyer power vs. supplier power
Impact on other business processes (i.e. procurement)	Nature and sensitivity of information being shared
Ease of inputting data into portal	Current buyer-supplier interactions
Impact on reputation	Impact on buyer-supplier relationship
Availability of eco information required	Cost of use
Advancements in software technology resulting in heightened web portal security mechanisms	Availability of resources and capability required to implement and use the web portal
Cost savings from reduced life cycle environmental impacts	Cost of integrating the web portal into existing practices
Top management support and buy-in	Level of commitment required
Consequences of non-conformance	Ease of retrieving data from portal
Who else is using the G.E.N.E.S.I. tools and platform	
Trends	**Potential Events**
Increasing eco-legislation and regulations	Pressure from other external stakeholders
Increasing customer demand for eco products	Increase in work load

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3.3.3 Two Axes Method

The two axis method, based on one of the approaches employed by Shell, was used to generate four contrasting scenarios that are related to the use of supplier web portals by placing a major factor influencing the future of the issue on each of two axes that cross to form four quadrants.

It was identified that the major factors influencing the use of the portals were related to the number of companies that would use a single portal; these are described in more detail below:

Table 3: Two axes related to the use of supplier web portals

Axis	Description
Multiple Suppliers ↔ Single Supplier	Number of suppliers that interact and input eco-information into a single web portal. At one end, the web portal is set up such that it receives information input from a single supplier; while on the opposing end, multiple suppliers can interact with the portal.
Multiple Buyers ↔ Single Buyer	Number of buyers that interact with and access information that has been uploaded into a single web portal. Much like the 'supplier axis', on one end, a single manufacturer can access information that has been uploaded into the portal and at the other end, multiple manufacturers can access the information.

The following diagram (Figure 2) shows the four scenarios that were developed for the supplier web portals, with each scenario represented in a single quadrant as a series of potential gains and barriers:

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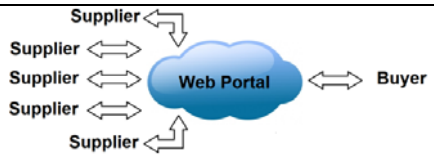
Scenario 1 - Multiple Suppliers/Multiple Buyers

- Buying into using the portals easier as there are a lot of stakeholders
- Costs of implementation and running reduced as all stakeholders interact with one portal
- Ability to create a more complex system as a result of combined resources
- More complex security measurers required to ensure secure information sharing
- Less time required to input and download data as it is all located in the same place
- Stakeholders not assured of confidentiality and fear losing any strategic advantages gained from their ability to implement eco-design without the shared portal
- Formation of an industry wide eco-consortium
- Web portal grows into a database that can be utilised for more than collecting eco-information for exclusive use with the G.E.N.E.S.I. platform
- Formation of a standardised way of sharing eco-information within the industry
- Stakeholders fear that others may be using the portal to either shop around for better products or to advertise their products
- Consolidation and attachment to consortium results in a champion that is passionate about ensuring that the portal is a success

Scenario 2 - Multiple Suppliers/Single Buyer



- Easy retrieval of information as it is all available in a single portal
- Buyer uses portal as a means of forming relationships with suppliers
- Reduced costs for buyer as only one portal is needed
- Suppliers with multiple buyers using the portal are required to input data into multiple systems and are faced with increased running costs
- Suppliers worried if the buyer is using the portal for more than just obtaining eco-information (e.g. as an e-procurement tool by comparing products from different vendors and deciding which one to buy that way)
- Buyer's bargaining power increases as the number of suppliers that sign on increase
- Buyers find that the web portal can be a strategic differentiator if correctly utilised

Scenario 3 - Single Supplier/Multiple Buyers

- Buyers' bargaining power increases and at the same time there is more incentive for the supplier to input into the portal
- Supplier only has to upload information once and can choose buyers who can view it
- Increased security mechanisms to ensure that buyers are comfortable with using the same portal as their competition
- Responsibility to ensure that portal is functioning properly lies with the supplier
- Supplier more comfortable with integrating e-procurement with the web portal
- Buyer-supplier relationship strengthens
- Buyer with multiple suppliers using web portals collecting information from different portals

Scenario 4 - Single Supplier/Single Buyer

- Time wasting as a result of uploading or downloading eco-information into or out of a number of different web portals (if a single buyer or supplier is interacting with more than one portal)
- Data input into the G.E.N.E.S.I. platform collated from a number of different sources
- Tedious nature of data input and retrieval discourages the use of the web portal by both parties
- Less stringent security mechanisms as access to information is limited to two parties
- Increased implementation and running costs
- Integrated with e-procurement to increase versatility and usability
- Party with the most bargaining power likely to impose their will more successfully

Figure 2: Four scenarios developed for the supplier web portal

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3.3.4 Scenario Output

Following the development of the scenarios, the following actions and critical issues were identified:

(i) Actions that could be taken to manage the risks inherent in each scenario:

Table 4: Description of the four scenarios

Scenario 1 - Multiple Suppliers/Multiple Buyers
Implementing heightened security mechanisms, possible due to advancements in technology, into the portal; even with data from multiple parties running through the same system, sensitive information never moves between competing companies Using the G.E.N.E.S.I. method to change the perception that firms have of eco-design in a bid to integrate it with existing NPD process Clearly state the function of the portal and ensure that it is used for its intended purpose by regulating the type of information that can be uploaded and the access that buyers have to information Develop robust ownership rights to ensure that the portal is well maintained through its day to day use while protecting the needs of the stake holders by ensuring that information sharing is secure
Scenario 2 - Multiple Suppliers/Single Buyer
Make sure the buyer does not have sole responsibility over the portal as would make it difficult to make sure that they are not using the portal in a way that disadvantages the suppliers. Ensure that suppliers have a way of making sure that the information being supplied is being regulated according to agreed measures Create a function within the portal that allows suppliers to export any information that they input and import it directly into a different portal if they have various buyers using the same type of portal and requiring the same information
Scenario 3 - Single Supplier/Multiple Buyers
Implementing heightened security mechanisms, possible due to advancements in technology, into the portal; even with data from multiple parties running through the same system, sensitive information never moves between competing companies Create a simple method for retrieving data from all the portals that the buyer is associated with and inputting the data into the buyers G.E.N.E.S.I. platform As the supplier has more control over the portal, they can use it to perform other activates such communicating any production and delivery issues with their buyers As they have the majority of the responsibility, ensure that suppliers are fully committed
Scenario 4 - Single Supplier/Single Buyer
Create a function within the portal that allows suppliers to export any information that they input and import it directly into a different portal if they have various buyers using the same type of portal and requiring the same information

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Ensure that both parties are equally committed to the success of the collaboration and are fully aware of the amount of work that will be required especially if they end up being associated with multiple portals Create a simple method for retrieving data from all the portals that the buyer is associated with and inputting the data into the buyers G.E.N.E.S.I. platform

(ii) Critical 'must-do' issues to address that are common across the various scenarios:

- Ensure that there is commitment to the portal from both buyers and suppliers, by framing it around business benefits for both parties
- Ensure that security of information sharing does not become an issue
- Create an implementation strategy to ensure that no one is exposed to unnecessary cost
- Reduce the amount of effort required to input data into the system and eliminate the possibility of entering information in the wrong format
- Eliminate or reduce the likelihood of the portal being abused

3.4 Scenarios Of Use

As the G.E.N.E.S.I. tools and platform to be used with the web portal are still being developed, it is difficult to be specific about the information that is to be uploaded and the format that it is required to be in. Before focusing on detailed cases of the day-to-day use of the supplier portal, it is important to understand the strategic purpose of the portal to ensure that most possibilities have been explored and that there is a common understanding and consensus about the user experience.

A number of use cases have been detailed below that focus on either the suppliers or the buyers interacting with the web portal. This is not an exclusive list of use cases but rather a list that shows a variety of different ways the portal could be used.

Use Case 1

When the supplier has uploaded product eco-information, the buyer is required to manually retrieve the information and input it into the G.E.N.E.S.I. platform in an appropriate format that the system understands. Information does not have to be retrieved by designers but rather by an individual (or team) that knows how to

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interact with the portal and is familiar with ensuring the information is converted, where necessary, and input into the platform correctly.

Use Case 2

The buyer is not required to manually handle the information that has been uploaded by the supplier as the portal is capable of feeding information straight into the G.E.N.E.S.I. platform software in the appropriate format.

Use Case 3

The supplier has a dedicated person (or team) responsible for acquiring the required product eco-information and inputting it into the web portal in the appropriate format. This is the only person (or team) that has regular interaction with the portal and is responsible for its upkeep. The person (or team) does not have to be an engineer or have an engineering background but they have to have intimate knowledge of the system and how to correctly input data in the appropriate form.

Use Case 4

The web portal is a system that various people from the supplying company have access to. For example, designers of the components being supplied manually enter information into the web portal. There is no one that has been specifically assigned the task of regulating the way in which information is uploaded into the portal.

Use Case 5

Suppliers are not only involved with the G.E.N.E.S.I. platform through the provision of eco-information of the products they supply but they also use the platform in the process of designing their own products. This creates a chain that simplifies the process of acquiring the various pieces of information that are required. With suppliers using the platform to design their own products, the supplier platform can export information in a format that can easily be uploaded into the web portal for the buyer's platform to retrieve and use. In most cases, a buyer is also a supplier to someone else.

3.4.1 Use Cases Analysed Against Scenarios

Scenarios can provide useful 'reality checks' on the proposed use cases by helping to consolidate the way the web portal is used with the overall vision of the web portal and highlight potential risks and challenges. As a result, the use cases proposed

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above were tested against the developed scenarios by mapping them against each other in a simple matrix (wind-tunnelling) (Foresight, 2009). The focus is on how robust each use case is (can it be performed within the scenario) and the ease of implementation and use. Wind-tunnelling offers a way of determining the versatility of use cases by identifying those which are:

- Robust or easy in all scenarios – suggests high versatility
- Robust or easy in certain scenarios only – suggests medium versatility
- Not robust or important in any scenario – suggest low versatility

Table 5: the use cases against the developed scenarios

Scenario	**Scenario 1 -** Multiple Suppliers/Multiple Buyers	**Scenario 2 -** Multiple Suppliers/Single Buyer	**Scenario 3 -** Single Supplier/Multiple Buyers	**Scenario 4 -** Single Supplier/Single Buyer
Use Case				
1	✓	✓	✓	×
2	✓	✓	✓	×
3	✓	✓	✓	×
4	✓	✓	✓	×
5	✓	✓	✓	×

Works ✓ Does not work ×

Robust Easy Robust & Easy

For the G.E.N.E.S.I. case, the table shows that the use cases would work will all the scenarios, except Scenario 4. Overall, Scenario 1 is shown to be the favourable scenario, with all use cases being deemed as at least possible and at most robust and easy.

3.5 Existing Supplier Web Portals

It is undisputable that the use of supplier web portals is on the rise as the popularity of advanced procurement increases. In general, these portals are mainly used to facilitate collaboration in e-procurement by allowing suppliers to respond to quote requests, improve order and inventory management, assess quality and compliance documents/ applications and submit electronic invoices.

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Exostar for aerospace, Covisint for automotive and Agentrics for retail are a few examples of industry specific supplier web portals that fall into the Scenario 1 category. These portals typically have a “single sign-on” design that allows a supplier to log into the portal once, then access individual portals of its various customers in one session, all the while ensuring that sensitive information never moves between competing companies. Companies such as GE, HP and Volvo, to mention but a few, have procurement supplier portals that fall into the Scenario 2 category. These ate mainly suited to large enterprises with a vast number of suppliers.

Portal technology comes from any one of the following vendors: those who maintain the actual portals, those who create the software that runs the portals and those who allow buyers and suppliers to fashion their own communication links. Glovia and Oracle are two vendors that offer online, self-service portals for suppliers. Suppliers get a single interface to interact with, while the actual system that a company deploys for extended procurement activities depends entirely on the user and industry.

Although fundamentally both types of portals are used to exchange information between suppliers and buyers, the aim of the G.E.N.E.S.I. portal is to acquire eco-information from the suppliers to utilise in NPD processes as opposed to being a procurement tool. Due to the difference in the nature of information being exchanged, a shift in focus from traditional procurement portals to compliance portals is required. Examples of such portals include BOMcheck, which falls into the Scenario 1 category; Freescale, which falls into the Scenario 2 category and vendors such as Enovia and Supplier Soft. These portals are generally used to exchange information including environmental compliance, conflict materials and materials compliance, amongst others. The strength of compliance portals lies in their ability to simplify and automate the process of acquiring data from different suppliers. However, their main weakness is that they require commitment from suppliers who might be reluctant to share information that they are not obliged by law to share. The main challenge buyers face is that of ensuring sufficient commitment from suppliers that ensures they provide complete information.

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3.6 Conclusion

It is important to note that the kitchen appliance manufacturing industry is mainly comprised of SMEs and as a result having just one portal that everyone interacts with (Scenarios 1) offers significant benefits in terms of acquiring supplier buy-in. it is important to ensure that the trap of making the overwhelming assumption that the bargaining power lies with the buyers is avoided. One way of increasing buying power is to consolidate the different manufacturers in the kitchen appliance industry.

It is also important not to underestimate the technology required to create true buyer-supplier collaboration. Most resource planning systems found in companies are not capable of handling such a job; these might be sufficient for managing internal processes but they are insufficient for communicating with a wide range of partners outside the organisation (Bowman, 2008). Software as a service, whereby applications are hosted by vendors, offers an option where the need to invest on elaborate in-house systems is eliminated, while making it easier for companies to adjust to changes in the market, and install updates.

Compared to more traditional EDI and XML information exchanges, portals require a significant investment from the perspective of the supplier (Keifer, 2009). The main costs encountered by suppliers include supporting technology and infrastructure, increased work load relating to acquisition and distribution of eco-information; while buyers would be faced with the cost of implementing and possibly maintaining the web portal. As a result, it is essential to further evaluate the overall cost and complexity impact to not only the buying firms, but to their suppliers as well. To eliminate the illusion of efficiency (especially for the supplier) that introduces additional costs and additional control and reliability issues that are sometimes associated with web portals, the supplier portal must be built on an effective direct business-to-business integration strategy. This strategy must consider the needs and capabilities of the suppliers and realistically provide support for integration that benefits both sides.

The use cases presented are designed to describe the range of issues that may apply when determining the scenarios of use. For the G.E.N.E.S.I. project the following decisions need to be made in made in order to construct an agreed scenario of use:

- The scenario that is best aligned with the strategies being implemented by potential portal users

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- How suppliers upload information into the portal
- How information is downloaded from the portal
- Who will construct the supplier portal; will this task be outsourced or be developed by the G.E.N.E.S.I. project team

After the presentation the supplier web portal and its potential scenarios of use, the next part will present the potential user stories of the G.EN.ESI platform. The stories are then linked to the the relevant business strategy scenarios described in Section 5 and to the supplier web portal (Section 6) in order to target the future tools and functions of the G.EN.ESI platform.

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4 ENVIRONMENTAL DESIGN ACTIVITIES: USER SCENARIOS FOR ECO-DESIGN SOFTWARE

4.1 Overview of Persona and User Story Development Activity

This section details the personas created for the GENESI project and goes on to describe the user stories that the GENESI tools and platform should satisfy. An internal workshop was held at Granta to generate and capture the personas and users stories. This workshop was attended by a cross-functional team including representatives from product management, software development, data development, collaborative project management, and services teams. A brief overview of the GENESI project was provided, as not all participants had been involved in the project prior to this point. The team then reviewed sources of requirements information including the GENESI proposal document, presentations from GENESI partners and minutes from initial meetings with the GENESI industrial partners (Faber and Bonfiglioli-Vectron). This information provided the basis for generating the personas and user stories but was supplemented with information drawn from the organisation's collective experience of developing eco-design tools for manufacturing companies.

The personas were defined first. For each persona, suggestions for high-level epic stories were captured. Once this had been completed for each of the personas, the complete list of epic stories was reviewed to eliminate duplicates or those that were considered to be of low value. The remaining epic stories were then addressed one at a time to break them down into lower level stories. The results of this process are presented in the following two sections.

4.2 GENESI Personas

A persona defines an archetypal user of a system. They are a short description of a fictitious user that may include details of their education, gender, role within the organisation, age, family background or any other information that might influence the way they interact with the system or their objectives for using the system. For further background information on the development and use of personas, please refer to the section appendix.

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Gianluca

Gianluca is 27 years old and is a Design Engineer in a manufacturing company. He joined the company after graduating 3 years ago. He spends the majority of his time creating 3D models of new parts and assemblies using CAD. His role also requires him to perform Failure Mode and Effect Analysis (FMEA) of his designs for which he uses an Excel spreadsheet template. During his degree Gianluca took some modules about sustainability and eco design but he has not had an opportunity to put this knowledge into practice to date.

Sofia

Sofia is 39 years old and is the New Product Development Manager at a manufacturing company. Her role involves: project management of current development projects; participating in design stage gate reviews; and contributing to the company's product strategy. She is always under significant pressure from the Board of Directors to ensure that projects are delivered on-time and to budget.

Antoine

Antoine is 48 years old and is the Sustainability and Product Stewardship Manager at a manufacturing company. He recently joined the company having previously worked as a compliance manager in a similar company. His role involves ensuring that all products comply with restricted substance legislation and implementing systems and tools to reduce the energy and CO2 emissions of the company, both from the factory and across the lifecycle of the product. He has a bachelors in chemistry and a masters in environmental management.

N.B. The Antoine persona appears in the final product manufacturer (collecting information) and in suppliers (supplying information).

Gregory

Gregory is 35 years old and is a Buyer for the manufacturing company. He sends drawings and specifications to suppliers to ask about feasibility, costs and timescales and requests new/updated datasheets for materials and components. Where possible, he sources materials and components from a list of approved materials and components. When this is not possible, he will try to source from an approved supplier.

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4.3 GENESI User Stories

User stories are the method used to capture requirements. As well as capturing requirements, one of the key objectives of a user story generation session is to promote discussion between the development team and the user. For further background information on the development and use of user stories, please refer to the section appendix.

In the following tables user stories have been listed under five themes:

- Set-up and maintenance
- Data input
- Analysis and reporting
- Interpretation and improvement
- Storage and reuse

Each story has been given a story ID and has been linked to the relevant business strategy scenarios described in Section 2 and the supplier web portal. One observation from this analysis is that there is little difference in the user stories that are relevant for the 'legislative compliance', 'competitive differentiation' and 'new market appeal' business strategy scenarios. This is because each of these scenarios involves some attempt at eco design improvement of the design of the product, it is just the level of environmental improvement ambition and company engagement that varies across the scenarios.

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Theme: Set-up and Maintenance						
Story ID	Description	Environmental benchmarking	Legislative compliance	Competitive differentiation	New market appeal	Supplier web portal
Setup-1	As Antoine, I want to be able to update the values in the in-house tables of the database so that the analyses performed are as accurate as possible	x	x	x	x	x
Setup-2	As Antoine, I want to be able to add new materials or processes to the in-house tables of the database so that the analyses performed are as accurate as possible	x	x	x	x	x
Setup-3	As Antoine, I want one set of material and processes that are referenced in the same way throughout the company so that the design team do not waste time matching the material names in the database to the materials they are using	x	x	x	x	x
Setup-4	As Antoine, I want to be able to identify which bought-in items we do not yet have a supplier declaration for so that I can contact the supplier to request the information					x
Setup-5	As Antoine I want the supplier web portal to support multiple suppliers and multiple buyers so that suppliers have an incentive to submit the information requested and manufacturers can quickly and efficiently obtain the information they need.					x

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Setup-6	As Antoine, I want a system that will help me to contact all the suppliers from whom I require information and keep track of who has provided the information so that I obtain the information we need as quickly and efficiently as possible.					x

Theme: Data Input						
Story ID	Description	Environmental benchmarking	Legislative compliance	Competitive differentiation	New market appeal	Supplier web portal
Input-1	As Gianluca, I want to be able to access the system from within my CAD client so that I don't waste time switching between tools and manually updating the Bill of Materials when I make a change		x	x	x	
Input-2	As Antoine, Sofia or Gregory, I want to be able to access the system from within my PLM client so that I don't waste time switching between tools and manually updating the Bill of Materials when I make a change	x	x	x	x	
Input-3	As Antoine, Sofia or Gregory I want to be able to view and edit a Bill of Materials so that I can run an environmental assessment or make updates to a BoM without having access to CAD or PLM	x	x	x	x	
Input-4	As Gianluca, Antoine, Sofia or Gregory I want the terminology used to be simple and clear so that I	x	x	x	x	x

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	don't waste time trying to understand what the system is asking me/telling me					
Input-5	As Gianluca, Antoine, Sofia or Gregory I want the content of the user interface to be in my own language so that I don't waste time trying to understand what the system is asking me/telling me	x	x	x	x	x
Input-6	As Gianluca, I want to be able to browse and search for components for which we have a supplier declaration so that I can then identify suitable components for inclusion in my product		x	x	x	x
Input-7	As Gianluca, I want to be able to select a component for inclusion in my product from a list of available components so that I can include the impacts of the component in the analysis of my product		x	x	x	x
Input-8	As Gianluca, I want to be able to send details of a part that we do not yet have a supplier declaration for to the relevant person within my organisation so that they can contact the supplier to request the information		x	x	x	x
Input-9	As Gianluca, I want it to be clear which information inputs are optional so that I can minimise the amount of time I spend inputting information		x	x	x	
Input-10	As Antoine, I want to receive a notification/email					x

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	when a customer is waiting for me to supply information about a product so that I can provide a prompt response to our customers					

Theme: Analysis and Reporting						
Analysis-1	As Gianluca, I want a dashboard that provides live feedback on the environmental performance of my product so that I can see if my recent changes have made things worse or better		x	x	x	
Analysis-2	As Gianluca, I want to be able to compare two or more variants of a design in a dashboard or report so that I can select the variant with the lowest environmental impact		x	x	x	
Analysis-3	As Gianluca, Sofia or Antoine, I want to be able to compare two or more dissimilar product concepts in a dashboard or report so that I can select the concept with the lowest environmental impact		x	x	x	
Analysis-4	As Sofia, I want the reports to be self-explanatory so that when I am presented with a report I don't have to contact the person who produced the report to ask lots of questions	x	x	x	x	
Analysis-5	As Sofia or Antoine, I want the report to contain all the key assumptions, variables and data sources so that I can do a thorough job of checking the analysis	x	x	x	x	

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Analysis-6	As Sofia, Antoine, Gianluca or Gregory, I want the system to report on energy, CO_2 emissions, water usage and cost so that I can understand the performance of a product across multiple environmental and cost indicators	x	x	x	x	x
Analysis-7	As Gianluca or Antoine, I want to be able to account for the speed-load performance profile of the electric motor I have selected in the use phase calculations so that I can select the most effective motor for my application			x	x	x

Theme: Interpretation and Improvement						
Improve-1	As Gianluca, I want the dashboard and reports to provide guidance on the phases of the product lifecycle or parts of the assembly that contribute most to the overall environmental impact so that I can focus on the most important areas		x	x	x	
Improve-2	As Gianluca or Antoine, I want the system to provide feedback on how I can improve the quality of the analysis so that I can ensure that my analysis is as accurate as possible	x	x	x	x	

Theme: Storage and Reuse						

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Story ID	Description	Environmental benchmarking	Legislative compliance	Competitive differentiation	New market appeal	Supplier web portal
Store-1	As Gianluca, Sofia, Antoine or Gregory, I want to be able to save the results of my analysis to a central, managed repository so that all users can see what analyses have previously been performed and avoid repeating work		x	x	x	
Store-2	As Gianluca, Sofia, Antoine or Gregory, I want to be able to save the results of my analysis such that I, or any of my colleagues, can reuse them in future so that, collectively, we don't waste time re-entering the data	x	x	x	x	

N.B. The user stories presented in this document are intended as an indication of the challenges that the GENESI tools and platform will help to address. They do not represent a contractual agreement to deliver a software system that will satisfy the requirements outlined in these user stories.

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5 CONCLUSIONS

This deliverable explores and determines relevant scenarios of use for the G.EN.ESI platform. The first section looks at potential scenarios of use for the G.EN.ESI platform from an organisational perspective. In this section, the following four common business objectives and associated eco-design activities were identified:

- Environmental Benchmark
- Legislative Compliance
- Competitive Differentiation
- New Market Appeal

Section 3 details the scenarios of use for the supplier web portal, highlighting the issues that must be addressed to make this area of the platform perform as intended.

Section 4 examines the personas created for the GENESI project and goes on to describe the user stories that the GENESI tools and platform should satisfy.

The scenarios of use presented in this document are a potential application of the G.EN.ESI platform and are defined based on the G.EN.ESI methodology. They are an indication of the challenges that the GENESI tools and platform will help to address.

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APPENDIX 1: ECO-DESIGN EXAMPLES AND CATEGORISATION

Literature Categorisation

In total 30 eco-design examples were included within the literature review, each of which was categorised against seven criteria, chosen to help understand the commercial drivers, company involvement, design approach and commercial output. These criteria, their constituent categories and the number of examples found in each are shown in Table 1. For clarity the categories have been listed according to their prevalence.

Table 6: Criteria and categories used to characterise eco-design examples

Criteria	Categories	No.	%
Company Size	Large	14	47
	SME	12	40
	No company involvement	5	17
Nature of Study	Co-operative	22	73
	Research	5	17
	Commercial	3	10
Project Driver	Competitive Differentiation	11	37
	Legislation	9	30
	Contribution to Research	4	13
	Customer Demand	3	10
	Perceived Cost Reductions	3	10
	Environmental Impact Reduction	3	10
	Perceived Quality Improvement	2	7
	Information (corporate knowledge)	2	7
	Perceived Sales Increases	1	3
Completion of an LCA?	No LCA	15	50
	sLCA	14	47
	Full LCA	1	3
Eco-design Strategy (LiDS Wheel (Brezet et al. 1997))*	Reduction of Materials	14	47
	Optimisation of End-of-Life System	13	43
	Selection of Low Impact Materials	11	37
	Reduction of Use Stage Impacts	11	37

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	Optimisation of Production Techniques	8	27
	No follow up activity	6	20
	Efficient Distribution System	5	17
	Optimisation of Initial Life-Time	5	17
	New Concept Development	3	10
Project Outcome (Product Innovation Levels (Hernandez Pardo et al. 2011))	Assessment and Recommendations	12	40
	Partial Product Improvement	10	33
	Product and Process Improvement	9	30
	System Change	6	20
	Functional Change	0	0
Commercial Output	Yes	20	67
	No	10	33

Discussion of Example Categorisation

The general characterisation of these examples offers several points of interest to the G.EN.ESI project. These points, listed below cover issues related to the scenarios of use and as well supplementary points included for their relevance to the development of the G.EN.ESI platform.

1) The G.EN.ESI platform is aimed at the independently operating commercial sector, however we can see from criteria 2 that only 3 of the 30 examples represent independent commercial activity, while the majority (22) are the result of co-operation between industry and research. While this could indicate that companies are less likely to write up and report their actions, it could also suggest that companies currently need the expertise and resource offered by research institutions. The goal for the G.EN.ESI platform is to enable commercial eco-design even for those with no previous experience, so we must therefore be mindful of the challenge this poses.

2) A lack of suitable expertise or resource is also implied by the equal involvement of SME's (12) and large corporations (14) within these examples, suggesting, as this does, that even those with available resource are still seeking support from research and academia.

3) The drivers for these projects were largely traditional (not new to business in light of environmental pressures), with very few cases (3) documenting environmental

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improvements as a driving force for activity. This translation of traditional drivers into new environmental activities is seen to be an important feature of modern eco-design that should be understood when trying to promote it.

4) Whilst almost all examples applied life cycle thinking, only 50% of them documented the use of an LCA tool. In all cases where an LCA was completed it was done so to identify environmental hotspots for information or to inform a re-design project. For those cases where an LCA was not completed, the team typically used their previous awareness and/or experience to highlight hotspots. This suggests that although an LCA may be vital when one is new to environmental design, it may lose relevance as awareness increases.

5) Also worthy of note is the predominant use of streamlined LCA's within these design examples. One full LCA was documented however this was a research based study, with no commercial involvement. This suggests that a full LCA is too resource intensive even when supported by research facilities. It also implies that, in this instance, the design community has a preference for resource efficient guidance over highly detailed information.

6) From criteria 4 we can see that those activities describing incremental design improvements, such as more streamlined material use or the use of simplified joining techniques, are most common. Those that require more external co-operation (distribution) or those that could be perceived as are more commercially risky (extended useful life or design and development of a completely new product) tend to be undertaken less often.

7) Examples of all eight categories contained within the Lifetime Design Strategies (LiDS) wheel were found in the literature review, exemplifying the range of eco-design activities that are taking place and the variety of goals to which the G.EN.ESI platform may be applied.

8) The findings of point 5) were mirrored by the order of prevalence relating to the example outcomes, with the majority being completed for information only, and only a few examples of system change. No examples of functional change were found.

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The regularity with which the identified business objectives were found within the eco-design examples is shown in the following table.

Table 7: Organisational objective identified within eco-design examples

Organisational Objective	**No.**	**%**
Environmental Information	10	33
Legislative Compliance	3	10
Competitive Differentiation	15	50
New Market Appeal	2	7

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APPENDIX 2: OVERVIEW OF HOW SCENARIOS OF USE ARE DEVELOPED AT GRANTA DESIGN

Background

In 2010 Granta Design began to implement a version of the 'Agile' software development method. Agile is an umbrella term used to describe several different software development methods that roughly adhere to the 12 principles of agile development captured in the Agile Manifesto:

- Customer satisfaction by rapid delivery of useful software
- Welcome changing requirements, even late in development
- Working software is delivered frequently (weeks rather than months)
- Working software is the principal measure of progress
- Sustainable development, able to maintain a constant pace
- Close, daily co-operation between business people and developers
- Face-to-face conversation is the best form of communication (co-location)
- Projects are built around motivated individuals, who should be trusted
- Continuous attention to technical excellence and good design
- Simplicity- The art of maximizing the amount of work not done - is essential
- Self-organizing teams
- Regular adaptation to changing circumstances

One of the key strengths of the Agile method is that it recognises that requirements often change over the duration of a project, often because the user understands their own requirements better as the project progresses. Agile can therefore be described as a reactive approach, as opposed to predictive approaches that attempt to capture and document user requirements in great detail at the beginning of project and then deliver against those requirements documents. In this way predictive approaches ignore the learning that takes place throughout the duration of a project and are less able to cope

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when user requirements change or when confronted with technical challenges that block progress along the planned path.

The Agile method is relevant for the GENESI as the project is delivering software for users that have little experience of eco design. Such eco design novices would struggle to provide a comprehensive set of requirements at this stage, as would be required within a predictive approach. Adopting an Agile approach does mean that there is greater uncertainty about the details of the tools and platform that will appear in the GENESI tools and platform. However, this is outweighed by the significant advantage of being able to adapt as the users learn more about their own requirements as they begin to experiment with eco design tools.

The following sections describe two key aspects of the Agile method, personas and user stories, and how they are implemented at Granta.

Creation of Personas

A persona defines an archetypal user of a system. They are a short description of a fictitious user that may include details of their education, gender, role within the organisation, age, family background or any other information that might influence the way they interact with the system or their objectives for using the system.

The aim of using a persona is to ensure that system delivers a set of features that maximises both the value and the usability for the key users of the system. They contribute to this goal in a number of ways:

- Understanding the user – By building up a picture of the range of users of the system and how their requirements differ (or overlap) the development can begin to create scenarios of use for each of the personas. It can also guide the design of workflows and the user interface by provide an indication of the level of knowledge about a task a specific persona might have.
- Clarifying assumptions - In a multi-functional development team, each member may have a different understanding of the knowledge, experience and objectives of a user type. Writing down personas helps to unearth differences in these assumptions and ensure the whole team has a consistent view of the user they are designing for.

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- Fully exploring the design – Personas allow the development team to view the design from multiple different perspectives and thereby ensure they have a complete solution.
- Providing a context for reviewers – Quality assurance and technical documentation staff may find it useful to consider specific personas when testing the software or writing guidance notes respectively.

At Granta, personas are generated by the relevant Product Manager(s), who is the person primarily responsible for capturing the requirements of the user. Personas are generated to cover each of the main types of user based on the Product Managers discussions with relevant customers and from market feedback. Personas are generally consist of a paragraph of two of prose text and captured in a Powerpoint presentation so that they can be easily shared and discussed with the development team.

Personas generally do not contain any project-specific information and can therefore be reused across projects, depending on the relevance of the persona for the particular project. Sharing/reusing personas across projects helps to ensure that different project teams have some common understanding of the types of user of the overall solution.

Writing User Stories

User stories are the method used to capture requirements within Agile. As well as capturing requirements, one of the key objectives of a user story generation session is to promote discussion between the development team and the user (or Product Manager as the representative of the user). There are a variety of approaches and templates that can be used to aid the writing of user stories. In general, a user story:

- describes one specific thing that the system needs to do for the customer
- is sufficiently brief and succinct that it can be written on a sticky note or index card
- is solution neutral
- uses language and terminology that is familiar to the user and avoids technical jargon

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Granta has adopted the following template for capturing user stories:

As a <type of user>, I want <some goal/requirement> so that <some reason>

For example:

As a Design Engineer I want the text values in the databases I use to be in my own language so that I understand the content

User stories can be captured at different levels of granularity. Often the team will begin by identifying the high-level requirements, sometimes referred to as 'epic stories'. These epic stories may then be broken into several lower level stories.

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