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A Value Case Approach for Analysing Goal Alignment in Multi-Stakeholder Networks: The Case of Sustainable Product Manufacturing in the Electronics Industry

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Abstract

Innovations are needed to solve societal challenges and adapt to a dynamic world. Most innovations require the support of multiple stakeholders in order to be implemented successfully. Stakeholders base their decision to support an innovation primarily on the attractiveness of the financial business case. Stakeholders faced with a negative case, especially those in a position of power within the network, will not support the innovation and block it from realization. This misalignment of value across a network is one of the largest barriers to cooperation and ultimately the successful implementation of innovations. The objective of this paper is to introduce a new way of looking at business cases for innovations from a multi-stakeholder perspective with a focus on identifying additional values and value exchanges rather than purely monetary costs and benefits. In addition, our methodology provides a visual tool to increase understanding and communication within the stakeholder network. We have chosen to use GreenElec, a European project focusing on achieving a more efficient use of resources by designing and manufacturing electronics that enable more effective recycling, as a case study. The project brings stakeholders throughout the network, from producers to recyclers, together to develop new innovations, be it business models or processes, needed to achieve efficient recycling of electronics equipment. We introduce the Value Case Methodology to identify additional values and, from this, potential solutions to redistribute value across the network stimulating collective action and the successful implementation of the GreenElec innovations.

Jelcodes:M21,O38

1 Introduction

The current social and political climate in western society has seen a push for more environmentally friendly and sustainable business models and products (Teece 2010; Birkin 2009). Within the electronic product industry there is a need for resource efficiency and to create more effective processes throughout the electronic product network. Customers are increasingly demanding "green" certified products and government regulations, EU and elsewhere, are setting higher standards for producers in terms of environmental regulations to lessen the negative environmental effects electronic waste provides, such as the WEEE directive (European Commission, 2013). Although these outside pressures exist, there is not a clear or easy solution to this problem. Often, this is due to conflicting interests of stakeholders and large dependencies within the multi-stakeholder network who hold power within a network.

A multi-stakeholder network is comprised of the various stakeholders involved in the realization of a particular good or service (Roloff 2008). These stakeholders may be manufacturers, government bodies, customers, recyclers, etc. (Kaplinsky 2002). Each stakeholder has their own individual role, interest, and value added which creates a unique dynamic within a stakeholder network. Understanding each of these factors for the various stakeholders is crucial if businesses want to effectively implement environmentally friendly and sustainable innovations, as it is critical to have support throughout the entire network. Vanhaverbeke and Cloodt (2005) discuss the idea of a value constellation to describe how companies must work together to achieve innovation. The paper states that companies build inter-organizational networks of stakeholders with different value added and specialty areas to achieve the commercialization of innovations. This idea of cooperation throughout a network increases understanding, communication, and looks for ways to define value across the stakeholders. However, when introducing innovations into the market cooperation may become difficult. This is where the Value Case Methodology approach becomes crucial.

Previous research on large multi-stakeholder innovation projects has a strong focus on monetization, i.e. translating other value into cash. However, not all values are easily monetized. The Value Case Methodology looks beyond financial values, making financial as well as non-financial values explicit. In this paper, we develop the Value Case Methodology, which is unique in its multi-stakeholder and multi-value approach. Multi-stakeholder and

single-value approaches exist, as well as single stakeholder and multi-value approaches. However, the multi-stakeholder and multi-value approach has not yet been elaborated. The real need for a multi-value and multi-stakeholder approach is evident and has been identified for two reasons. The first one is that today, we see these kind of projects emerge more and more in our society and its complex, sector transcending challenges, invoking innovative transitions. The second is that exactly these projects stagnate because of the partial rationality of the individual stakeholders, mostly for financial reasons or "not being able to work out the short term business case".[1]

The Value Case Method looks at the costs and benefits on three levels for each stakeholder in the network: people, planet, and profit. Further, it provides a visual tool to identify value alignments and misalignments in a multi-stakeholder network as well as identifying potential value exchanges to create a more even value alignment in the network. Driving cooperation and collective action is the ultimate goal of using this method. The perspective on three levels helps in aligning actors across the network by opening communication and increasing the knowledge of positions of other stakeholders in regards to the innovation. It also sheds light into how businesses can more effectively work towards sustainability while maintaining their current position or potentially increasing their position in the market.

The goal of the Value Case Methodology is first to create a form of mutual understanding between the stakeholders so that they are conscious of each other's value and of the extent in which each particular value should addressed according to each stakeholder. In short capturing the motivation and wishes of the individual stakeholders in a more common language. Next, the Value Case Methodology will challenge stakeholders to look at the innovation afresh, from their mutual understanding. This may stimulate the stakeholders to reshape or redefine the innovation in order to fulfil the wishes of the stakeholders. Once a level of consensus has been reached on which values the innovation should address we believe sufficient motivation for participation amongst all stakeholders will allow the stakeholders to invest and the innovation to take place. Typically looking at innovations as a

[1] An example of a multi-stakeholder innovation project, and inspiration for this research, is the smart living master plan, as described in the book 'the Art of Smart Living' (Baken, 2009; 2010). In this project a collective action by a number of different prominent Dutch industry players was required. Despite the great confidence in the necessity and potential societal value of the project, the participants observed great difficulties in the decision making process of several partners. One of the struggles is to reflect the perceived value in the business cases of the individual partners. We felt that the instrument of the individual business case was not sufficient to shape the process and the decisions: a value case was needed to capture the multiple stakeholders' perspectives and the multiple values.

broad value generating engagement. The Value Case Methodology will be further outlined in the methodology section of this paper. The focus of this paper is on the Vale Case approach to cost benefit analysis and creating multi-stakeholder acceptance of innovations identified within the domain of Sustainable Product Manufacturing.

2 Theoretical background

In 1993 Normann and Ramirez introduced the idea of a value constellation, referring to the group of stakeholders who work together to create new value and innovative products (Norman and Ramirez, 1993; Vanhaverbeke and Cloodt, 2005). This emerged from the development of innovation in the market and increased competitiveness where "strategy is no longer a matter of positioning a fixed set of activities along a value chain... successful companies do not just add value, they reinvent it" (Norman and Ramirez, 1993). They suggest that reinvention coincides with a co-productive network of actors who aim to increase overall value production and is linked to increased innovation with companies such as IKEA. They propose a new way of thinking for companies in terms of partnerships and cooperation, but they do not touch upon how to successfully integrate these networks into a cohesive constellation. The value case approach provides a tool to overcome barriers and increase such collaboration.

While companies may know that change is required in order to achieve a successful implementation of an innovation, drastic changes are not always feasible due to the company structure (Tidd and Bessant, 2005; Utterback, 1994). When discussing innovation management Tidd and Bessant (2005) describe how even strategic firms can be limited in their actions when it comes to innovation, "Sometimes, they are limited in knowing where and how to acquire new knowledge beyond the boundaries of their traditional business". While they have the ideas expanding beyond their typical structure to say a value constellation mind-set is not a likely next step. Many large, mature companies act in this strategic manner which is why it is crucial to find ways to move beyond these boundaries and work in a more collaborative way.

2.1 Methods for analysing the innovation

The business case is one of several methods described in the literature to analyse the effects of an investment decision The business case analyses the financial effects for a single stakeholder and a single innovation, in a certain area and confined period of time, usually a

short term. Implicitly thereby, a choice for the dominant value, i.e. financial values, is made. Based on monetary costs and benefits, the business case calculates the profit that a stakeholder expects to make. A business case only incorporates financial (cash flow) values that are part of the business model of the stakeholder concerned. The business case method is able to provide a general overview of the financial value of an innovation for all stakeholders combined, by simply combining their business cases. Typically, this aggregated business case to identify overall financial value is not by default part of any project. If all business cases lead to a positive outcome, i.e. all stakeholders involved have a positive cash flow and those required decide to invest, there is no need for further analysis with respect to go-ahead decisions. (Assuming the go-ahead decision of this project does not compete with that of others.) However, this is not always the case. Furthermore, the effects of implementation of the project may affect an environment larger than that of the involved stakeholders. Taking only the (financial) values of stakeholders into account is often not enough. One has to consider the whole systems of stakeholders and weighted effects on short, medium and long term. It is therefore questionable whether a traditional financially oriented business case is an adequate method to come to an investment decision in complex multi-stakeholder projects, as the costs and benefits vary for the different stakeholders that need to be involved (Van Scheppingen et al., 2012)

Whereas the business case seldom includes anything other than financial values, there is often need for a broader perspective. Social return on investment (SROI) is a method to specifically determine the qualitative public effects of an investment (Emerson and Cabaj, 2000). By comparing the economic value of social benefits with the financial investments made by an actor, their social return on investment is calculated. This methodology focuses on the social effects of an intervention. However, also economic, environmental and financial values are included in the analysis (Wright et al, 2009). The outcome of an SROI analysis should not be restricted to one number, but it should provide insight in the social impact of an intervention, in which monetization plays “an important but not an exclusive role” (Wright et al., 2009: 463). Some of the qualitative effects can be quantified and monetized, however, the steps to monetize these effects are not specified within this method. The outcome of an SROI analysis shows what the qualitative impact of an innovation is on society or a specific, predetermined area SROI specifically enables policymakers to determine which intervention delivers the best qualitative effects from several alternatives. This method only includes the effects aimed at by policymakers to achieve a certain policy goal. The method does not include financial

effects for specific, separate stakeholders. Only public expenditure and public revenues are included in the methodology. Furthermore, SROI only provides an overview for the impact on society from one specific project. It does not provide an overview for both the individual stakeholders and the overall impact of an innovation. The method is aimed at policymakers, making it less useful for private firms to substantiate their decisions.

Both the business case and SROI have a single-stakeholder view From a single stakeholder's viewpoint, the decision to invest is substantiated. However, a project can have a broad impact across society, affecting multiple stakeholders. The most commonly used method when a project has a broad impact across society, is Social Cost Benefit Analysis (SCBA). SCBA analyses the effects of an intervention or innovation from a societal point of view (Domah and Pollit, 2001; Eijgenraam et al., 2000; ECORYS, 2008; Jones and Scotchmer, 1990.). From this viewpoint, both financial and non-financial effects are taken into account to analyse the investment decision. A positive outcome provides insight in the desirability of an innovation from a societal point of view, but not per se from the perspective of a single or multiple stakeholders investing in the innovation.

2.2 Determining values

Values can be identified on numerous dimensions, an example being values on people, planet, profit and pneuma dimensions (Elkington, 1997; Zohar 2012). Many articles name costs, benefits and other effects in these dimensions. The effects mentioned differ per case and per article. When scoping the literature to these dimensions, it can be noted that articles with a financial focus often name comparable factors, such as production cost and revenues (Mischra et al., 2013), whereas articles with an environmental focus often mention different factors in each article, for example different pollution indicators such as carbon dioxide, methane, PM10, nitrogen oxide, and numerous others (Erikstad et al., 2008; Thórhallsdóttir, 2007; Weisbrod et al., 2009). Literature with a broader focus often does not list specific effects and when they do, the lists differ strongly from one another (GRI, 2011; Ostrom, 2000; Hubbard, 2010). Despite the numerous effects mentioned and the identification of several values specifically interesting for multi-stakeholder situations, compiling an exhaustive list of possible effects and values based on previous literature is not feasible as for every case the set of effects and values is unique. The list of effects would be too long to be used as a generic checklist.

As a comprehensive list of all possible effects is not practicable, strands of literature are studied on different methods to find and identify effects. Several methods are based on the triple bottom line[2] (Elkington, 1997; Norman & MacDonald, 2004). The Global Reporting Initiative (GRI, 2011) provides an extensive method on how to report on costs, benefits and other effects on economic, environmental and social dimensions. The specific aim of that framework is to support sustainable development. The indicators in the method therefore focus on accountability and sustainability of firms and are less usable for substantiating a collaborative investment decision. Hoorik and Bomhof (2010) also provide a framework based on the triple bottom line. The method of Hoorik and Bomhof entails the definition of a number of effect categories. These categories are placed in a framework of people, planet and profit and direct, indirect and systemic dimensions. These categories and dimensions are then used in interviews with actors involved in a project to have the actors think of effects within the categories and additional effect categories and effects. The interviews are held with actors only rather than a broader group of stakeholders as the actors are themselves involved in the (changed) process. Hoorik and Bomhof have summarized this in Figure 1.

	Direct	Indirect	System
People	Safety and health Productivity Work quality	Human performance Comfort, wellness Job satisfaction	Employment Social inclusion Welfare Behavioural change
Planet	Energy use, GHG and other LCA indicators for production, use and disposal	Information effect Transport/ distribution	Dematerialisation Number of trees Rebound effects
Profit	Costs for design, build test Costs for operating & maintenance costs investments in training	Shorter process times High efficiency Less errors Higher quality	Higher transparency in chains

Figure 1: Effect categories (Hoorik & Bomhof, 2010)

The framework emphasises that (direct) effects for one may imply other effects for others. A supplement to this framework is the notion of a fourth 'P': pneuma (Zohar, 2012). Pneuma represents the spirit which spurs action; the intrinsic motivation of stakeholders fuelled by

[2] Triple Bottom Line argues that there should be an additional focus on people and planet, instead of just on the financial bottom line: the profit.

categorical moral reasoning (Sandel, 2013). It appeals to a notion from Sinek (2011) stating the importance of defining why decisions are taken and things are done, in a specific way.

The effect categories provide a broad overview of values. Hoorik and Bomhof (2010) propose to acquire the input to fill the framework by conducting interviews with actors involved in the project. However, interviews limit the gathered values to what is in the minds of the stakeholders. It provides a subjective and limited list of values rather than an objective list of values. Therefore, Van Weelden (2011) suggests asking stakeholders what they would experience as change in terms of activities instead of what effects they see. Actors will often have a thorough and objective insight in what activities will change, because of an innovation or intervention. Knowledge on changed activities forms the basis for the financial impact of an innovation on the actor. From the changed activities, the effects on people, planet, profit and pneuma can be deduced. Therefore asking an actor for their changed activities and deducing the values from this, rather than asking the actors for values directly, provides a more extensive and more objective list of values. This list can be further substantiated by the method of role reversal. In this method the actors are asked to take the viewpoint of another actor. From this new viewpoint they can review both the values of the other actor as their own values. This provides an objective list of values.

2.3 Quantifying values

Qualitative effects are often analysed by quantifying the effect. Many of these methods use monetization. Boer and Larsen (2010) describe four types of monetizing methods:

1. Revealed preference: Monetizing value using prices observed on a (derivative) market.
2. Stated preference: Monetizing value using surveys on what people state they are prepared to spend on a matter.
3. Avoidance cost: Monetizing value using the amount of money required to avoid an effect.
4. Key figures: Monetizing value using standardized figures from earlier studies on similar matters.

We discuss two quantification methods: multi-criteria analysis (MCA) and conjoint analysis. Quantification in these methods is not necessarily done in terms of money. Both methods aim to find the stated preference of stakeholders.

With MCA the stakeholders themselves assign weights to effects, thereby stating their preference (Saaty, 2008). With this input, MCA provides an overview of how the different effects combine to a positive or negative outcome for the stakeholder. Sensitivity analysis can show the impact of changes in the effects. The current challenges with MCA are the inability to deal with subjectivity and inconsistencies in answers of the stakeholders (Yeh et al, 2000; Saaty, 2008).

The second method described here, conjoint analysis, is able to deal with these issues. Conjoint analysis is mostly used as a marketing research technique to help modelling consumer preferences. The basic idea can however be used in different contexts. The technique asks consumers (stakeholders) to choose between a number of alternatives, or to rate various alternatives. An alternative is a set of attributes (values). Alternatives vary slightly from each other. This enables determining the utility and how sensitive a consumer (stakeholder) is to a change in the parameter value of a value, i.e. the 'outcome' of the value. In terms of money, the latter is called price elasticity. However, in this paper we look beyond price, and hence, from this point we refer to it as point sensitivity.

Negotiation

Now that we have discussed the most relevant elements of the generic multi-stakeholder innovation process in the context of the VCM, we discuss the process (negotiation) itself in this section. Although there are many interesting theories on negotiation, we limit this discussion to one recently developed method. The SID4IOP method of Eckhartz (2012) is designed for inter-organizational settings[3]. This method helps stakeholders to achieve agreement on value distribution in a shared project. It involves anonymous information exchange and chatting amongst the stakeholders. The method uses structured disclosure of sensitive financial information. This method also involves an online bidding process. The more bidding rounds it takes to reach agreement, the more information is revealed, leading to a fairer distribution. However, the costs for giving up anonymity also rise as the number of rounds increases. Making this information available influences behavior of stakeholders positively towards contributing to a collective action. This has proven to be successful in the validation of the method (Eckhartz, 2012).

[3] Inter-organizational projects cross organizational, functional or budget boundaries. Decision power is shared and there is a disagreement amongst the stakeholders on the cost and benefit distribution.

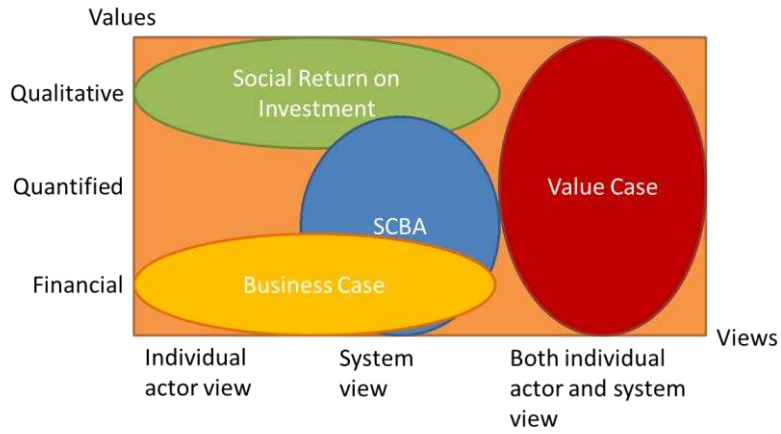

Figure 2: Position of several methods of analysis

3 The Value Case Methodology

The VCM should be seen as an extension to a generic multi-stakeholder project approach. This implies that stakeholder's values are in scope from scratch as value based "requirements". Along the course of the project definition and decision phase focus is on satisfaction of these values by means of shaping the project definition. This is supported by a quantified and systematic elicitation of the stakeholder's values and the project definitions score on these values (Step 1: Value Identification; Step 2: Value Quantification). The shaping of the project definition is part of
Step 4: Value Alignment and this is preceded by understanding the stakeholder's sensitivity for close alternative project definitions (Step 3: Value Sensitivity).

It is crucial to distinguish the identification of a value that is not yet satisfied and to what extent that is (Step 2: Value Quantification) from the means to actually satisfy it. The latter is not something that can be prescribed. The creativity required for identifying the right change to the project definition that fulfils the need and shifts the stakeholder to acceptance needs to come from the stakeholders in interaction (in
Step 4: Value Alignment). It can be based on suggestions identified in Step 2: Value Quantification.

The Value Case Methodology (VCM) researches the value of a collective proposition/action for a system as a whole and how it is balanced with the value for the individual stakeholders in it; from there a decision for proposition/collective action is taken whether to proceed or not. The result of the VCM is the Value Case. The value case is the equivalent to the multi-

stakeholder business case. It answers the question who gets what, in terms of values, both financial and non-financial.

The VCM can help an otherwise failed decision to undertake collective action to succeed, by:

a) Making stakeholders' values explicit;
b) Identifying alignment opportunities;
c) Redefining the innovation to make it acceptable for all stakeholders involved.

In the generic process discussed in the previous chapter, at least the financial values were included. Stakeholders' decision on whether to cooperate might be (partly) based on non-financial values as well. These non-financial values are not necessarily made explicit. However, it is likely that they play an implicit role in the decision-making process of the stakeholder. The VCM makes these values explicit , thereby providing more insight in the motivation of the stakeholder, which may help a stakeholder make a more rational decision.

In the VCM an attempt is made to align the stakeholders. Some stakeholders may need compensation, as their incentive to participate is too low in the current situation. Compensation will increase their incentive to cooperate and therefore collective action is more likely to take place.

By facilitating a structured and information-based negotiation, it is more likely that bottlenecks will be found in the definition of the original innovative value proposition. The VCM makes a redefinition of the innovation possible to make it overall more acceptable.

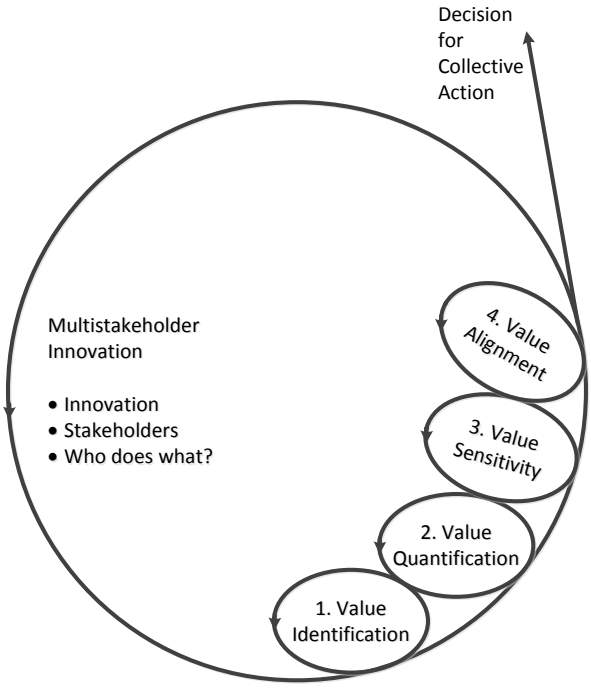

Figure 3: an illustration of the process

As can be seen in Figure 3, the VCM consists of iterations. Within one iteration of the VCM the elements required for the generic innovation process are assumed to be known. The elements only change when a new iteration starts. We assume that the VCM is applicable when:

- (Innovation) project description and purpose of investment are given
- There is a fixed set of necessary stakeholders.
- Each stakeholder has sincere intention to undertake collective action
- The stakeholders have decision-making power
- There can be multiple stakeholders within one organization
- The overall costs and benefits are known and agreed upon
- The business case cannot be made or is indecisive for each individual stakeholder

Typically when an innovation has a platform character and it is complex in nature, the innovation will likely have to involve multiple stakeholders with different roles, backgrounds and values.

Outcome of the VCM can be threefold:

a) Interchanging values within the scope of project;
b) Value-adding activities;

c) No collective action.

Outcome 1 indicates that the distribution of values has shifted, due to the alignment that takes place. Figure 4 illustrates this for a particular value. For this value, the more the better. In this scenario there are three stakeholders: blue, green and red. The pie on the left represents the original situation. The pie on the right represents the situation after alignment. During the process of exchanging values, the stakeholders have come to an agreement that the blue and green stakeholder obtain more of the value depicted below, at the expense of the red stakeholder. This is a so-called zero-sum exchange; the overall sum of the values stays the same. It is possible, but not necessary, that the red stakeholder gets more of another value in return. It might also be the case that the red stakeholder wants the innovative plan to succeed and is willing to decrease his share in the total value to increase the success rate of the collective action. These transactions become more complex when more values are involved in such a transaction. For instance, shareholder 1 receives compensation of values A and B, at shareholders' 2 expense who in turn demands compensation in value C from shareholder 3. The number of values involved in such a transaction can be as many as the identified values.

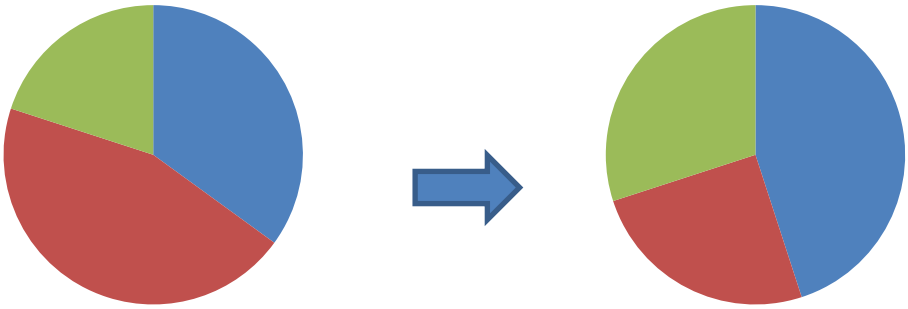

Figure 4: Interchanging values within the scope of the project.

The VCM makes values explicit. This may lead to the insight that not all relevant values were taken into account in the beginning. For instance, stakeholder X can offer stakeholder Y some value-adding activity that might only be remotely related to the original idea, but it concerns a value that is highly appreciated by stakeholder Y. In that case, we find ourselves in outcome 2; value-adding activities. The pies in Figure 4 will be larger. This will change the original plan, illustrating the iterative nature of the process.

Of course, outcome 3 (no collective action) is still a possible outcome. The VCM aspires to increase the rate of success.

The VCM consists of four steps that can be entered from each negotiation iteration, as discussed in the previous chapter (see Figure 3):

- Value Identification. For each stakeholder the relevant values that the innovation should affect are elicited. A qualitative insight on who gets what values is produced.
- Value Quantification. In case the distribution and impact of the qualitative values identified cannot be determined unambiguously, additional insights are needed and the who-gets-what and who-does-what are quantified in appropriate units and measurements.
- Value Sensitivity. Based on the definition of the innovation, the range of acceptable values for the innovation for each stakeholder are elicited from testing modest deviations from the base project definition. These are visualised and analysed and a list of alignment opportunities is the result.
- Value Alignment. A structured process aimed at getting an overall acceptable innovation, based on the alignment opportunities is performed.

The VCM is essentially linear, but after each step a decision for collective action can follow. After each step the generic elements of the innovation, stakeholders and who-does-what may need to be determined again, causing a new iteration of the (general multi-stakeholder innovation) process. The process terminates if agreement is reached, or if no alignment opportunities lead to an overall acceptable innovation. The steps will be discussed one-by-one in this section. We are aware that anonymity is an important issue within this process and where possible anonymity will be ensured.

Step 1: Value Identification

Identification of values is crucial to the decision-making process. In this step we find out which values the stakeholders associate to the project. The outcome is a list of relevant values.

For every stakeholder we form an idea, by conducting interviews, on:

- The reason why the VCM is conducted. We introduced a number of criteria. The VCM can be implemented from scratch or it may be initiated if a project halts. Was the project aborted? If yes, why?
- Value based "requirements". Important values for the stakeholder that the project is expected to address, e.g. using laddering.
- Division of Values. Who-gets-what in terms of values? Most likely, this will give us qualitative answers.

This qualitative information is obtained by asking explicit open-ended questions to individual stakeholders. We suggest Van Weelden (2011) and the technique of laddering (Reynolds and Gutman, 1984; Reynolds and Gutman, 1988, Pike, 2012) to determine a long-list of values. We shorten this list to the most relevant values by means of ranking by individual stakeholders, inspired by Eckartz (2012) and multi-criteria analysis. Here, also pneuma, the fourth P, and factors like time and place are implicitly taken into account by the focus on the stakeholder's incentives.[4]

After this step, there is more insight in the values connected to the project. Stakeholders have individually explored the values of the project and their standpoint on this. This might cause stakeholders to change their decision of participation. Thereby, collective action might take place. If this is not the case, we turn to step 2 of the value case methodology.

Step 2: Value Quantification

Value quantification may result from step 2 and satisfies the stakeholder's need for additional information. Furthermore, it provides the necessary basis for step 3. For each (relevant) value, we have to answer the following three questions:

a) How to quantify the value in question? For example should we be looking at CO2 reduction, additional trees or both, when quantifying the value 'Environment'?
b) What is the quantification of the answer on question a? For this we need to measure, look up (from previous measurements), or estimate the number.
c) What are the practical possibilities to use this value for alignment? What does it take to increase or decrease the project definition's score on this value? This is input to
d) Step 4: Value Alignment.

[4] At this moment, making them explicit would be too much detail. Therefore, it is left for future research.

In the previous chapter some techniques were named for the quantification of values. Obviously, this step is very case dependent. A literature study, an external expert or data analysis might be needed to answer the questions above.

As this step gives stakeholders more insight in the division of values, it could again lead to a change in stakeholders' decision to participate. If this is not the case, we turn to step 3.

Step 3: Value Sensitivity

In this step, we analyse value sensitivity, using the following three sub steps:

a) Elicitation. For each stakeholder and each value, we determine its sensitivity to a change in the parameter value[5], the stakeholders' point sensitivity.
b) Visualisation. We visualize this point sensitivity.
c) Analysis. We analyse the graphs on two levels: stakeholders and values.

The steps will be discussed next. Outcome will either be a (slightly) changed set of stakeholders or continuation at step 4.

Elicitation

We determine the point sensitivity and acceptance criteria per stakeholder per value by using conjoint analysis. Point sensitivity denotes how sensitive, in terms of acceptance, a stakeholder is to a small change as compared to the parameter value of the initial proposal6. The parameter value is denoted by P and the parameter value of the proposal by P*. We determine how sensitive stakeholders are to a small change in P*. This idea is based on utility theory; how much would stakeholders' utility change when the proposal changes. Utility, which we denote by u, can in this context be interpreted as the willingness to cooperate. The point sensitivity in utility theory is often referred to as elasticity. Since most people associate elasticity with money, we prefer to use the term point sensitivity.

Furthermore, we determine the acceptance level of each stakeholder. There is a certain utility at which the stakeholder will accept the proposal, which we call u*. This is a threshold value; every offer that leads to a utility of u* or higher will be accepted by the stakeholder. Every offer that leads to less utility will be denied by the stakeholder. In this step, we determine the

[5] The parameter value is the 'outcome' of the value. This can be a number, but also a discrete outcome like a colour, yes/no, and so on.

[6] The proposal of tasks and financial values of the original idea, is the basis. If the original idea was changed in the generic multi-stakeholder innovation process, the idea which encountered the least resistance, is the basis.

value of u* for each stakeholder, by using conjoint analysis. Since we have introduced many definitions here, let us recap this in a table:

Table 1: Definitions related to Value Sensitivity analysis

Abbreviation	**What is it?**	**Meaning**
P	Parameter value	The 'outcome' of the value(s).
u	Utility	The utility a stakeholder derives from a parameter value P. In this context, it can be seen as the willingness to cooperate.
P*	The offered parameter value	The offer under consideration.
u*	The threshold utility	A stakeholder's utility must be equal to or greater than u* in order to cooperate.

Visualisation

Inspired by Tarakci (2013) and perceptual mapping (Steenkamp et al., 1994; Bijmolt and van de Velden, 2012), we visualise stakeholders' preferences. We plot graphs with the parameter value on the horizontal axis and the utility of the stakeholder on the vertical axis. Each value has its own graph, which includes plots for all stakeholders.

For sake of simplicity, we now concentrate on a single plot for a single stakeholder. We will explain later on how this is expanded to all values for all stakeholders. The curve we plot denotes the point sensitivity for this particular stakeholder concerning one particular value.

Previously, we tested how the stakeholder would react to an adaptation of P*. How much would this influence the stakeholder's utility? We find the parameter value P on the horizontal axis and utility u on the vertical axis in Figure 5. We tested how utility u would change if a small change in P* would occur. Therefore, the curve is situated around P*.

There is a certain utility level at which stakeholders will accept the proposal, which we have defined as u*. Stakeholder's acceptance depends on the complete offer, not on the single value we draw in a graph. Therefore u* will be of the same level, no matter what value we draw.

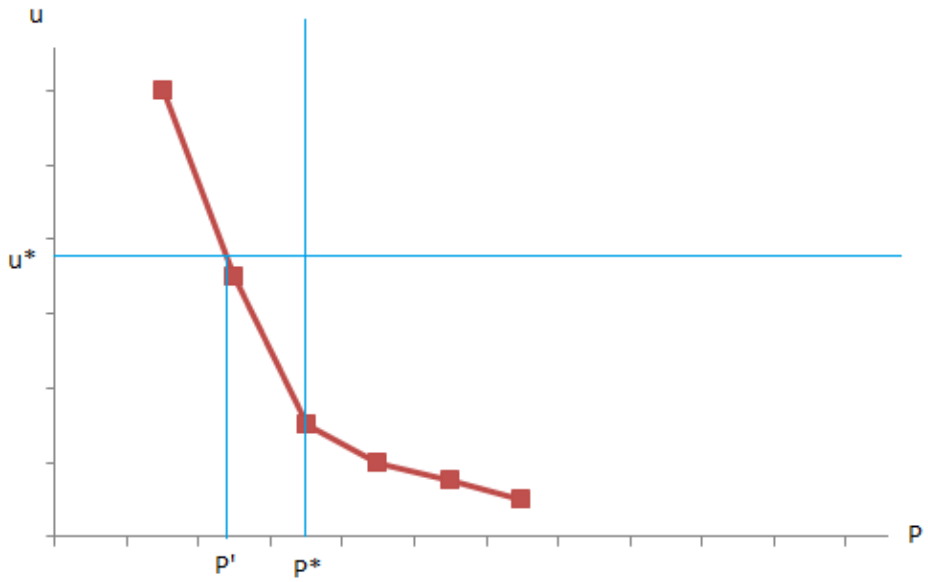

Figure 5: Point sensitivity curve of one value for one stakeholder

If the point sensitivity is negative (i.e., the slope of the curve is downwards), an increase in the outcome of that value means that the stakeholder is unhappy about this increase. If the point sensitivity is positive (i.e., the slope of the curve is upwards) an increase in the outcome of that value means that the stakeholder is happy about this increase. If the point sensitivity is zero, the stakeholder is indifferent. In Figure 5 we see a stakeholder with negative point sensitivity: the higher P, the lower his utility.

In Figure 5 we see that at offer P* the stakeholder's utility is below u*. That means he will not cooperate when he is offered P*. This stakeholder therefore needs to be 'compensated' in order to come to acceptance. A possible compensation is to decrease the parameter value to P' or less. When we are able to achieve this, the stakeholder will cooperate, because his utility then exceeds u*.

Now, the point sensitivity curve of each stakeholder can be drawn into this graph in a similar way. This can then be executed for each value[7], resulting in a series of graphs; one graph for each value. An example of this can be seen in Figure 6.

[7] An additional assumption for this visualization, is that the values are orthogonal, i.e. the values are mutually independent. If this is not the case, we can still continue our analysis. However, we must pay extra attention to interdependencies amongst the values.

In Figure 6, we see an extension of Figure 5 by the inclusion of two other stakeholders. All three stakeholders have a negative point sensitivity for this particular value (i.e., the curves have a negative slope). However, the degree of point sensitivity varies among the stakeholders. This can be seen from the angle of the slope. The steeper the slope, the more sensitive a stakeholder is to a change in the parameter value.

The parameter value of the initial proposal (P*) is the same for each stakeholder. However, the derived utility levels differ across the stakeholders. In particular, the stakeholder with the purple curve derives much more utility from P* than the two other stakeholders. This can be seen by looking at the distance between the purple curve on the one hand and the green and red curves on the other hand at the level of the vertical blue line.

The level of u* differs across stakeholders. We see that the purple stakeholder has a lower threshold value for utility than the green and red stakeholder. Furthermore, we see that the purple stakeholder is already above its utility threshold at P*, which means he will accept the offer P*. We also see that any change in this particular value will not change his acceptance as the complete curve lies above his threshold value.

On the other hand, the point sensitivity curve of the green stakeholder is below his u* for any value of P. This means that this stakeholder cannot be compensated sufficiently by means of this particular value in order to let him accept the proposal. In other words, to compensate the green stakeholder, we will have to focus on other values. The red stakeholder however might reach his personal utility threshold by lowering P*.

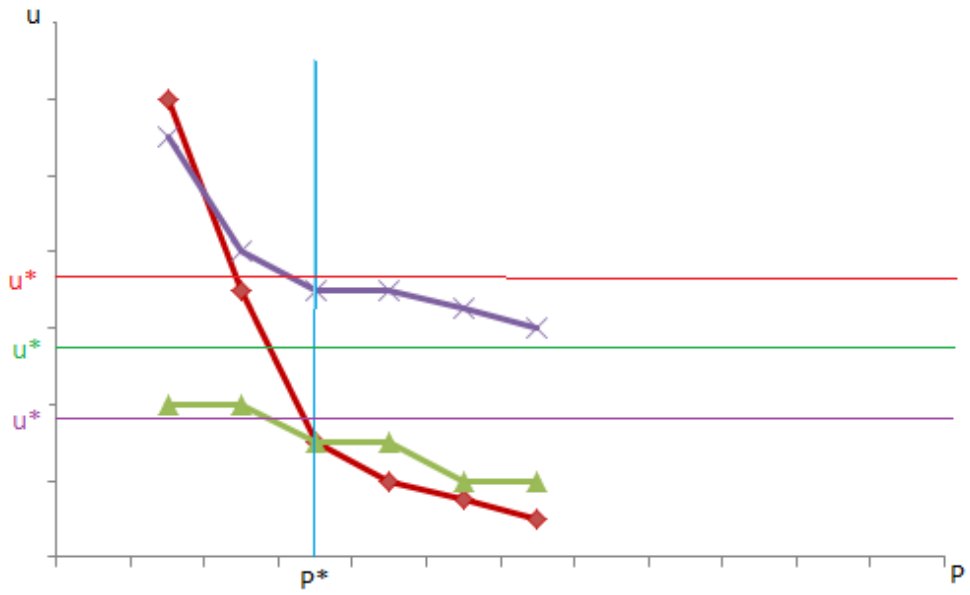

Figure 6: Point sensitivity curves of one value for multiple stakeholders

These other values have graphs which may contain completely different curves. A few examples of such curves can be found in Figure 7. Curves can be non-monotonous if a certain threshold-level are reached, e.g. stakeholder may have no use for extra supplies of water or gasoline beyond a certain point.

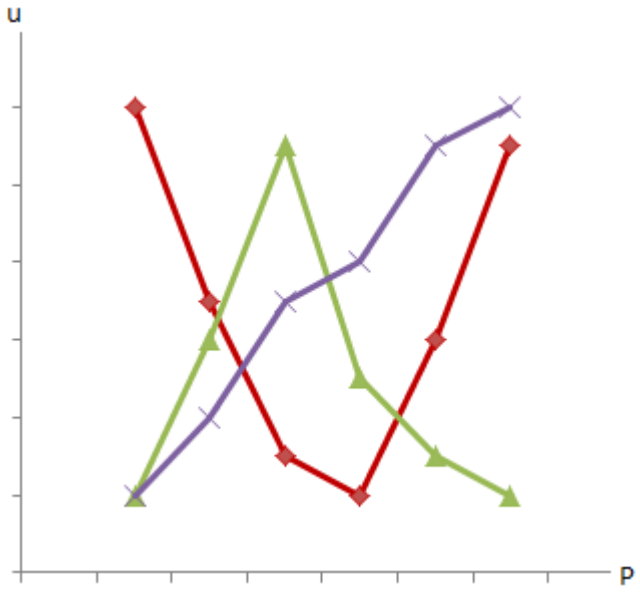

Figure 7: Examples of point sensitivity curves

Analysis

Previous information gives us insight in the values that are the most promising to use for alignment (compensation). We are looking for compensation with minimal costs and maximal effect, i.e. an exchange of values that leads to a Value Case against minimal costs.

When determining the most promising values, we must take into account the interaction, bottle-necks and side-effects. We analyse the graphs on two different levels:

- Values
- Stakeholders

First of all, we analyse which values have a collective effect and which values only have individual effects. For instance, only one stakeholder will benefit from a financial compensation, whereas an alignment on a value like 'environment' is likely to affect multiple stakeholders. Therefore, we consider the latter to be more promising because of the collective nature of the effect. We do not need the graphs to determine if a value is collective or individual.

We use the graphs to deduct which value has a large effect on the acceptance (utility) of stakeholders. We do this by comparing how much compensation is needed (increase or decrease in P*) to gain acceptance, we call this the distance to acceptance. We have to make a distinction between stakeholders with a utility below and above u*. The former group needs compensation, the latter group can compensate if necessary.

From the graphs we can also deduct which values are (too) complex for alignment. These will be the collective values in which stakeholders with negative as well as positive point sensitivity occur, like in Figure 8.

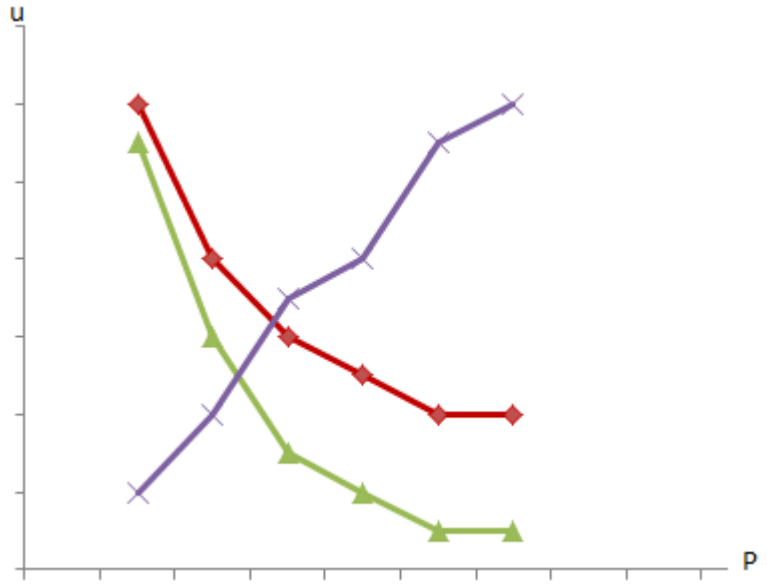

Figure 8: Positive (purple) and negative (green and red) point sensitivity curves

The graphs also give us insight in the expected response to proposed transactions of the stakeholders (a). We can see which stakeholders would accept proposal P* and which stakeholders need to be compensated. We can identify ‘blockers’. Blockers have a different sign of point elasticity than the other stakeholders. For example, when most stakeholders’ utility would decrease with an increase of the parameter value, a blocker would be a stakeholder whose utility would increase with an increase of the parameter value. An example of a blocker would be the purple stakeholder in Figure 8. This is inconvenient if a change in parameter value will have an effect on everyone, i.e. it is a collective value. In that case, an increase would be beneficiary to a lot of stakeholders, but this blocker-stakeholder might cause spanner in the works. The graphs help us to identify such a blocker, after which we can find out the cause of this and use it in negotiation.

It is possible that, with help of the graphs, we find out that some stakeholders will never agree to collective action. If that is the case, we need to go back to defining the group of stakeholders. If that is not the case, we continue with step 4.

We believe that we cannot yet develop a general algorithm that ranks the possibilities of alignment in terms of success rate. We identify what alignments of values potentially lead to acceptance, but not yet how that can be achieved. That is up to the stakeholders. The outcome, however, will depend on the order of the alignment of the various values. It is

pragmatically believed that it is more likely to come to collective action if we start by exchanging the most promising values (a "greedy" approach).

Step 4: Value Alignment

This step consists of a structured process aimed at getting an overall acceptable innovation. It is based on the alignment opportunities of step 3 and the stakeholders' creativity.

For the facilitation of the process we use the structured-disclosure technique of Eckartz (2012), which we discussed in the previous chapter (the SID4IOP method). This method helps actors to achieve agreement on value distribution in a shared project. For the VCM, we want to expand this method using serious gaming and make it 'suitable' for the VCM.

The Value Alignment is an iterative process, which terminates when:

- Agreement is reached and collective action will take place.
- An alteration of the elements is necessary. In this case the generic multi-stakeholder innovation process, discussed in the previous chapter, is started again with a changed innovation plan or different group of stakeholders.
- No collective action, because no alignment is feasible. Since the order of alignment is crucial, one can reverse all executed value transactions and start again, or admit to failure.

A fourth possibility is that changed preferences or values occur, due to external changes. For example, a rising price in the materials needed, new available studies on effects, or different incentives for stakeholders due to organizational changes. If this happens, most likely the VCM needs to start over from the beginning.

4 The Case of Sustainable Product Manufacturing[8]

GreenElec is an ENIAC Joint Undertaking project consisting of a consortium of European companies representing stakeholders in the electronic product network, ranging from producers to recyclers.[9] The main goal of the GreenElec project is to achieve a more efficient use of resources by designing and manufacturing electronics that enable more effective recycling. In the consortium, partners have proposed a number of potential innovations from new design processes to more effective sorting processes to achieve this goal. Each

[8] This case has been described by the authors in section 8.1 of Bastein et al. (2014).
[9] http://www.hitech-projects.com/euprojects/greenelec/

innovation assists in increased resource efficiency, but requires different investments and services from each stakeholder, and not all of these investments are directly beneficial for the stakeholder but perhaps enable another party in the network. These innovations are difficult to realize when this cooperation of multiple stakeholders is essential to the successful implementation of the innovation. It is crucial to understand with whom the costs and benefits lie and to open communication and awareness of these cases across the network. With this knowledge and common understanding new business models or policy interventions can be identified and analysed to further define the innovation and its impact on the existing stakeholder network.

While to some extent stakeholders are driven to achieve increased resource efficiency, there are many individual and interacting barriers which are holding them back. For example, when looking at producers of electronic products their responsibility for their products has been extended past the sales point to after use. This was implemented through the WEEE (Waste Electrical and Electronic Equipment) Directive which requires producers to play an active role in the collection of electronic waste both through collection schemes and financial support (European Commission, 2013). Producer Responsibility Organisations (PROs) are meant to help drive the recycling process to fully close the loop in the electronic product lifecycle. While these organisations provide some additional incentive for producers to become more resource efficient, as a part of the price of every electronic product sold goes to support the PRO, the costs of the PROs are passed down to the consumers when paying for the product. Thus, while this WEEE Directive is a good first step towards resource efficiency in the electronic product network, there are many other barriers facing stakeholders to become increasingly resource efficient and ultimately a more circular economy.

Increasing collection is one thing, but increasing resource efficiency within products and processes across the network requires more, this is what GreenElec tries to tackle. Smelters and producers are important players in this network. Smelters have strong contracts with recyclers which require certain material standards be met regarding the waste they deliver. Further, they have a strong negotiating position for material reuse, making them an integral stakeholder in achieving innovations as they will have power to accept or reject changes which directly impact their role in the network, thereby also impacting their direct suppliers and customers. Further, producers are central in the achievement of resource efficient innovations in the network. They set the standards for how their products are assembled and

have a strong negotiating position with their component manufacturers regarding the materials used. However, currently their focus is primarily on reliable, low-cost materials in their production process, not resource efficient materials.

Focusing more on the producers, there are potential changes to their product design or their processes which may increase resource efficiency, especially at the end of life. However, the greatest barrier for the producers regarding these changes is that they do not offer lower costs or other direct benefits (such as a large market demand for these products). Producers find many resource efficient or eco-innovations to be a large cost investment for them where they cannot directly reap the gains, but instead the end of life (EOL) actors (such as sorters and recyclers) will see the benefits.

The biggest issue we have found is communication throughout the network and the large barriers faced by the power holders in the network (primarily the producers). Producers then often act as a barrier for the end-of-life stakeholders to achieve their goals as they hold crucial information and do not have the incentive to share. For instance, sharing specific product or material information could directly impact their competitive advantage as such information is valuable for their competitors, they would be taking a risk without direct benefits in return. So there are strong inter-actor links as well as inter-barrier links relating to market and technology barriers primarily as well as organisational and market barriers. Producers will update their products and become more resource efficient if there is a consumer market for it or other direct financial incentives (such as lower-cost processes), but processes which do not directly translate into a positive business case are often ignored as it is not the focus of these producers (market and behavioural barrier).

When we take a closer look at the electronic product value network, we observe an interesting interplay between the different barriers (Figure 9) that influence the uptake and diffusion of resource efficient innovations, that facilitate optimizing component and material re-use (such as setting up materials databases, simulating recycling and re-use processes). This figure represents a simplified version of the web of constraints which the electronic product network faces. There are several actors with various barriers which need to be overcome. How the stakeholders are connected to one another, in addition to how their barriers are related (for example: producers risk aversion further supports the end-of-life actors barrier to like of information) creates a complex web of constraints.

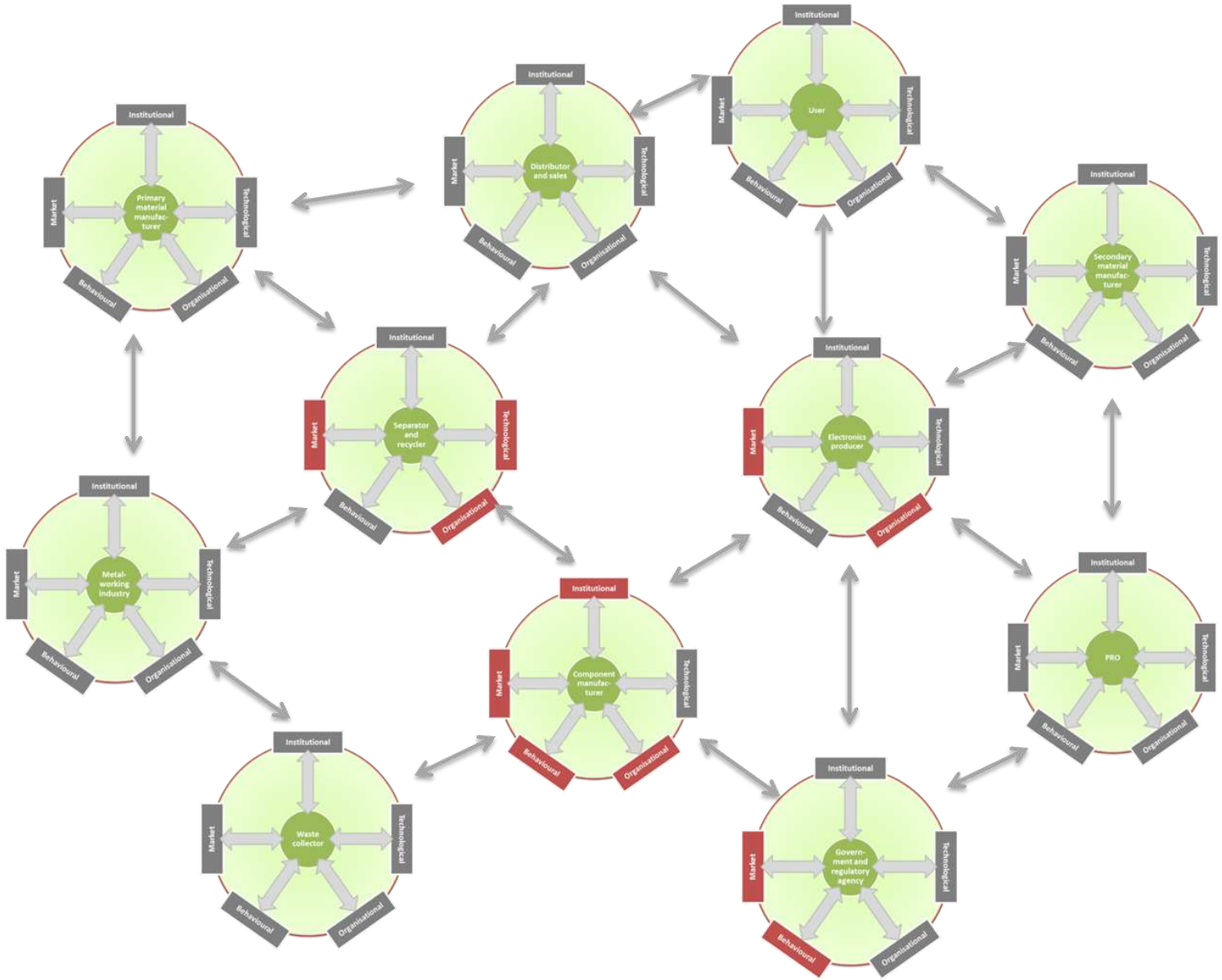

Figure 9 A schematic representation of the electronic product value network

Though the primary materials manufacturer is not directly involved in the innovations, they do experience costs. They do not have the power in the network, so these costs or barriers are not prevalent. They will have to compete more heavily with recycled material with the successful implementation of these changes. Therefore, it is important to keep the competitive advantage perspective in the story.

The component manufacturers experience more barriers than any other actor in the electronic product value network (Figure 9). An institutional barrier for the component manufactures is the lack of standards. The work to compile a database or perform extra analysis on their products is only seen to be costly, so there is no internal motivation. This would require an external push by regulation to motivate them. Currently, this lack of external incentive is a large barrier for the component manufacturers to change anything. Organisational barriers for the component manufacturers exist in extra paperwork, while at the same time there are no economic rewards. This can be linked to the market as their primary customer is the electronic producer. They want to keep production costs low (and have large power in the network) and implementing such innovations is costly for secondary manufacturers which is passed down to the producers. This hurts their competitive advantage as they do not gain much by adding these in. A behavioural barrier exists in a general resistance to change, but market barriers are probably the most important barrier for the component manufacturer. First, availability of data is a problem among component manufacturers. Without support for external information on data, this creates a large burden for the component manufacturers as they would need to find a way to gather this information. Second, communication through the value chain is problematic. Communication two steps up or down the chain is virtually non-existent. Companies focus on themselves and their core suppliers and customers. These innovations mainly benefit the EOL actors, but this does not impact them so to speak. Lastly, component manufacturers also experience a risk for their competitive position when providing deep intelligence about component composition.

Electronics producers mainly experience organisational and market barriers. Organisational barriers exist in the extra steps in the production process, which thereby will take more time. Production costs for the whole supply network will be higher and it is unclear who will be in charge of the new services. On the market side, there is a risk for the competitive position of the electronics producers, especially when sharing too much information with other actors in

the network. Similar to component manufacturers, there is a lack of information from the value chain and data gathering is expensive and time consuming.

Separators and recyclers experience technological barriers in insufficiently accurate assessment techniques. This is largely linked to lack of data availability and communication, which is at the same time a market barrier. Without certain information elements, the technology is limited in its capabilities.

Government and regulatory agencies mainly indicated to experience behavioural barriers in the lack of consensus on recyclability. Besides this, on the market side policies and regulations seem to be ineffective because of a lack of market demand and lack of governance for the services provided. The other actors in the electronic product market, have not reported notable barriers.

The producers do not only face financial barriers there are also organisational, behavioural, market, technical, and institutional barriers to increasing eco-innovation and resource efficiency within the stakeholder network. Below are some examples of these barriers:

- Institutional: No subsidies or policy incentives to make more recyclable products;
- Market: More costly products impacts market competitiveness (working within current market conditions);
- Organisational: Mentality within organisations to comply or only to innovate if it provides a positive business case, which is not always immediately the case;
- Behavioural: Not on the foreground of people's minds, not a primary concern. Within producer organisations designers have a focus to meet their targets and only comply to what is absolutely necessary;
- Technical: Requires investment in new technology and/or software.

Each of these barriers is linked to another and can be acting against the same eco-innovation, creating a complex system to change. Further, market conditions limit their ability to invest in more resource efficient products when they currently require higher costs. Most companies invest in resource efficient innovations to reduce costs, but in some cases it may be too costly to invest as is the case found in GreenElec.

5 Conclusions

Today's business market is rapidly changing with new innovations. However, the success of many innovations depends on cooperation of other important stakeholders within the network. This challenge increases with stakeholders with power face an unclear or negative business case in regards to the innovation. What is their motivation to cooperate? How can new solutions be identified to assist the innovations land successfully in the market? That is where the Value Case Method has been developed from. It looks at values across three different levels and across stakeholders to identify opportunities for value redistribution and the creation of positive cases for all stakeholders. The Value Case Method uses direct input from the stakeholders and asks for their opinion on how important the various effects are for this business. With this input a visual tool is created to be used in understanding value misalignments and identifying new opportunities within the network. In this case study, the Value Case method has demonstrated its added value under actual market conditions with a diverse stakeholder network.

GreenElec is focusing on a number of potential innovations to achieve more efficient use of resources and close the loop from recyclers to manufacturers in the electronic product lifecycle. Currently, the EU has identified a problem within recycling of electronic products and electronic waste production and GreenElec has been implemented to further investigate this problem, identify the underlying causes and provide solutions. Looking at the Problem Solving Cycle (Karis 2011), the Value Case can be used in the first three phases: identify the problem, define the problem and develop alternatives. This provides input for defining the solution (through the developed alternatives), implementing the solution, and evaluating the solution. Within the GreenElec case, the Value Case Method has provided insight in new possible business and regulatory interventions to realise a number of innovations in the market. This transparency allowed for slight redesigns in the innovation to include business models which redistribute value to stakeholders facing a negative case. By highlighting imbalances in the network, partners were able to move from a stand-still into discussions to find solutions. Parties which originally had no incentive to participate now see potential

benefits in these reworked innovations, making them acceptable for all stakeholders and therefore viable.

The case study of GreenElec has shown that barriers to resource efficiency improvements generally experience a web of constraints. Not coincidentally, this case heavily relies on networks of actors to jointly come into action in order to change a business model or a mode of action. Besides introducing elements of organisational barriers (changing within one company is obviously simpler than changing processes within a network of stakeholders), this network dependent change also leads to the complexity that any actor may experience a different set of barriers. Communicating about these barriers and solving them becomes a very difficult task. Such complex networks may only come into action once systemic changes have been implemented that lead to a common goal and a focus of all players involved, without them having to agree on the common goal.

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