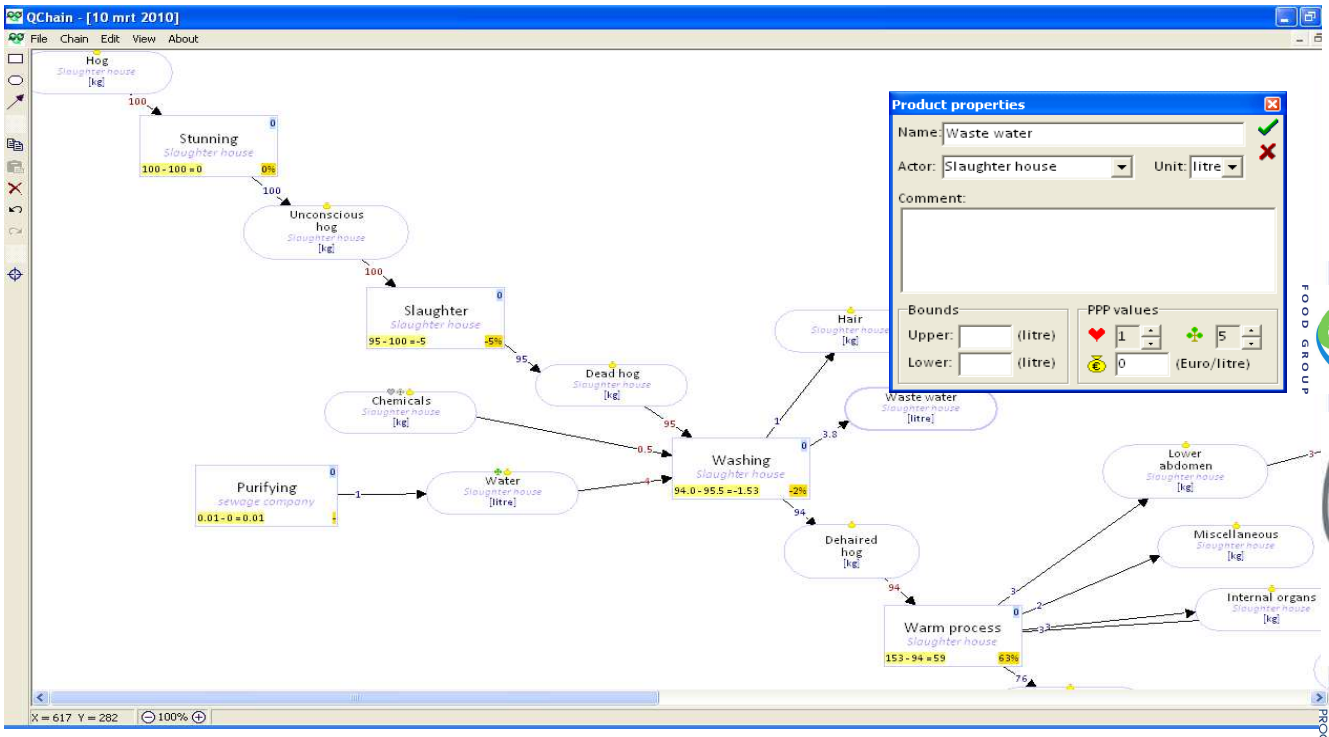
Toolbox Value Creation Handbook

Charting People, Planet and Profit in value chains



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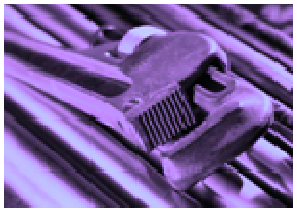
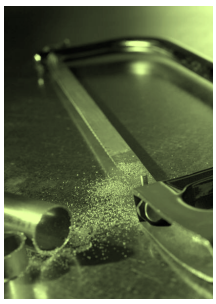


1. INTRODUCTION



Many companies transformed their behaviour towards environmental issues. It stays, however, a challenge to find sustainable solutions – solutions that not only benefit the environment and society, but also the company. To create a sustainable society companies need new data and information regarding e.g. environmental and societal impacts of new products or processes are necessary, but these are often missing. Information systems can play an important role here and many tools are already developed. We started this project with the intention to develop a toolbox, in which all these tools are gathered and their complementarities highlighted. However, during our search it became clear that one, in our view, crucial tool was lacking: One that (a) integrates People, Planet, and Profit value (b) focuses on the whole production chains and (c) allows flexible data input. A new tool, *QChain*, was born.

QChain is meant for anybody who works on sustainability issues, aiming to create a sustainable production chain. In practice this will often be policy makers, champions, consultants and network coordinators that work on a sustainability problem or valorisation issues. The tool is especially useful in organizations that feel the need or want to create the need to not only focus on profit, but also reckon with people and planet value – their licence to produce. QChain is a drawing tool that supports shared value creation for sustainable production chains. It helps users to:

- Get a picture about WHERE THEY STAND by:
  - visualizing (parts) of the production chain, with inputs, outputs and activities;
  - including by-streams and by-products;
  - visualizing people, planet and profit value for all inputs and outputs.
- Generate NEW SUSTAINABLE IDEAS by:
  - Identifying where value is lost or can be gained;
  - Identifying other stakeholders that need to be involved;
  - Generating new ideas to valorise inputs and output and developing scenarios.
- Decide WHERE TO GO by:
  - Comparing scenario's on PPP value;
  - Prioritizing them on PPP value;
  - Judging which scenario needs to be followed up.

By visualizing both main and by-products with their people, planet and profit value the tool aims to stimulate discussion and support decision making in finding existing or "hidden" value and identifying opportunities where and how new value can be created. The drawing method used in this tool makes users instantly aware of where

they stand and where they could go, which motivates to undertake action in the highly complicated and uncertain area of sustainability. Next to that, the tool is quick and easy to understand, use and adjust – alone or in a group. The best moment to start using the tool is in the early state of a value creation process and preferably before the pressure of society becomes severe pro-actively, instead as a reaction to societal complaints). In other words, use the toolbox in the exploring phase of an innovation project to develop a vision of sustainability or an useful scenario for a sustainable production chain and to decide which actions and initiatives to pursue.

In this handbook we will describe how to use this tool. We will start with describing the procedure that has to be followed, in order to find new sustainable solution. Here, we will also describe when to use QChain. Then, we will provide you with a practical manual how to use QChain. Following, we will give you tips about other tools that can be used that support the value creation process. We hope that this tool and handbook may help you to create a sustainable world!

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2.1 Before Using QChain

Before using the tool form a team, define the system boundaries, and set the project goal. It is important to discuss the goal before defining the situation how it is now (the next step), otherwise today's reality may influence or even change the goal. The key questions that will be answered in this step are:

- Which persons need to be involved?
- What is the area of focus?
- What is the goal?

A. Form a team

Before starting the whole process, it's important to recruit the right persons for various reasons. Establishing an appropriate team is a critical aspect in ensuring that the work has real potential to create value (Taylor, 2005). Next to that, it ensures e.g. corporate commitment, which is one of the most critical elements in the eventual project success. A strategy should be developed to inform and engage senior management throughout the project, in order to give the eventual recommendations the best chance of being fully understood and appropriately evaluated. Making separate presentations to the senior management teams (of each companies involved) has proved to be successful (Taylor, 2005). These presentations could outline the scope, objectives of the project, tools to be used, and the nature of eventual outputs. This also gives the company the opportunity to individually consider the potential benefits, i.e. "what's in it for me" (ibid).

TIP: Team members should possess the right seniority in connection to higher authorities, sufficient authority in getting the required information from relevant departments, and the right competencies and capabilities (see du Chatenier, 2009; Taylor, 2005; 2006).

B. Define the system

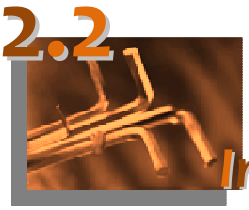
An understanding of the scope of the processes is a pre-requisite. It starts with describing how the system is *constituted* (Robèrt, 2000; Robèrt et al., 2002). Questions to pose are: How is the system itself constituted? What are the relevant principles for the constitution of the system, including both ecological and social principles? (Waage, 2007; Waage et al., 2005). Then, select a specific value stream as the focus for analysis and improvement (Jones and Womack, 2002). A value stream is typically defined as a specific product or product family serving a specific customer or market segment (Taylor, 2005). Selection of the target value stream or focal product (Francis et al., 2008) across a whole supply chain involves three aspects (Taylor, 2005:748): First, it is necessary to decide the scope of the value chain project in terms of the distance along the chain to be included; should everything from raw material supply to final consumer be considered or only part thereof? This is usually determined pragmatically by the resources available and the companies involved. The second aspect is the selection of a specific pathway through what is often a fairly complex supply network. It is usual to select a pathway, which has significant volumes, so that any improvements will have a significant impact on the business. The third aspect of value stream selection requires the identification of a target product group. This is often done on the basis of Pareto analysis of sales value or volume and the selection of top selling products (for more information read Taylor, 1999 and Taylor, 2005 and).

TIP: Focussing on the flux of critical materials within the entire value chain is recommended in order to identify all life-cycle-wide effects (Busch and Hoffmann, 2007).

C. Set the Goal

Establish the specific project objectives. Identify outcomes and success, by defining a stage, a certain favourable outcome, in the systems mentioned above. Questions to pose are: How can sustainability be defined? (Waage, 2007; Waage et al., 2005). What are the basic mechanisms by which humanity can destroy the system? What are the principles for sustainability (i.e., a successful outcome: increasing concentrations of substances extracted from the Earth's crust; increasing concentrations of substances produced by society; physical impoverishment by over-harvesting or other forms of ecosystem manipulation; and resources are used fairly and efficiently in order to meet basic human needs worldwide) (read for more information (Robèrt, 2000; Robèrt et al., 2002).

TIP: Read literature on performance indicators for People, Planet and Profit value and let them guide you in determining the goal (read for more information Bossel, 1999; Buch & Dixon, 2009; Cruz and Boehe, 2008; Hartmuth et al., 2008; Hildén and Rosenström, 2008; Lehtonen, 2008; Maxwell and Van der Vorst, 2003; Maxwell et al., 2006; Porter and Kramer, 2006; Skouloudis et al., 2009; Waage et al., 2005; Zahm et al., 2008).



2.2 Inventory of PPP in Production Chain

This step is about the identification, quantification and allocation of PPP value to (parts of) production processes in the production chain (Van Berkel et al., 1997). First, develop a *current state map* of the whole supply chain for products, from production to purchase of the final products by the consumer. Next, compare the current state map with the goal as identified in the previous step and identify the problem; which is the discrepancy between the two. The key questions that will be answered in this step are:

- What is the state of affairs concerning PPP value in the production chain?
- What is the discrepancy between the desired and the actual situation?

A. Develop Current State Map

The development of a current state map starts with (1) the division of the manufacturing process into unit operations: an area of the process or a piece of the equipment where materials are input, a function occurs, and materials are output (Van Berkel et al., 1997). The analysis typically focuses on the 'primary' activities that are specific to a particular product. These are product design and development, supply, production, distribution, marketing and post-sales service, also referred to as from farmer, to broker, processor, distributor, retailer and consumer (Johnston and Carrico, 1988). There are also a number of 'supporting' activities such as R&D, human resources or finance that are not attached to individual products, but which nevertheless may add value to that product (Rieple and Singh, 2010).

(2) For every unit operation the associated material input and output and transformations are identified. Every unit operation is drafted as a block. By connecting the individual unit operations in the form of a block diagram, one prepares the process flow chart. It is important that by products are taken into consideration (see for more information Linton et al., 2007). For each input output, it's common to include a mass balance which indicates the material flow (Taylor, 2005). This data forms a basis for prioritising pathways within the supply chain for analysis and improvement.

(3) For both supporting and primary activities the positive and negative environmental, social impacts and costs are assessed and any increased value achieved by the activity. When assessing the People and Planet value one could make use of several checklists, for instance the Sustainability Assessment Checklist (Maxwell et al., 2006). While some PPP aspects allow qualitative measurement, others aspects can only be measured qualitatively. Relying on the judgements and intuition of the assessors is preferred, because of a lack of appropriate data. By connecting the various

PPP aspects and value to specific products companies are forced to think of sustainability in specific ways, which could make their efforts to prove sustainability more productive (Maxwell et al., 2006).

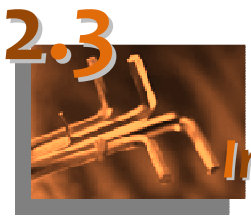
TIP: Start with the main line and fill in the details later, by first drawing the main processes, then the main inputs and outputs, followed by specifying the details. Draw for each new detail a new diagram. An input can be a material stream, energy, but also landscape with recreation value. Each PPP aspect can be visualized as an input or output.

B. Define the problem

This step is the earliest opportunity to bring a common understanding of sustainability and sustainable development issues to the team (McLellan et al., 2009). There are a couple of strategies to define the problem.

1. Use the current state maps as a basis, reflect on it and identify issues and problems right away. Questions to pose are for instance In what ways, and to what extent, are we contributing to the violation of the system conditions today? (Waage, 2007; Waage et al., 2005). By evaluating the PPP values, an "issues and problems map" can be developed.
2. Compare the actual situation with the desired situation (the goal). The identified discrepancies form the basis for the problem definition.
3. Reflect on the four quadrants of the sustainability portfolio and decide to what extent the current state contributes to the four issues and define the degree of portfolio balance (for more information see Hart, 1997).
4. Reflect on the areas of competitive context and its aspects, for instance the local availability of supporting industries or the size and sophistication of local demand (for more information see Porter and Kramer, 2006). Any and all of these aspects of context can be opportunities for sustainable initiatives.

TIP: The problem often is, that the problem is not seen. The GROW model provides excellent questions, which create awareness about the problem situation (see for more information Landsberg, 1997).



2.3 Improvement Options for PPP Value

This step in the process aims at the generation of improvement options for products, production processes and life cycles in different stages of the value chain (Van Berkel et al., 1997). To achieve this, one needs to choose which issues or parts of the

problem to address, define the strategy, and develop alternatives or scenarios. Key questions answered in this step are:

- Which part of the problem needs to be worked on?
- What's the best approach to tackle this (part of the) problem?
- What might be solutions to the problem?

A. Choosing the issue

Mapping of the chain throws up many issues and improvement opportunities (Taylor, 2005). No single company can solve all problems. Therefore, each company must select issues that intersect with its particular business. Remaining issues are best left to those organizations that are better positioned to address them. The essential test that should guide the selection is not whether a cause is worthy but whether it presents an opportunity to create shared value (see for more information Hart, 1997).

TIP: Ask yourself; given the company's , society's and environment's impact on each other, how might you address social and environmental needs in a way that creates a meaningful benefit for People, Planet and Profit? (Porter and Kramer, 2006).

B. Define the strategy

Next, strategies for forward movement need to be articulated that is a process for the transition towards sustainability, and the safe development thereafter (Robèrt, 2000; Robèrt et al., 2002). Questions to ask are: What are the basic strategic principles and guidelines for sustainable development by which specific actions can be fostered in a strategic way to move purposefully towards success? (Waage, 2007; Waage et al., 2005). Strategies are for instance a step-by-step approach, flexible platforms, and low hanging fruit (Robèrt, 2000; Robèrt et al., 2002).

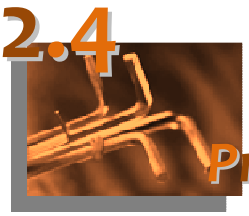
TIP: For more information about these strategies, please read Robèrt (2000) and Robèrt et al. (2002).

C. Develop the alternatives

Developing alternatives and possibilities for improvement options is typically the next step in the design processes (McLellan et al., 2009). In this step, a small number of initiatives that generate large and distinctive benefits for society, environment and the company is mounted (Porter and Kramer, 2006). Evaluating the chain on the identified performance indicators is one approach to derive a possibility, which is a logical follow up from the inventory state (Perez and Sanchez, 2009). Another strategy, according to the backcasting technique is to envisioning the situation where the goals have been met, and then planning what one must do now to move towards that point (Mulder, 2007). A question to pose is for instance: What concrete actions should be undertaken in order to reach success? (Waage, 2007; Waage et al., 2005).

Whatever strategy is being taken, the alternatives or scenarios should be aligned with the goals set.

TIP: The scenario should be credible and tantalizing as a possible development and should therefore be consistent and sufficiently detailed. At least three scenarios are needed. See for more information about scenarios Mulder (2007).



2.4 Prioritization of Improvement Options

This step in the process aims at the generation of improvement options for products, production processes and life cycles in different stages of the value chain (Van Berkel et al., 1997). For doing so, one need to analyse the improvement options, compare the scenarios, and choose the one that meets the future state vision best. Key questions that are dealt with in this step are:

- How feasible and effective are the improvement options?
- What is the best improvement option for follow up?

A. Analyse Alternatives

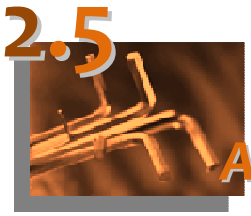
To successfully integrate People, Planet and Profit value into the design process, sustainable decisions must be viewed as strategically driven decisions, evaluated by comparing the relative costs and benefits. QChain provides a level of decision support by a multi-criteria analysis dialogue, where the various scenarios can be compared on People, Planet and Profit value. However, weighting of different environmental impacts is still highly controversial due to methodological constraints as well as the limited availability of high-quality environmental impact data (Van Berkel and LaFleur, 1997; Van Berkel et al., 1997). Therefore, it is important that also other, more qualitative strategies are being used, such as reviewing the possibilities versus the plan (Francis et al., 2008). Furthermore, the SMART action plan (specific, measurable, achievable, realistic, timed) provides a systematic method of selecting projects, ensuring they related to the overall improvement aims and establishing quantified goals, timescales and resource requirements (Taylor, 2005).

TIP: Think about benefits in the long run and forget short term thinking for a while. A SWOT analysis might be a useful additional tool to identify the strengths, weaknesses, opportunities and treats of each analysis (xx). Involving an external reviewer could provide a fresh pair of eyes that see new or different things.

B. Develop Future State Map

Finally, but not least, a decision needs to be taken about which scenario(s) will be selected for further consideration or development into a Future State Map. Most sustainable choices will involve balancing competing values, interests, and costs. The future state map is in fact the scenario for the future (for more information read Pontius and Neeti, 2010). This map can form the basis for the actual construction of the plan or further calculation of PPP value according to the level of detail of the map.

TIP: Develop a well-considered and structured action plan, (Choo et al., 2007; Kylen and Shani, 2002).



2.5 After Using QChain

When the future state map has been defined, the process of actual development of the idea can get going. Frameworks to support this process are among others the Sustainable Product and/or Service Development (SPSD) approach (Maxwell and Van der Vorst, 2003; Maxwell et al., 2006) and the Green Product Development model (Chen, 2001). Before applying these frameworks one has to choose metrics, develop a communication plan, and create a receptive organisational context. Key questions answered in this phase are:

- What tools can be used to measure performance in the course of the project?
- How should the internal communication take place?
- How should the project be implemented in the organization?

A. Choose metrics

Metrics for sustainable development are different concepts and tools for measuring and monitoring the transition (Robèrt, 2000; Robèrt et al., 2002). There are two levels. Firstly, metrics can be used to (i) test the relevance, quality, and quantity of various activities to ensure they are really aligned with the principles for sustainable development. Examples are measurements to determine that material flows are really decreased to levels that are sustainable. Secondly, one can (ii) perform metrics on specific impacts in nature (when principles for sustainability are violated). Examples are various indices on "global warming potential of gases", or "H+ equivalents of acidifying substances" (Robèrt, 2000:248).

TIP: Use existing toolboxes to identify appropriate tools (see for instance Van Berkel and LaFleur, 1997; Van Berkel et al., 1997, Maxwell and Van der Vorst, 2003; Maxwell et al., 2006).

B. Develop communication plan

It appears that the understanding of the concept and context of sustainability not consistent across project stages (McLellan et al., 2009). This is not surprising as many baselining studies are performed by specialist consultants, while the multiple areas of plant design are performed by separate design teams, and finally separate and often-changing teams of operators run the operation in the production phase. The transfer of knowledge or understanding between phases of the project is therefore essential. Different phases of the project-production cycle will have different requirements for integrating sustainability, but, an integrated, consistent, project and operation-wide framework for sustainability thinking would aid significantly in transfer of knowledge, understanding and development of sustainable alternatives and initiatives (McLellan et al., 2009: 1423).

TIP: The impact of communication or interaction between team members depends on the homogeneity of the group. In contexts such as project work where frequency of communication and homogeneity are high, work may be successfully undertaken without much communication or interaction between project members, even though substantial computational and epistemic complexity may prevail (Enberg et al., 2006). Team members of an interdisciplinary team should have close and constant interaction and work together from start to finish (ibid).

C. Create a receptive organisational context

Achievement of improvement usually requires strategic as well as operational change. It is recommended to develop a strategy to create a receptive atmosphere for the improvement options developed (Taylor, 2005). Involving senior management is regarded as a key element. Team members have to ensure therefore that the directors have sufficient understanding of not only the recommendations, but also the underpinning sustainability concepts in order to make a reasoned judgement as to the appropriateness of the proposals (ibid). A series of communications need to be scheduled to explain interim findings and recommendations (see for more information Taylor, 2005).

TIP: Keep in mind that the person you approach might perceive the project as a threat. In such a case, it's necessary to clarify the problem in his or her own language and make him or her problem owner. Posing questions is a much powerful tool than having a great speech in this respect.

3.1 The QChain Application

QChain is a Windows™ application. It is a quick, easy to use, but smart production chain visualisation tool. Users provide PPP values about production processes and products (activities, inputs and outputs) to create a diagram of the production chain that can serve as a "map" or a "visualisation" showing the elements of the supply chain and the associated PPP values. The *chain diagram* created by QChain shows the production chain, inflows, outflows, and the PPP values created (or consumed) at a glance. The main purpose is facilitating informed and meaningful discussion. Therefore QChain aims at enabling users to easily and quickly create a diagram and assign values with a minimum of drawing elements.

QChain user interface

The main view (user interface) of the application consists of a menu bar, a toolbar, and the drawing area (
Figure 1). The commands of the application are accessible through its menu and toolbar buttons (Figure 3 and Table 1). Chain diagram is drawn by selecting drawing objects (which is either a product, a process or a link) from the toolbar and placing them on the drawing area. A *process* is what transforms inputs products to output products. Raw materials, intermediates products or final products are simply called *products*. PPP values are assigned to products and are entered through a dialog box that is displayed by *double clicking* on each product. A line drawn from a product to a process or vice versa is called a *link*. Incoming links (from the perspective of a process) connect input products to processes, and outgoing links connect processes to output products. *Double clicking* on a process displays the process properties dialog. The process properties dialog shows the ratios (proportions) of inputs and outputs thereby defining the material flow through the production chain.

The toolbar provides commands like "create a new process", "undo", "seek target", etc. Some toolbar commands are (de)activated based on the drawing object (process, product or link) selected in the drawing area. The status bar at the bottom of the application windows shows the location (the x- and y-coordinates in pixels) of the mouse pointer and the zoom level (in percentages) of the drawing.

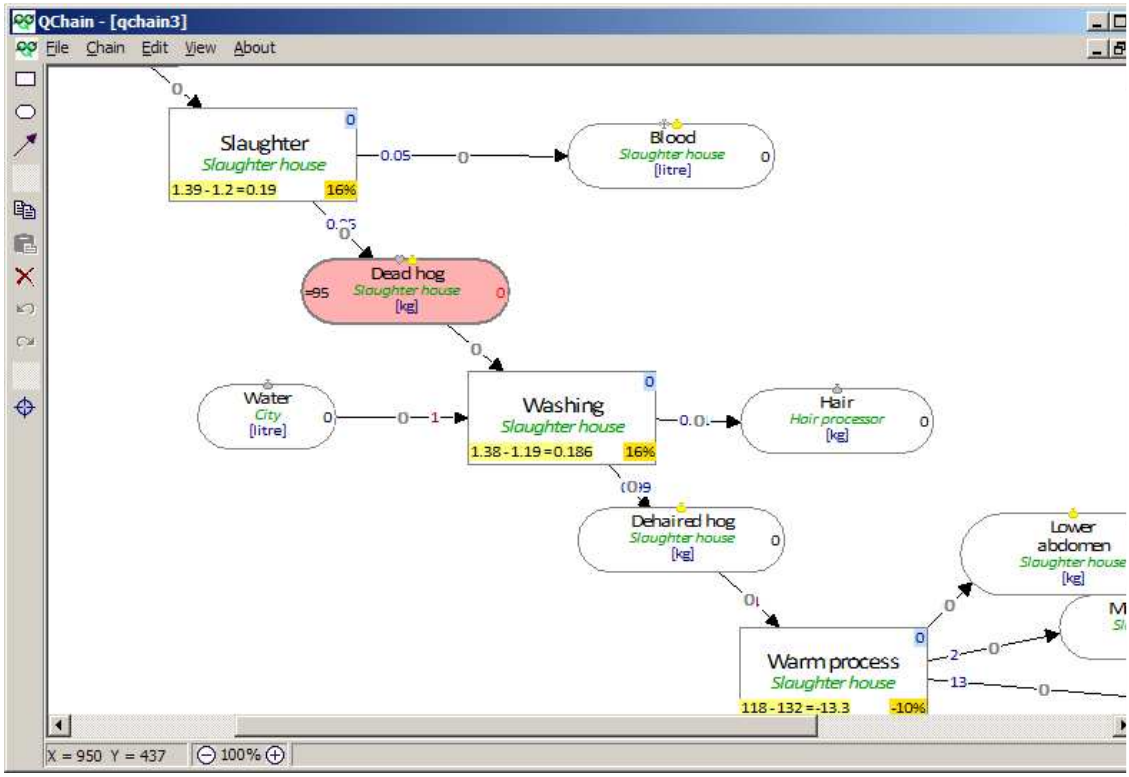


Figure 1. The QChain window

PPP values at a glance

Production chains can be very complex. They may stretch over a number of firms and business units within those firms. They may involve many stakeholders each with their own PPP value judgements about inputs, intermediate and final products. Often, no single user has an overview over all aspects of the production chain. If the essence of the production chain is not represented using the right abstraction level it will be difficult to get insight over PPP aspects of the chain.

QChain aims to show its users the total picture of PPP at a glance and therefore provides features to capture only the essential elements of the production chain. The chain diagram needs to be understandable to all stakeholders, therefore QChain is made as simple as possible. A chain diagram has only three drawing elements. An oval shape represents a *product*, a rectangle represents a *process* (activity) and a line represents a *link* (a flow of input or output connecting a product with a process). All information about the production chain is displayed in the diagram. Values are shown in the shapes or on the line that connects the shapes, making it possible to display PPP aspects of the supply chain at a glance.

For instance, Figure 2 shows part of a chain diagram that represents a single process in a slaughter house. In slaughter house meat processing, the pig's organs and abdomen are removed from the carcass in a process called "warm process". It is so called because the process takes place under very warm conditions. The diagram shows at a

glance the following: input-outputs proportions (94kg of hog resulting in 3 kg abdomen, 13 kg organs, 76kg carcass, and 2 kg of other outputs); the amount of input products used and output amounts produced for a given amount of target product - which in this case was 8 kg of a specific type of meat (not shown in figure) (15, 0.48, 12.2, 0.32kg respectively); one of the PPP values (in this case profit) (i.e. input value 132€, output value 118€, resulting in 10% loss). The value at top-right corner of the process shape (0.16) is redundant – it shows the ratio with which outputs proportions are multiplied to produce the input - output amounts. In addition quantifications, actors, etc. are shown.

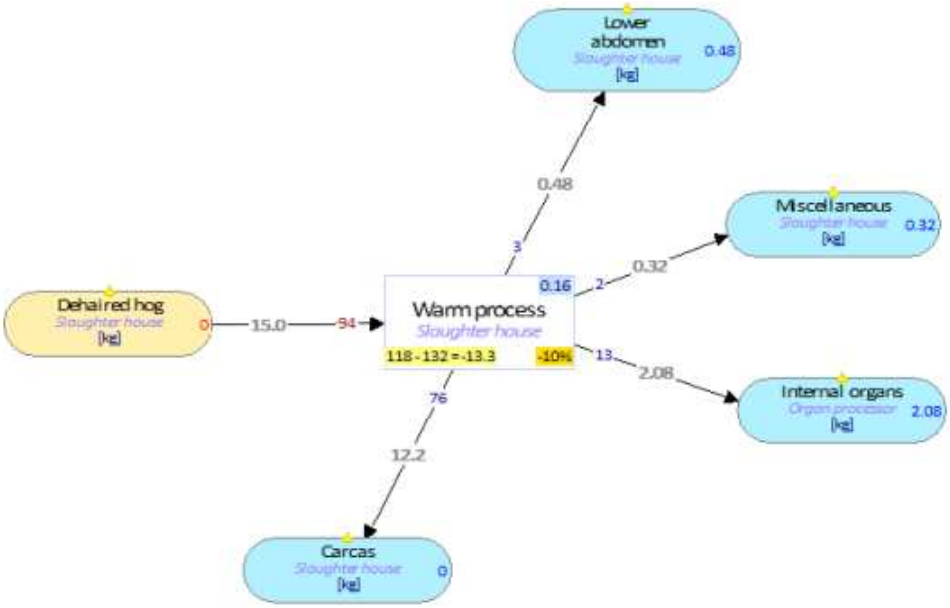


Figure 2. PPP values at a glance

QChain Commands

The menubar

The menu bars contains five sets of menu commands: *File*, *Chain*, *Edit*, *View* and *About* (see Figure 3). The *File*, *Edit* and *View* menu groups provide the usual file, edit and view commands, and they are self-explanatory. In the *Chain* menu, the *Properties* command shows the *Chain properties* dialog. In the *Chain properties* dialog users can change the name of the diagram, provide a description and select the default scale unit (eg. nr, kg, litre, etc.) The *Actors* menu item displays a dialog window that shows the PPP values for each actor. The *Weight* command displays a slider for each PPP (People, Planet and Profit) aspects. Users can adjust to the sliders to indicate the relative importance of People, Planet and Profit aspects. The weights are used to determine what the optimum amount of each product is in a *seek target* recalculation.

The *Seek target* command allows users to compute new optimum amounts of products for a new target output users want to simulate. Seek target allow users to generate consistent scenarios. The *Copy diagram* command allows the user to copy the diagram either to a file or to the system clipboard. The *Chain* menu group also lists the QChain diagrams that are currently open. Selecting the QChain diagram in the list brings the diagram to the foreground. The *About* menu item displays the about dialog box.

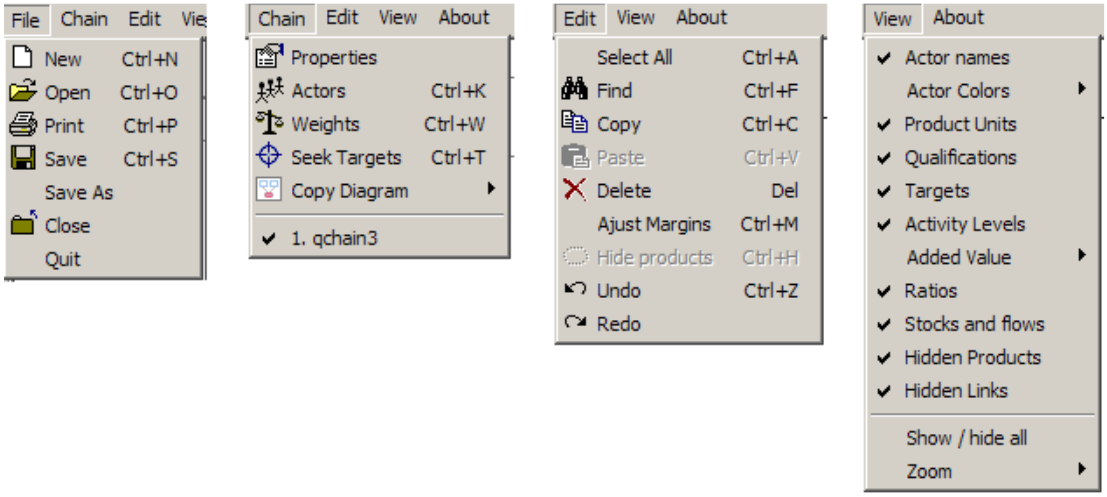


Figure 3. QChain menu items

The toolbar

The toolbar, located at the left-hand side of the application window, contains drawing, editing and viewing command buttons. Chain drawing is done exclusively using the drawing toolbar drawing commands. **Table 1** describes the commands that in detail.

Table 1. The toolbar commands

	*Process.* To draw a process click on it and click on the drawing area.
	*Product*. To draw a product click on it and click on the drawing area.
	*Link*. To draw a link click on it, click on a product (or a process) and then click on a process (or product).
	*Delete* .Select a product or a process and select this command to delete it.
	*Copy*. Select this command to save the selected items to Windows' clipboard.
	*Undo*. Select this command to "undo" your previous action.
	*Redo*. Select this command it reverse the previous "undo" action.
	*Seek target*. Select the product for which you have specified a *target* amount to produce and select this command to calculate the amount of other products to be used to meet the target specified for the selected product.

Drawing a chain diagram

Drawing a chain diagram is accomplished by selecting products and processes from the toolbar and dropping then on the drawing area and connecting them with a link. A link is drawn by selecting it from the toolbar and dragging a line from a product to a process, or vice versa (see Table 3 for detained description). A link can be drawn from a product to a process or the other way round. In mathematical terms the chain diagram is a bipartite graph (bigraph) with two distinct vertex sets which are *Products* and *Processes*, such that all links in the graph are between products and processes. Links between two products or between two processes are not allowed. A link represents an input or an output of a process. A link drawn from a product to a process indicates that the product is an input to the process. A link drawn from a process to a product indicates that the product is an output of the process.

A QChain diagram should start and end with one or more products. A chain diagram starts with "raw materials" (initial input products) and ends in "final products" (end output products). All products and processes should be connected, which means there is always at least one *path* from an initial input products to an end output product. In this way it is possible, when doing a summary analysis, to "summarize" a sub-chain in one process, as long as one knows the conversion factors between input and output products.

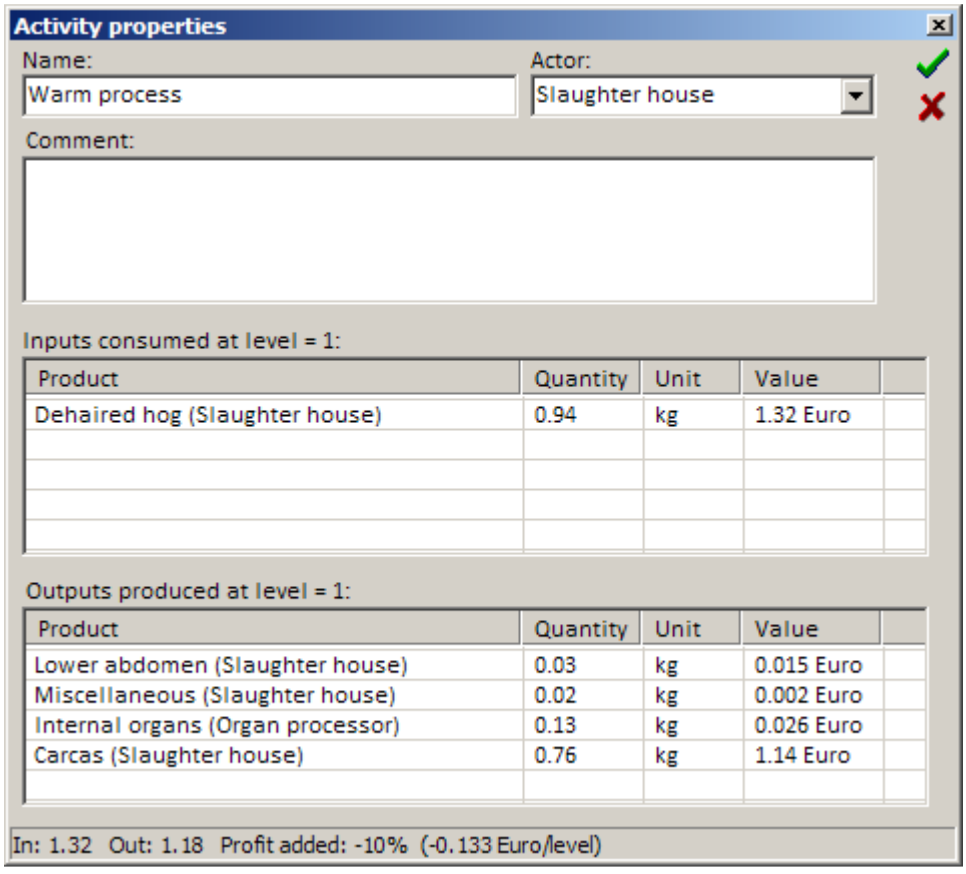


Figure 4. Process properties

Filling in the details of processes and products

Double clicking on a process displays the process properties (Figure 4). In this dialog, the user specifies the *Name* and the *Actor* and provides the description of the process (*Comment*). All inputs and outputs are listed and are initially assigned the value 1 as the quantity. The quantities represent the *flow* of products through the production chain indicating the proportions with which inputs are converted to outputs.

Product properties are displayed in the same manner as process properties by double clicking on the corresponding drawing element (Figure 5). Besides *Name*, *Actor* and *Comment*, the user can change the measurement unit (*Unit*) of the product, the amount upper and lower bounds (*Upper* and *Lower*) to be produced, and the PPP values.

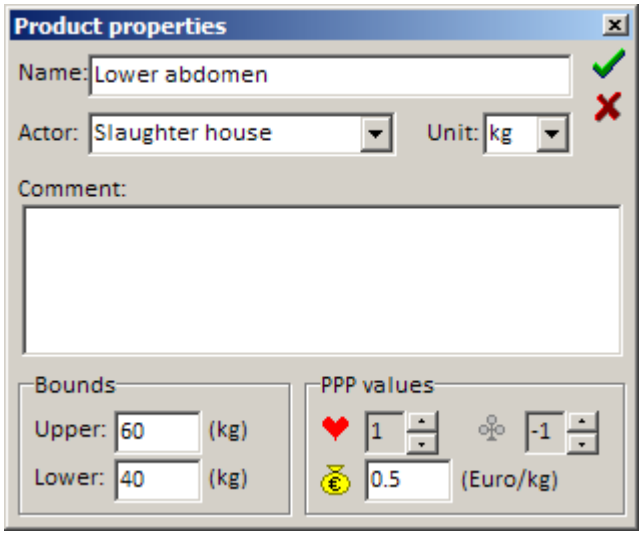


Figure 5. Product properties

The People value is specified quantitatively in price (in Euros (€)) per unit of measure. People and Planet values are specified qualitatively using an interval scale with range from -10 (most negative) to 10 (most positive). PPP values are also displayed using symbolic indicators. Table 2 shows the PPP symbols. It is up to the user to assign a meaning to the People and Planet values. For instance, -10 will probably mean "could cause the company to be out of business", while +10 could mean "will cause a major breakthrough for the company".

Table 2. PPP symbols

PPP	Symbol	Description
Profit		+ve profit value (unit price >= 0)
		-ve profit value (unit price < 0)

People	♥	+ve people value (value >= 0)
	♥	-ve people value (value < 0)
Planet	♣	+ve planet value (value >= 0)
	♣	-ve planet value (value < 0)

Table 3. Toolbar commands for drawing a chain diagram

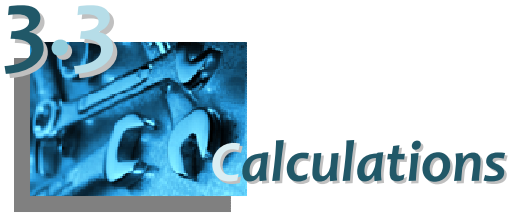
Draw process (activity) command. To draw a process click on the process symbol and click on the drawing area. The *process* editing dialog shown below will be displayed.

Enter the name of the *process* in the first field and enter the a*ctor* (actor is the owner of the process or product) in the next field. When done, select the OK (✓) button and the process is placed in the drawing area.

Draw product command. To draw a product click on the product symbol and click on the drawing area. The product editing dialog shown below will be displayed.

Enter the name of the *product* in the first field and enter the *actor* in the next field. Enter the measurement unit in the *unit* field. Units can be kg, litre, metre, etc.

Draw link command. To link a product and a process click on the link symbol and click and drag the mouse from the product to the process or the other way round. The arrowhead at the process end indicates that the product at the other end is an input to the process; likewise the arrow head at the product end indicates that the product is an output of the associated process.

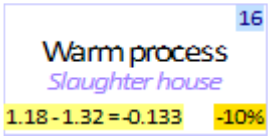
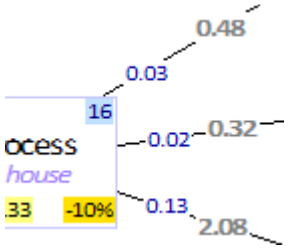


Setting targets and scenarios

The users sets targets by providing lower and upper bounds of the product to be produced or consumed. Users normally have sufficient information about the present state, i.e. the amounts produced and consumed in the present scenario are known. Therefore, the present state can then be represented by setting the same value to both lower and upper bounds. However, to do a "what-if" analysis users need to make various changes to the present conditions (or define various desired future conditions)

defining a scenario. In that case, QChain helps users to compute the amounts consumed and produced based on given target lower and upper bounds. Users can generate a consistent set of amounts consumed and produced by executing *Seek target* command. QChain visualises the results obtained by goal seeking using various symbols and values integrated in the chain diagram. Table 4 summarizes the visual feedbacks of goal seeking.

Table 4. Visualisation of goal seeking results

Product		**Product.** The values on the left show the lower and upper bounds as specified by user. The value on the right is the amount produced (but not further consumed in the chain) computed by goal seeking.
Process (Activity)		**Process.** The values in the lower left corner are the values produced, values consumed and the resulting net value. Based on the selected view the values can be of unit Profit, People or Planet. The value in the lower right corner represents the net value as percentage of values consumed. The value in the upper right corner represents the ratio with which the proportions are multiplied to produce the output values. Since the output amounts are shown on the links, this value is redundant.
Link		**Link.** ALink contains two values. The value close to the process shows proportions as provided by the user. The "shadowed" values close to the product are the result of goal seeking showing the actual amounts produced or consumed to produce the target amount.

Chain scenario summary

Chain summary (chain scenarios summary) allows users to compare the various scenarios generated by them. In addition it allows users to do a "what-if" analysis in terms of "what if this actor is not considered?" or "what if this product is not considered?". The resulting PPP values are displayed using a spider diagram (
Figure 6).

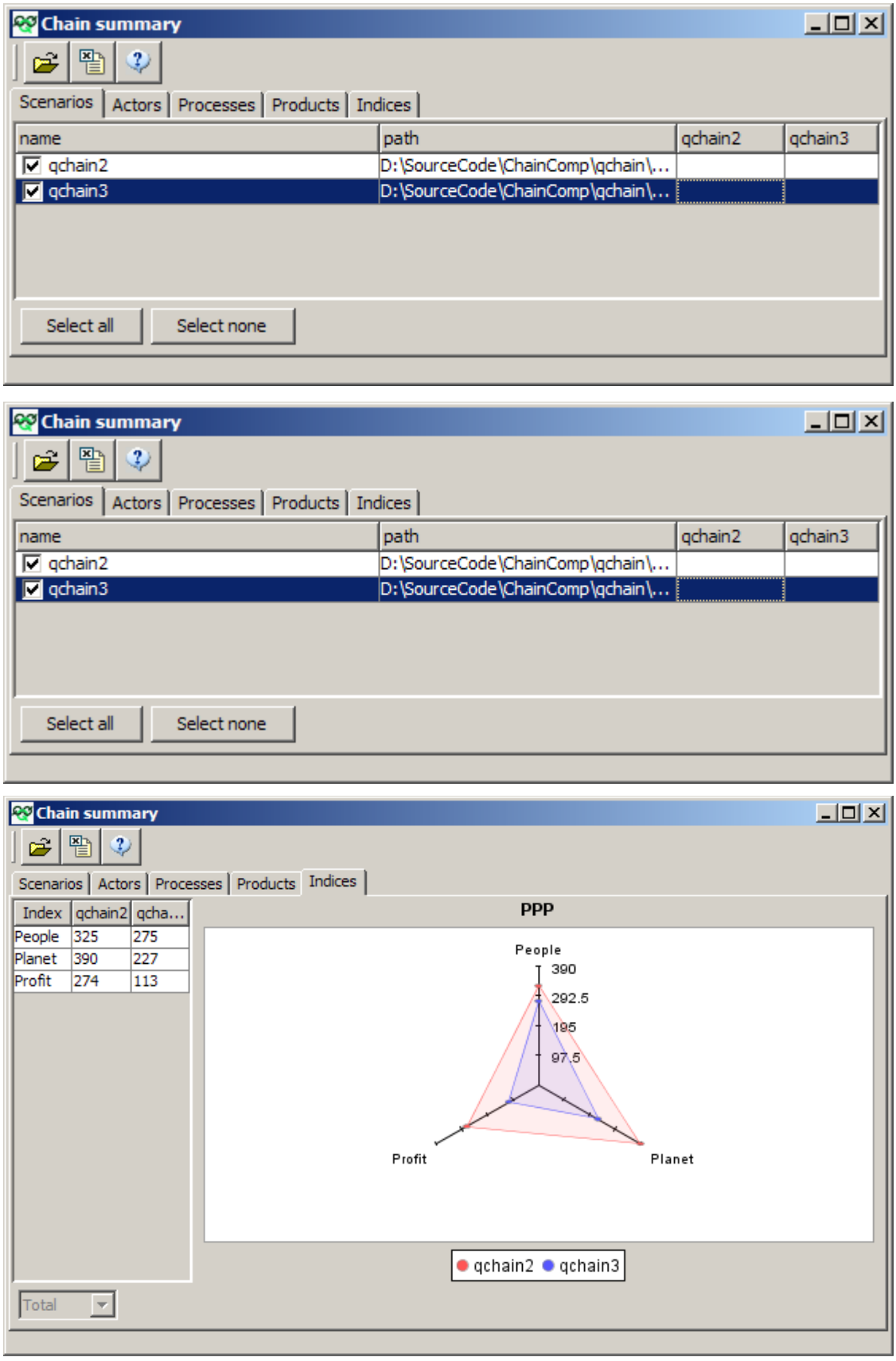
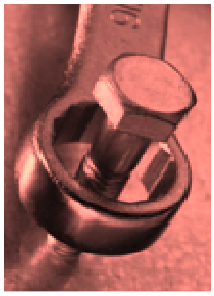


Figure 6. Actor summary dialog box



4.1 Procedural Tools

With procedural tools we mean tools that concern PROJECT MANAGEMENT.

For project management in general, read:

- Project risk management: processes, techniques and insights (Chapman and Ward, 1996).

For identifying other stakeholders, use:

- The *root definitions* of Soft Systems Methodology (Checkland, 1981). Root definitions take into account six elements, under the acronym CATWOE: C: Customers, those who benefit from T; A: Actors, those who do T; T: a Transformation, a hypothesized or real process that transforms the state of some entity; W: the Worldview that makes T meaningful; O: the Owner, those who could stop T; E: External parties who might be affected by T.

4.2 Relational Tools

With relational tools we mean tools that concern INTERPERSONAL MANAGEMENT.

For safeguarding intellectual property, use:

- The partnering contract (Poppo and Zenger, 2002).

For interpersonal management in general, read:

- The Pfeiffer book of successful team-building tools (Biech, 2008).

For informal meetings, use:

- Websites and books with tips for going out, like http://www.buitenbusiness.nl/ and Webfavoriten (Roos, 2007) (both in Dutch).

4.3 Technical Tools

Technical tools are tools that concern the CONTENT ISSUES. More information about the tools mentioned below can be found in Van Berkel and LaFleur (1997), Van Berkel et al. (1997), and Baldwin et al. (2005).

For inventory, use:

- Life cycle inventory
- MET matrix
- Eco-balance
- Material & energy balance

For improvement options, use:

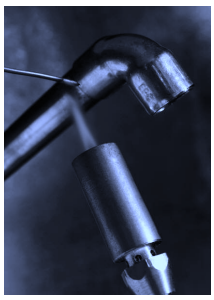
- Ecological principles
- Product improvement approaches
- Product improvement matrix
- Pollution prevention Techniques
- Pollution prevention Strategy
- Option inventory
- Blueprint

For prioritization, use:

- Benchmarks
- Total cost calculation
- Life cycle cost calculation
- Life cycle evaluation
- Eco portfolio analysis
- Product summary Matrices
- Eco opportunity
- Option evaluation

For management, use:

- Design for environment
- Cleaner production indicators Matrix
- Process audit
- Cleaner production guide
- ISO14000
- EU Eco-Management systems



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Appendix: Software tools for toolbox value creation

According to the PowerPoint presentation of Alex van Andel "3P's value creation in agri-food business processes" and our previous discussions, the value creation toolbox should at least have the following functions:

1. display graphically an intuitively value creation processes
2. 'regulate' and show the various stakeholder opinions
3. enable interaction among stakeholders, support collaborative valuation

The presentation demonstrated the first function using a form of conceptual mapping tool – probably CMap from IHMC. CMap is one of the many so called "concept or cognitive mapping" tools and allows to easily and quickly draw relations among concepts – in this case value creation processes.

The second goal was demonstrated using excel-type tool – probably a mockup created using Excel. Various stakeholders opinions was presented as a table, one table for each value creation process. The mathematical computation proposed resembles multi-criteria analysis.

The idea proposed to achieve the third goal is based hosting the applications on a shared server. Both the first and second functionalities need to be offered as web-based applications.

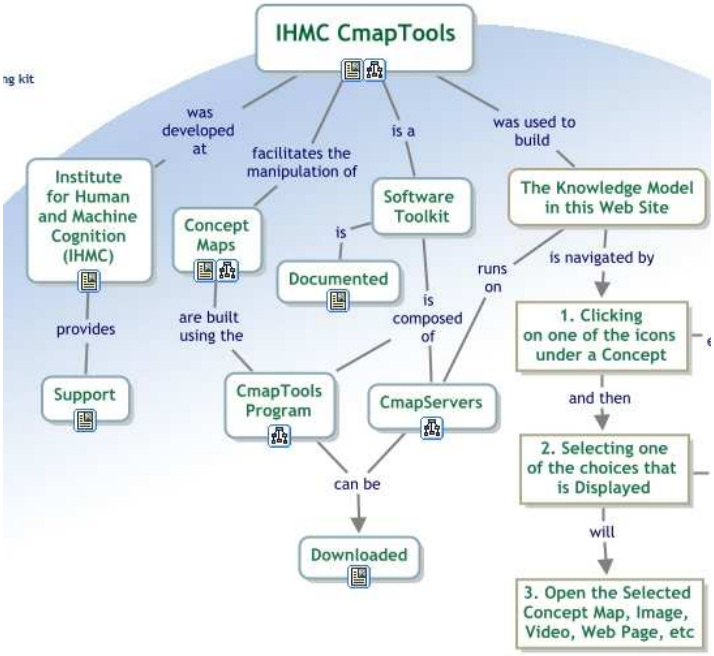
It is further proposed to build (mainly compose) the toolbox from existing tools. To achieve this, we need to do the following:

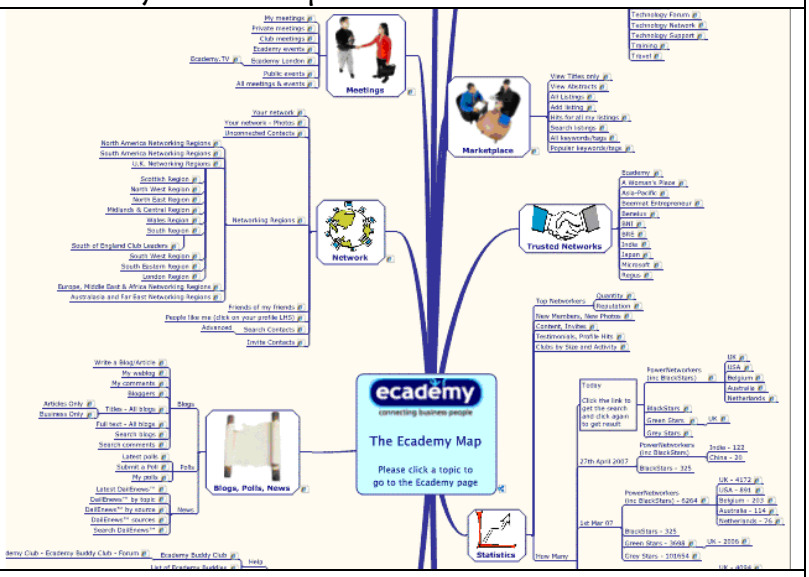
1. making an inventory of existing tools
2. selecting the right tools
3. make the tools to interoperate

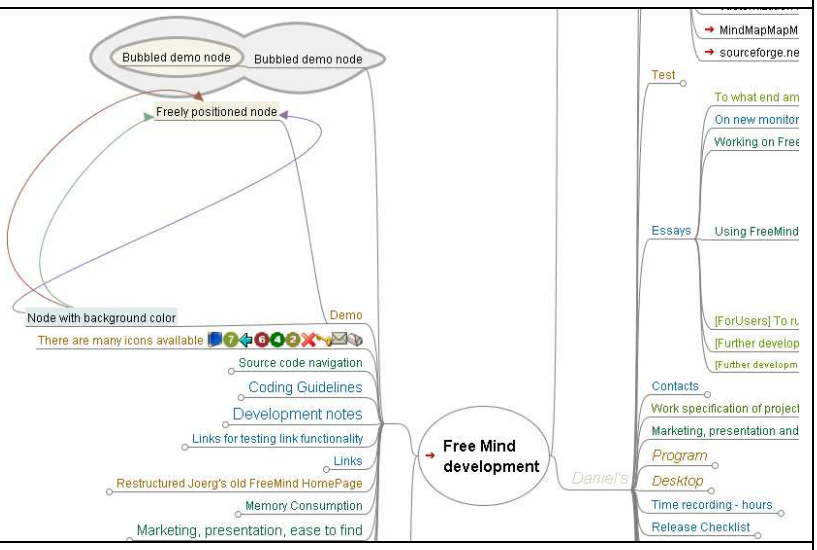
This document tries to fulfils the first task.

The tools listed in this document can roughly be classified (for our purpose) in three groups: 1) tools for visualizing value creation processes, 2) tools for stakeholders' PPP valuation, and 3) other relevant tools.

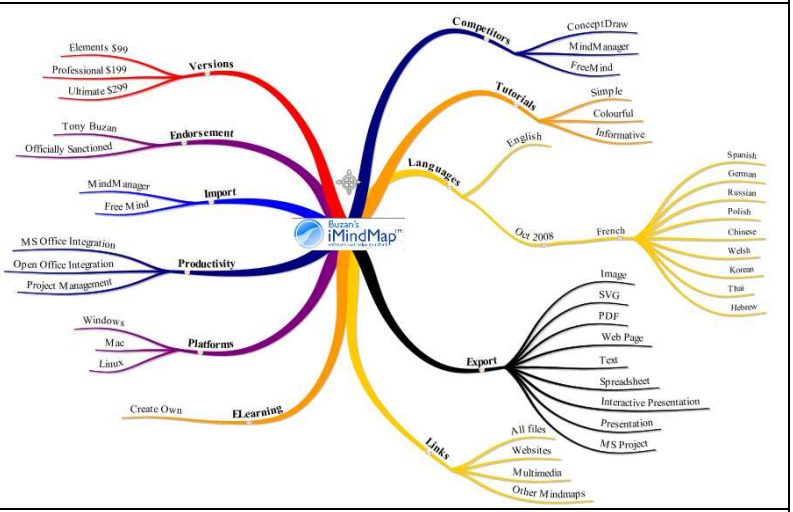
Purpose	Tools
Process visualization	CmapTools, MindManager, FreeMind, iMindMap, Personal brain, Topicscape
Stakeholder PPP valuation	Excel, AquaDT, IIASA MCA
Other relevant tools (actor analysis, data entry, etc)	DANA

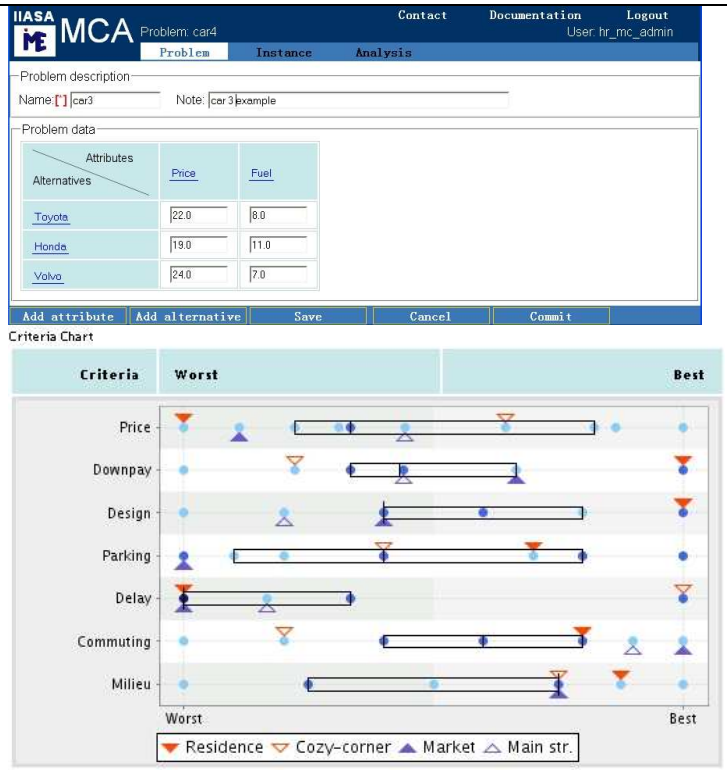
Name	CMap, CmapTools
Origin	Represent children's conceptual understandings.
Functionality	Knowledge representation – a graphical tools for organizing and representing knowledge
Author / owner	Florida Institute for Human & Machine Cognition (IHMC). Non-profit.
Process representation and presentation	No specific support for process representation or visualization. However, CMap's easy, flexible and intuitive conceptual 'mapping' or linking facility makes it a good candidate for process visualization.
Collaboration support	CMap comes in two flavors. The client tool that can be installed on a desktop computer and the server version which enables different users to collaborate working with conceptual maps.
Stakeholders' opinions processing and representation	None – or at least not easily or not directly
Supported format	CMap uses a proprietary 'text format' – thus not a binary (cryptic) format. It is reasonably easy to convert text formats to other desired formats.
Application examples	
More information (URL)	http://cmap.ihmc.us Software help files
References	http://cmap.ihmc.us/Publications/
Alternative tools	MindManager, FreeMind, iMindMap, Personal brain, Topicscape
Comments	

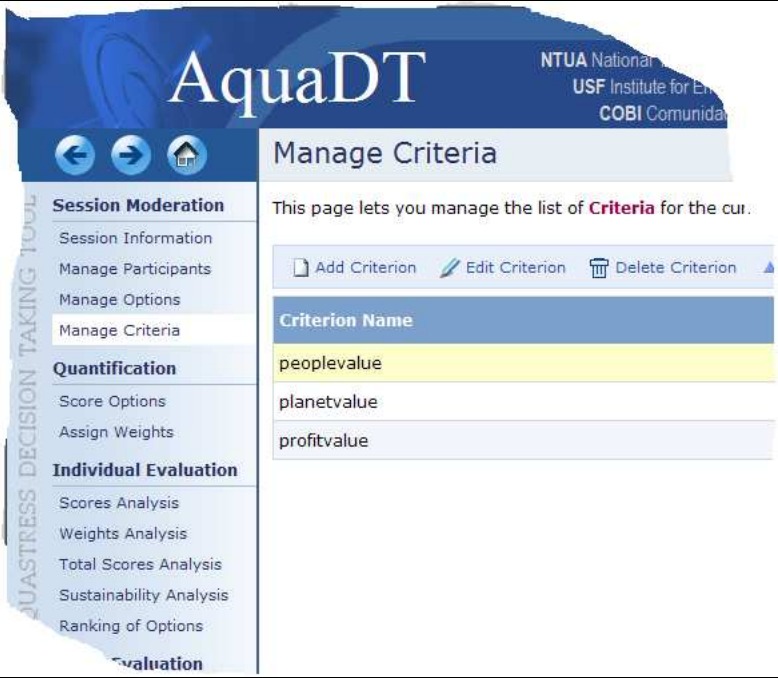
Name	MindManager
Origin	MindManager is presented as a creativity support tool.
Functionality	Brainstorming – aims to organize complex ideas and processes and communicate them with others
Author / owner	MindJet, commercial
Process representation and presentation	The company claims that the tool's API enable to create process diagrams.
Collaboration support	Yes
Stakeholders' opinions processing and representation	None – or at least not easily or not directly
Supported format	It exports outputs in many formats; it interoperates with many Microsoft products.
Application examples	
More information (URL)	http://www.mindjet.com/ MindManager 8 Quick Start Guide MindManager Large Scale Deployment Guide
References	http://ssc.sagepub.com/cgi/reprint/20/3/338.pdf http://aallnet.org/products/pub_llj_v99n01/2007-11.pdf
Alternative tools	CMapTools, FreeMind, iMindMap, Personal brain, Topicscape
Comments	Commercial application: as usual more claims than what the tools is capable of. The company claims that MindManger allows you create process diagrams but in practice what it provides seems less than what CmapTools does.

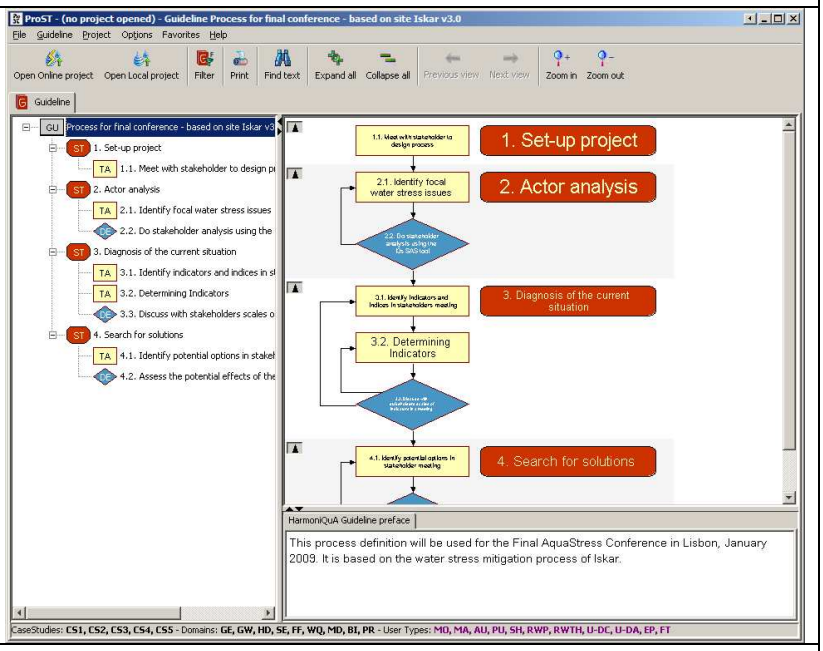
Name	FreeMind
Origin	FreeMind is an open source 'mind-mapping' software, probably developed as response to commercial applications.
Functionality	Brainstorming
Author / owner	Free, available from SourceForge
Process representation and presentation	None
Collaboration support	Probably none
Stakeholders' opinions processing and representation	None – or at least not easily or not directly
Supported format	
Application examples	
More information (URL)	http://freemind.sourceforge.net/
References	A Visualization Tool for the Sitemap of a Knowledge Portal and the Concept Map of Group Knowledge
Alternative tools	CMapTools, MindManager, iMindMap, Personal brain, Topicscape

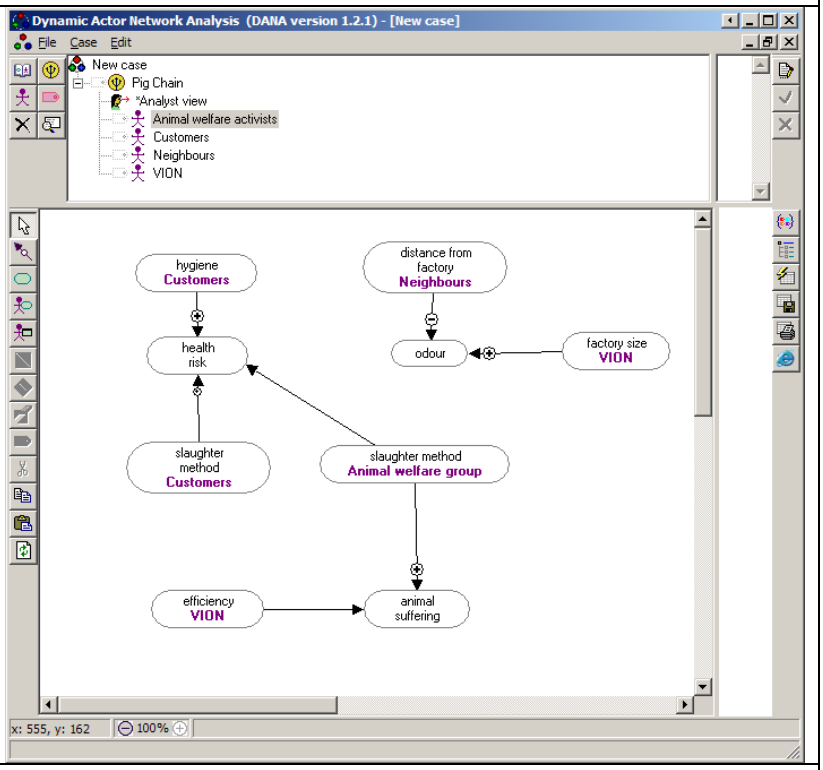
Name	Topicscape
Origin	Topicscape claims that the tool's unique visual approach will mitigate information overload
Functionality	Brainstorming with an interesting 3d visual representation of conceptual relationships
Author / owner	3D-Scape, commercial. A free version available
Process representation and presentation	None
Collaboration support	Free version has no collaboration support
Stakeholders' opinions processing and representation	None
Supported format	OPML, OML, HTML, structured text, can import (FreeMind, MindManager, Personal Brain)
Application examples	
More information (URL)	http://www.topicscape.com/
References	
Alternative tools	CMapTools, MindManager, iMindMap, Personal brain, FreeMind
Comments	Trial version is very difficult to use

Name	iMindMap
Origin	
Functionality	Brainstorming
Author / owner	
Process representation and presentation	
Collaboration support	
Stakeholders' opinions processing and representation	
Supported format	
Application examples	
More information (URL)	
References	
Alternative tools	

Name	IIASA MCA (multi-objective optimization)
Origin	IIASA Integrated Modeling Environment Project
Functionality	Multiple criteria analysis tool for use when a large number of alternatives – each possibly having a large number of attributes – are involved.
Author / owner	IIASA, Free access
Process representation and presentation	None, but sessions enable to capture process steps
Collaboration support	Yes
Stakeholders' opinions processing and representation	Yes
Supported format	
Application examples	
More information (URL)	http://www.ime.iiasa.ac.at/mca
References	User guide to the MCA (IR-09-21) Report on the pairwise-outperformance methods (IR-09-23)
Alternative tools	AquaDT

Name	AquaDT (multi-criteria deliberation)
Origin	AquaStress project
Functionality	multi-criteria assessment
Author / owner	NTUA-National Technical University of Athens. WUR has the right of use
Process representation and presentation	None, but sessions enable to capture process steps
Collaboration support	Yes
Stakeholders' opinions processing and representation	Yes
Supported format	Known database format
Application examples	
More information (URL)	http://environ.chemeng.ntua.gr/AquaDT
References	AquaDT Manual A tool for multi-stakeholder participation Mitigation of Water Stress through new Approaches …
Alternative tools	IIASA MCA

Name	ProST (Process Support Tool)
Origin	WU
Functionality	Process (project) support tool
Author / owner	WU
Process representation and presentation	Yes
Collaboration support	Yes
Stakeholders' opinions processing and representation	None
Supported format	XML
Application examples	
More information (URL)	www.harmoniqua.org
References	http://harmoniqua.wau.nl/public/Products/papers.htm
Alternative tools	

Name	Dynamic Actor Network Analysis (DANA)
Origin	Pieter W.G. Bots
Functionality	Actor network analysis – supports policy analysts to map out the roles actors (organizations, stakeholder groups, or individuals) play in some policy situation
Author / owner	Pieter W.G. Bots
Process representation and presentation	None
Collaboration support	None
Stakeholders' opinions processing and representation	Yes
Supported format	HTML
Application examples	
More information (URL)	http://www.dana.tudelft.nl/
References	http://www.dana.tudelft.nl/bibliography.htm
Alternative tools	
Comment	