
FOCUSSING INNOVATION STRATEGY FOR SUSTAINABILITY WITH THE CHEMICAL INDUSTRY AS EXAMPLE

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ABSTRACT

To make sustainable management and innovation attractive for companies, they need focus. In particular SME's don't have a clear view on where innovation should be aimed at in relation to sustainability. It just seems too complex. At the same time innovation suffers from the 'innovation paradox': much knowledge is available but it is often not used because there is no clear view on how to select the right innovations for a sustainable and profitable future. A practical approach has been developed to focus on the key areas of attention and key issues which constitute a company's major challenge for sustainability and continuity: FOCISS. Its aim is to connect sustainable development with business continuity in a relatively simple way. It involves stepwise zooming in on key issues and defining the best innovations for these issues. The method uses structured interviews and workshops. At the same time it channels effective exchange of views and information within a company on these issues. This, in turn, leads to real commitment and deeper understanding of what sustainability involves. The method has been developed and tested in cooperation with industries from different sectors. Its results for chemical and food processing industry are shown as example.

Keywords

Innovation, strategy, management, sustainable business, chemical industry, system approach.

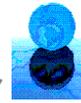
INTRODUCTION

Focus for the company

Most companies, large and small, confirm that sustainable development is essential, for society and economy. That implies that it is important for them. However, most do not have a clear view on how to make it practical. So most companies, in particular the smaller, tend to act, as if sustainability is for the larger companies and the politicians. They consider it more as a risk, rather than an opportunity, and do not see that it is the major driver for innovations, also in their business.

There are several barriers in this matter that have to be addressed, more or less simultaneously, in order to help companies to focus on a sustainable and thus viable future.

- a. Sustainability appears to be too complex, with too many issues involved, most of them with no clear relation with the actual business and daily operations.



- b. There is much knowledge available for innovations, much of which also sustainable. The problem is however to select the best strategy. As a result no choices are made and available knowledge remains unused. This is one of the principal causes of the innovation paradox. Companies tend to stick to what they already know.
- c. Companies select a strategy with innovations that are based only on short term arguments. Therefore often strategies and innovations are chosen that are not optimal or even are completely ineffective for becoming a sustainable business. It even can set companies on the wrong track for a real profitable and sustainable future.

Thus, companies need a clear focus. To that aim a better understanding of what sustainable development and sustainable business really comprises, is needed. Based on that a good view must be generated on the actual role a company has and which influence sustainability aspects have on it.

Understanding sustainability

A company must understand its own interest and role in sustainable development to be able to act adequately on new developments and constraints. The right choice for profitable innovations which also lead to sustainable development cannot be made without understanding the basic issues and backgrounds. It must therefore understand its place and role in the complex socio-economic structures which it is part. Those systems (eg for producing food, supplying energy and transport) consist of many components, both technical and organisational (Geels 2002). Companies are the main actors in those systems. How such systems are organised and used is strongly influenced by 'culture', with differences between individuals, groups and nations. Those systems are continuously changing. This, in turn, influences the companies in their performance and their options. When looking back in time, one can see major changes in all systems, the so-called 'transitions'. Examples are the introduction of steam power, the introduction of cars for mass transport, the introduction of ICT. This type of fundamental changes (innovations) in the system imply coherent - and mutually strengthening - developments in technology, economy, culture and organisation.

Sustainable development is unthinkable without radical changes in those structures. Wishing for sustainable development means in essence 'that we wish for a society in which it is still pleasant to live in, in 20, 30 years and beyond'. As an example the efficiency of resource use of our economy must increase with a factor 10 till 20. It is clear that this will not be achieved by improving existing technology or even with radical new technology alone. A different way of using technology and the way we organise its use to 'fulfil our needs' is required. Understanding the system approach and the effect of such transitions, also for individual companies, is essential.

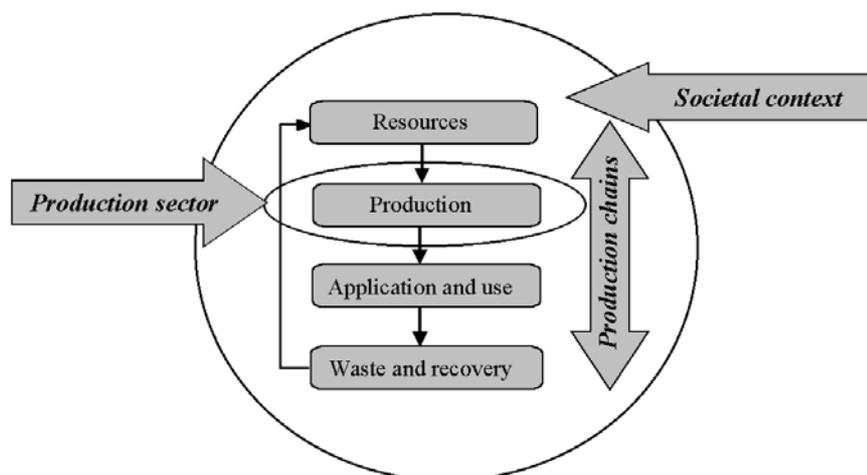
But sustainable transitions need to be 'focussed', for instance leading to production systems that use much more renewable resources and require less transport, and to products that enable people to use much less energy in their households and are easy to recycle without much loss of resources. It is a subject of much debate, whether such a focused transitions will occur spontaneously, due to market influence, economic constraints and consumer preferences, or that some external driver is needed in laws and regulations decided on by society. It is also uncertain if these transitions will easily come about or only after some 'crises'. That they will occur however is certain. So companies will have to respond and adapt in time to survive under these changing economic and societal conditions.

Therefore a sensible business approach must take into account the changes that will occur in such ‘sustainable transitions’. Companies must change course in order to survive: sustainable business!

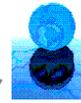
Focus on all system levels

Transitions take place on three different levels: within the production sector itself, at the production chain level or at the level of society as a whole (figure 1) (Venselaar 2005b). On sector level the own production processes must be made as clean and eco-efficient as possible. It also concerns optimising the added value (economic, ecological and social) of the sector and taking advantage of the new business opportunities sustainable development offers. On the chain level, chemical industry, in cooperation with suppliers and clients (which are also industries, such as builders, food production, car manufacturing etc., chemistry is a generic function!) should make the material chain, from basic resource till waste as lean and eco-efficient as possible and supply the means so that the material chain is closed by minimising losses and reuse. On the societal level chemistry faces the challenge to develop and supply the means (materials and products), which can meet the needs people have (energy, transport, food, housing etc.) in a sustainable way.

Figure 1: Three levels of systems and transitions



Most companies address only the production sector level with sustainable business development. The ‘Planet’ aspects (environment, resources, ecology) and employee related aspects (labour conditions) are thus emphasized. Many companies, certainly those in the chemical industry, have an environmental management system and use that as base for sustainable business management. That system, however, concentrates on the first level of operations and is not really capable to take completely into account the role a company plays in the two other system levels. Not only the eco-efficiency of chemical industry on sector or chain level is important, but also the relation between production and consumption and the right way (also in societal responsible sense) to respond to the societal needs, locally and globally. On these levels in particular the ‘people’ aspects (prosperity, well-being, quality of life etc.) play an important role.



Approaches are being developed to incorporate such system thinking into management systems for sustainable business (Azapagic 2003). They must include an innovation selection strategy that can handle the systems issue.

Overcoming the innovation paradox

Sustainable development is already a major driving force for research and new developments. In many fields many new, efficient and environmentally friendly processes have been developed and can be used in economically viable alternative production routes. Substantial improvement in efficient resource use has already been achieved. Production installations can be downscaled and production time reduced (Venselaar 2003). However, to ensure that actual, sustainable innovation takes place, this new knowledge must be used: innovation is not just 'developing something new', but 'applying something new and/or in a novel way'.

However that often does not seem to happen or at least not as fast as possible and necessary. So, though driven by sustainable development requirements, these research results do not yet lead to sustainable development, in actual practice. Of course, the required fundamental changes in systems need time. Nevertheless, there appears to exist an 'innovation paradox'. It can be done; it is often economically sound, already now, but certainly in the long run. Nevertheless it doesn't seem to happen or at least not very fast (Venselaar 2005b). There are several reasons for this phenomenon. An important one is that companies do not have sufficient insight in future developments, and their role in it. As described before, that is the same insight needed to decide on a profitable strategy for sustainable business. When this insight is provided, the apparent barrier for using novel technology or methods of operation is lowered or even disappears completely. Focus on sustainability can also solve the innovation paradox to some extent.

RELATING CORE BUSINESS AND INNOVATION WITH SUSTAINABILITY

Background

To assist a company in 'sustainable management' and 'social corporate responsibility' various approaches exist. Often they contain checklists with large lists of issues that have to be considered. As said before, certainly for SME's they are too impractical. They are neither designed to set priorities nor to zoom in. Using these to develop a strategy could easily result in too many options and priorities to handle. Such lists are very useful when evaluating the sustainability of a company as a whole, or when an official report on sustainable performance is required. An example of the latter is the GRI list (GRI 2007). It is however neither necessary nor sensible that every company pays attention for every possible issue to become sustainable. Reasons for that are:

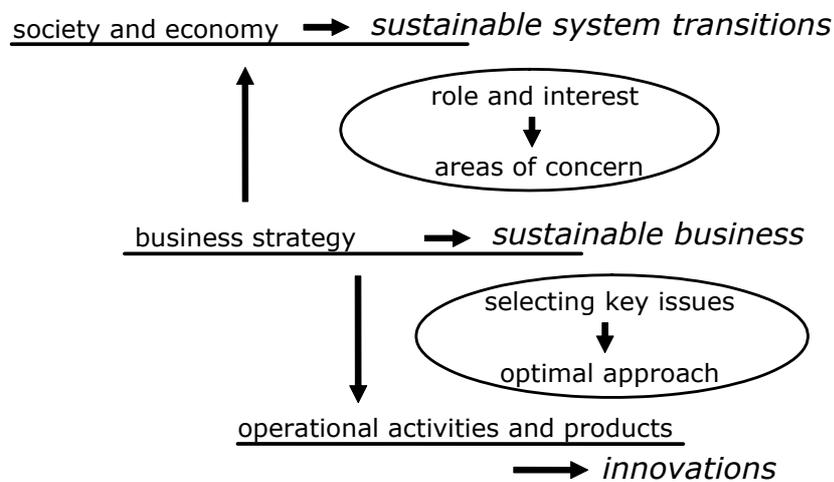
- a. A company has commonly only real influence on issues which are connected with their core business. Example: if water is essential for a company's activities, it must be involved in securing water resources for the future, locally and regionally. If child labour might be involved in intermediary products, a company could influence it.
- b. A company, certainly a smaller one, can only give effective attention to a limited number of issues. If the priority list becomes larger than 3 or 4, real attention for the whole list will dwindle. A more realistic approach involves a concise 'shortlist' of crucial issues that have to be addressed.

- c. When an issue is taken up which is not really essential, in such a way that it has no real consequence for the future and/or profitability of a company, activities in that field will be stopped when a company has a less profitable period, inevitably resulting in a waste of time, money and resources.
- d. It is, also because of the factors given before, very difficult to keep all actors involved, internally and externally, when there is no common feeling that a sustainability is essential and an essential factor in selecting innovations.

Zooming in on key issues

It must be possible to zoom in on the key issues that are specific for a particular company in view of its character, products, location, ambitions etc. 'Key' implies that they comprise a major risk for business, in any way, when not dealt with in time and in a proper manner. The principle of the approach is shown in figure 2. First role and interest of a company in specific socio-economic systems must be defined. That is determined by the manner sustainable development might change these, e.g. through system transitions that will occur as a result of that. Secondly a company must decide which areas within the relevant transitions are the most essential for its continuity (opportunities and risks!). Within these areas it must select the key issues it has to face. Only for those issues it has to determine the best approaches / innovations.

Figure 2 *Selecting the innovations that are relevant for a business in a changing system*



FOCISS approach, starting points, main goals and requirements

To do that zooming in in a practical manner, the FOCISS approach has been developed: Focussing on Innovation for a Sustainable Strategy. The approach is developed through practice based research. Direct cooperation with companies is the best assurance that the most practical and effective approach, also for them, will emerge. The various 'tools' needed are based on existing models and approaches but are adapted on base of the experience and the comments of the companies. This is an ongoing process.

Basic principles are:

1. It must treat sustainability in its broadest form, People, Planet, Prosperity (including Profit) and therefore also the aspects and issues that sometimes are treated separately as 'Corporate Social Responsibility' and 'Corporate Governance'. They all contain issues that are essential for that 'future in which it is pleasant to live in' and therefore might prove essential for a company because of the risks or opportunities it creates.
2. It must also aim at the systems, and the total production chain the company or a specific product/activity of the company is part of. Risks and opportunities are created not just within the own processes of activities, but commonly more likely in the stages before or after the own activities. Quite often companies tend to neglect these stages, because they can not influence them (at least: that is what they say). Nevertheless changes in the stages before or after the own activities will inevitably influence the company!
3. To make practical implementation of the method feasible, it must result in a small number of issues to be addressed.
4. The selected issues should be clearly related to the core business and activities of the company and therefore easily recognisable as essential. That creates commitment and removes the risk of losing involvement when economic conditions become less advantageous for the company.
5. A platform must evolve for extensive internal communication about sustainability, the issues, views and ideas for options. Selecting the key issues is just the first step to change course but a crucial one.

Further requirements seen as essential for the approach are:

- a. Practical and effective in particular for SME's. It should be simple and straightforward.
- b. Relatively fast and not very time consuming.
- c. As much as possible using the own views and information of the company. External stakeholders, such as customers and NGO's could be involved, but it must still be 'the company's own choices and views'.

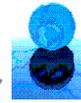
Commitment before 'completeness'

Experience shows that studies and advice prepared by an external party does not easily create effective commitment in an SME, notwithstanding how well informed and scientifically based it is. In our view creating commitment is, in practice, more needed for starting sustainable business than 'scientific analysis and completeness'. So the method does not necessarily lead to 100% coverage of all issues and all possible profitable innovations. It should lead however to justifiable (so profitable) and effective actions with sufficient support in the company.

Sustainability before innovation

Sustainability requires innovation and innovation that does not take the (near) future constraints set by sustainable development into account will not pay off in the end. Common attitude is however that first an innovation is selected on base of (short term) financial and market factors. Sustainability is brought in as the second step, usually with the intention to make the selected innovation as sustainable as possible.

That, however, should be the other way around. First the sectors and issues which are essential for the future of the company have to be defined, fitting the expected sustainable development in the area a company operates in, (see figure 2). However, an innovation that



appears to be sustainable in itself, doesn't necessarily have to fit in a sustainable business strategy leading to a viable future for the company.

As example:

One can invest in very innovative processes that use less energy and therefore seem to be very sustainable. However when the product produced in that process is not useful in sustainable products, e.g. which use less energy or are easy to maintain or recycle, it is not sustainable in the long run, in a sense that it creates continuity for the company. We observe also that innovation in companies is often directly aimed at energy, for reduction or alternative resources, and on new processes that produce less waste. However the real issues for a company may be something very different, such as uncertainty of resources and socio-economic problems with their products. For instance: TV cook Jamy Oliver brought single-handedly a whole fast food industry on its knees when promoting healthy food for school lunches in England. That is also 'sustainability'. There are certainly parallels with chemicals in products e.g. PVC, softeners in plastics, aspartame etc. And more will come!

At the other hand, an innovation selected to address a key sustainability issue, is not automatically sustainable either. Selection of a less scarce resource could imply more transport or more environmental and social problems where the resource originates from. Both situations for instance occur presently with the development of bio-based fuels using vegetable oils. It appears a sustainable innovation, but it does not address the real issue: too much transport. It is not really effective because the overall CO₂ reduction is small, if not effective. And it creates quite unsustainable effects elsewhere.

A prerequisite for any approach which attempts to find sustainable solutions should therefore make sure that the occurrences of such biases and rebound effects are prevented.

FOCISS approach, description

Development

The approach has been developed in cooperation with companies from quite different sectors of industry: electronics, chemistry, food, construction of printing equipment, building etc. The method is made such that only small adaptations are necessary to make it fit for use in different types of businesses. It became clear however that some differentiation in the basic set-up might be useful. That is done in the subsequent stages when it was used in the chemistry and food processing sector. Such sector specific adaptations mainly occurred in the phrasing of questions, basic information on standards issues to be considered and such. The basic set-up has been improved based on progressive experience, but not in sector specific way. Further improvements might be necessary for specific tools and methods used in the approach e.g. the rating method' (see hereafter). That still proves to be arduous in practice and certainly needs further research.

Main elements are:

1. A stepwise 'fast zooming in protocol' initially aimed at the key areas of sustainability, which are relevant for the company, secondly at the major issues within these areas and thirdly at the most promising innovations (in view of economics and sustainability). The 'zooming in' is structured in such a way that it leads to a significant reduction in effort and time a company and the advisors involved have to spend.
2. Tools for discussion, reflection and selection, designed and adapted for this purpose. The main instrument is a 'FOCISS matrix' to define the areas that must be discussed (see hereafter, and figure 3. A rating procedure is used during interviews and during the workshops to stimulate forming of opinions concerning the importance of sectors and issues

involved and the priority they should be given. The workshops are set-up in such a way that they create effective exchange of information and views and focus on the most relevant points of discussion.

The FOCISS protocol

The stepwise zooming protocol is described in Table 1. Strict adherence to that protocol has indeed proved to be necessary to reveal the advantages and characteristic results, as stated above.

Table 1 Main outline of the FOCISS protocol

1	preparations	introduction in company
		defining scope and selecting participants
		collecting background information
2	key areas of attention	interviews
		workshop
3	key issues	inventory and elaboration of issues named for the selected key areas of attention
		workshop
4	sustainable innovations	inventory of options
		rough estimates of costs and (future) profits
		'sustainability effect'
		workshop

The instructions and details in the protocol are such that, when adhered to, the result is:

- high relevance against little time spend
- strong involvement of own staff leading to strong commitment
- small number of really crucial priorities but high profile in company

A major point in the protocol is that the people involved are strongly incited to give their views, to come up with issues and to give a rating (see hereafter). They often know more than they tend to tell. It is that information that is required.

Necessary preparations

To inform and involve all people in the company, and certainly the staff and those that will be directly participating through the interviews and workshops, a thorough introduction is necessary. It must clear the ground for an open discussion on what sustainable development really is and what it implies for a business. Many misunderstandings, wrong assumptions and clearly biased views exist.

When defining the scope of the study, a production process must be selected that is sufficiently homogeneous with regard to the resources till the use of the product(s). That means that in the various stages in the total chain different parallel paths of actions and situations will only occur to a small extent. That will not be the case when a company makes a series of quite different products. In that case making consistent choices and conclusions is almost impossible.

Selection of participants to be interviewed and for attending the workshops, must take into account that all relevant issues can be covered by expertise to some extent. External parties as suppliers, customers and NGO's can participate. Up till now that has been done in only one case (see also remarks under 'benchmarking').

As a support in the interviews it is found useful to make an inventory of the known concrete sustainability issues that occur in the sector a company is part of. This inventory is called the 'sustainability mirror'. For instance the larger issue of climate change is translated in more practical issues as levies on CO₂ emission and emission trade, restrictions on energy use in general, options for renewable resources as well as new markets for substances and materials used for other forms of power generation and low weight materials for reduction of energy consumption.

The FOCISS matrix

A matrix was developed to create a clear overview of all aspects that have to be reviewed, over the whole production chain and for 'People, Planet, Prosperity': the FOCISS matrix. Using this matrix in the interviews stimulates people to express their views. And by working systematically along all the matrix fields an inventory can be done without the risk to overlook any relevant aspects.¹ It has been based on a matrix developed specifically for environmental issues (Leopold 1971). Various other methods use this matrix too. On the horizontal axis all the stages of the total production chain are listed. Since these can differ from company to company, they have to be adapted for each individual case. On the vertical axis the various sustainability aspects (from the People, planet, Profit categories) are clustered into about 8 till 10 groups. The matrix has to be customized for a company and the specific process or activity selected. It results in 80 till 100 matrix sectors to be inventoried.

Figure 3 Basic outline of the FOCISS matrix, used for the interviews

<p><i>criteria:</i></p> <ul style="list-style-type: none"> - can it affect the business - short or long term - strategic and economic effect - effect on sustainability 	resource extraction	intermediate products	transport and storage	production Steps	storage and trnsport	porduct use and mainenance	discarding, recycling
sustainability aspects	production chain and product life cycle						
Planet environment, resources, ecology							
People socio-cultural, personnel							
Prosperity (Profit) value for company, society and other stakeholders							

critical assessment of each areas and all issues involved

¹ The HAZOP method to determine process safety issues, operates more or less in the same way. (Lawley 1974)

Interviews and follow up

Normally four to five key persons are interviewed using the matrix. They give their view on all possible issues that might be of interest for a specific area, as defined in the matrix. They also have to give a score, based on how crucial they think the issues in that section might be for the company, with respect to continuity, sustainability and profitability. The number of interviewees might differ, dependent on the size of the company. We found that a larger number of interviewees did not result in many more issues or more precise ratings.

Issues can involve risks and constraints, but also opportunities and new options for better performance. The information is gathered and discussed in a workshop with the staff and other parties involved. Based on this inventory, 3 or 4 key sectors are to be chosen.

In the second stage the issues from those key sectors are described and inventoried in more detail. In a second workshop subsequently 3 or 4 key issues are selected from that. In the third step the possible innovative approaches to handle those key issues (risk or opportunity!) are being inventoried and described. A first evaluation of their economic effect and their real effect on the sustainability of the business is made. On the basis of that outcome, a choice is made for the most useful innovations in a third and final workshop.

Rating method

To facilitate priority setting the persons involved are asked to give a rating for importance on the aspects and issues in the various steps. That has to be done directly after the interviews and during the workshops. These are of course rather subjective ratings, based on their own information and expertise. By combining the results a sort of 'balanced subjectivity' is created. The results do not automatically set the priorities, but form the basis for further discussion.

Several rating methods have been tried, from simple to rather complicated. Three have been considered and tested to some extent: rating on a scale, forced rating and the Q-method. Rating on a scale implies that to each item a value on a scale of 1 till 'n' is assigned as considered reasonable. Forced rating implies that to an 'n' number of items a value of 1 till n must be attributed, and each value can only be used once. Q-method implies a more elaborate approach, in between both former methods. The rating values that can be assigned to an item here are still limited but it gives more leeway for rating items with the same value when it is difficult to differentiate (McKeown 1988) ².

Because the matrix used in the interviews can easily contain 100 till 120 fields which each have to be rated, all methods become impractical, certainly when the interviewees find it difficult to give a rating to their 'subjective opinion'. With rating on a scale too easily average values were given to all items. So some form of 'forced rating' proved necessary. Q-rating looks attractive but was impractical under the circumstance. We decided to work with normal forced rating separately for all aspects along the y-axis. So 1 to 'n' has to be assigned on every row again along the x-axis. A bias that occurs, of course, is that a rating '5' in one row (eg for the aspect 'resource use') is not the same as a rating '5' in another row (eg for the aspect 'social benefits'). However final priorities are not based on those ratings. The rating results only form the start of the discussion in the workshops.

² As an example when rating 30 items, one does not work with values 1 till 30 but 9 categories are defined with 1 till 9 which can be assigned respectively 2-3-3-4-6-4-3-3-2 times.

The ratings of the different interviewees give a 'median value' and scattering.³ The fields with high median values and those with a large scattering including high values will have to be discussed in the workshop. In practice there is mostly a clear separation in 10 till 20 areas with highly scored fields from the remainder. The latter are not subject to further discussion, however not without checking with all the participants involved.

Workshops

In the workshops all persons that are interviewed must participate, and when possible other staff which is likely to have views and additional information on the issues that have emerged from the first rating process. The total staff will likely be involved in implementing the decisions made. To get their commitment, they should be involved in the decision making process as much as possible. The selected fields, issues and later innovations are discussed in a structured way. Also here a two stage rating process is applied, based on 'forced rating'. That is done initially before any discussion has taken place, and a secondly at the end. The last rating determines the final selection of respectively the key areas, the key issues and most sensible innovations that will be subject for the further steps in the study.

The system approach as element in the method

As discussed before, attention for the system approach is important, if not crucial for attaining an effective sustainable management strategy in a company. That is achieved because the initial focus is on sustainability prior to innovation. In the interviews, the workshop discussions and in the 'sustainability mirror' sustainable transitions that could or will occur within the socio-economic system in which the company operates are brought up. One must be careful that not only issues and changes within the own activities and operations at the plant are discussed, as frequently happens when discussing 'transition to sustainable business'.

The result is that proposed innovations sometimes do not have that clear sustainable look the ad hoc selected sustainable approaches appear to have. But they will be much more effective towards sustainability by facilitating a sustainable change in the system as a whole.

As example:

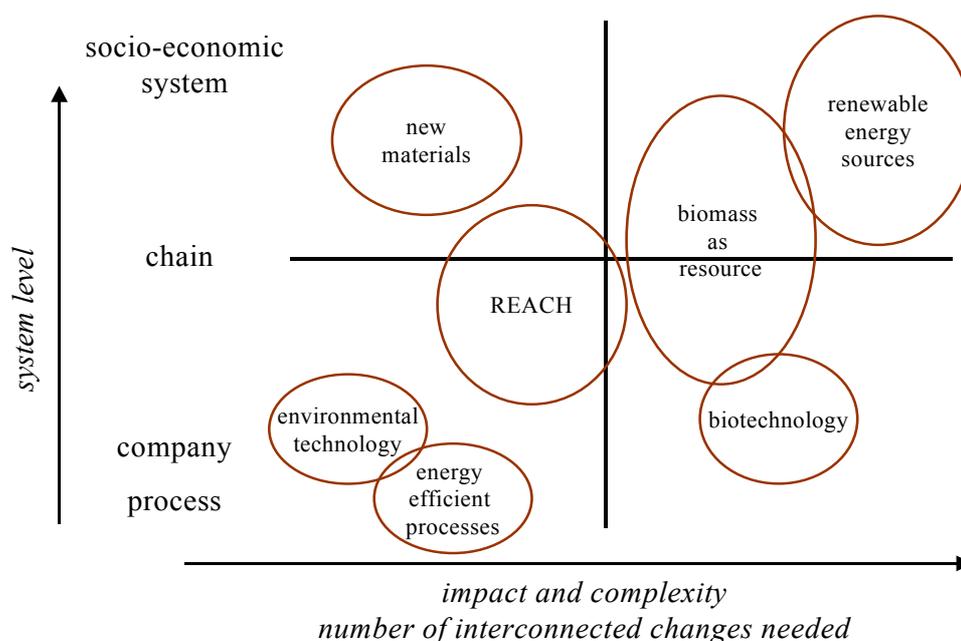
It is quite likely that a transition will have to occur in the transport systems as we know them. Changes are needed concerning energy consumption, but also concerning noise, safety etc. New, cleaner fuels and lighter vehicles are needed but insufficient to solve the entire problem. Just new manners of transport are insufficient. Reduction of the need for transport will be needed too, for instance by organizing production in a different way. Measures to that aim are not seen as sustainable at first. 'It is just good business'.

The levels on which innovations act are important. That determines how far-reaching an innovation will be and how complex implementation is. As is said innovations can be categorized according to the impact they have on the various levels of transition (see figure 1). To assess that, a simple diagram was made which characterises the issues and innovations with respect to their impact and their complexity. At a higher level more changes are needed and/or more changes will occur in other parts of the chain and the economic systems in which the specific company operates. Figure 4 is an example of such a diagram. All these areas for innovation emerged during the studies for the chemical

³ The median value means that the number of ratings given with a higher value is the same as given with a lower value. For our approach this is a more relevant value then just the 'arithmetic average'.

companies involved. It is obvious that innovations chosen tend to be positioned in the lower left part of the diagram. It is also observed that the better options for sustainability and viability are found more up and to the right side. Especially smaller companies see (and probably have) too many obstacles to go there, another aspect of the innovation paradox.

Figure 4 impact and complexity of issues and innovations in chemistry



Creating effective commitment

The FOCISS approach also explicitly aims for creating commitment in the company.

Means to that aim are:

1. Involvement of all key personnel in a company, including the director;
2. Use of the knowledge available within the company itself;
3. Improving 'transversal' communication by the workshops;
4. Aiming at innovations based on own choices and decisions.

Reports and recommendations from external consultants are too often 'only gathering dust' because people too often do not feel involved and even resent it. Furthermore most companies, even the smaller ones, possess a lot more knowledge and insight in the relevant issues, backgrounds and available options than often recognized. It has not been made accessible before. The procedure and in particular the interviews are aimed to uncover that and make it useful in a structured way.

One of the functions of the workshops that conclude each stage is to share information. Information, problems, unknown aspects, but also possibilities and wild ideas cross the boundaries that often exist in an organisation. Sometimes perfect solutions were found that could not have come up without this mode of communication. Certainly some additional research might be needed for specific items and in particular to draw the 'broader picture' but the main body of information, views and conclusions is felt to be 'own'. As a result there will be a strong commitment to implement the results.

Benchmarking

It is of course useful to see how right and complete the results of this approach are. The following questions should be answered:

- are the selected key areas, key issues and innovations, indeed the essential ones;
- are essential areas, issues and/or innovations overlooked.

To that aim it should be compared with other methods and results obtained by other means. It proved difficult to do that. To our knowledge really comparable approaches do not exist, certainly where it concerns the other aims such as creating commitment and amount of effort and time involved.

A sort of benchmarking was attained by inviting companies to join in the pilot projects which are known to have been involved already in other projects concerning sustainable management (of which there are many in the Netherlands). The result was that the same areas for attention and key issues came forward during the interviews and workshops, but even there a few new ones. They confirmed that in this way, a broader view was generated than just the obvious issues. Besides they felt that existing priority setting was strengthened.

Another factor is if all relevant information is indeed available within a company. In the studies up till now only in one case customers and suppliers were invited to participate because they were crucial in the design and construction of the product. Companies appear to be rather insecure about discussing such issues with 'the outside world'. In reports from NGO's and governmental bodies the same issues for the particular industry sector came up as found in the studies. Thus, as we assumed, people in companies have, all together, a rather complete overview on the issues and problems that exist in relation with their activities. However, that is commonly not discussed and information is not shared within a company. This approach, in particular the workshops, created an opening for that.

RESULTS IN THE CHEMICAL AND FOOD PROCESSING INDUSTRY

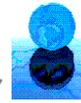
Characteristic results

So far, the method has been used in 8 chemical and food processing companies, SME's of different sizes but also independently operating units of large international companies. These companies produce a wide range of products, including specialty chemicals, polymer specialties, chemically modified natural products, fruit juices and bakery products.

Typically 3 or 4 key areas were defined, and evaluated to find the key issues and possible innovations. Of course some of those were obvious. However about one third of the areas that came up did not yet get much or even any attention at all before the study.

A differentiation can be made in:

- o 'Expected areas'. These are often the ones which are already being dealt with in a company. So they scored highly in the interviews. These commonly concerned the own production processes and concerned better efficiency, less energy, reduction of waste. In the end however, these were certainly not always selected as the real top priorities for the future.
- o 'To some extent unexpected'. In every company one or more areas, which up till then were not seen as crucial, received a high score. Typically socio-economic developments in the region or 'elsewhere' are a factor in this group of areas. An example is the availability of materials and intermediates which are imported from political unstable areas or which



are based on ‘unethical production practices’. These were considered less relevant before, because they were seen as not (easily) influenced by the company.

- o ‘Totally unexpected’: in some cases totally new key areas of attention emerged that had been overlooked before. One example was packaging, which most people in the company had seen as someone else’s problem. But also complex changes in the use of products due to changes in agricultural practice came up, which, besides being a risk, even offered quite new opportunities for business.

Particularly the issues and innovations for these ‘unexpected key areas’ will need more time and even cause frictions. Research and investment programs will have to change focus.

Those are the issues and areas that lay more in the left upper part of the scheme in figure 4.

The innovations selected

Not in all studies the last step in selecting the best innovations was taken. Some companies found the key issues sufficient for a strategy and sometimes because they were planning new investments anyway in which the issues could be taken up ‘automatically’. Sometimes the complexity of the key issues defined was such that more study was necessary. And sometimes the solution was totally obvious and very complicated to implement.

In discussing innovations within the company one must distinguish between three types of innovations, regarding the level of impact on one or more sectors and issues. To some extent that parallels the impact the company has with the innovation on the three levels of transitions as described above.

1. Changes concerning one specific issue in a key sector have no large impact on other issues or sectors and have an effect on the production level of transitions. (for instance a better separation, a new process, environmental measures)
2. Changes in several stages, in the chain, occur and are needed, and lead to changes in the way the chain operates, and to ‘integrated innovation’. Examples are:
 - Choosing a new resource which leads to new processes and somewhat different products;
 - Attention for socio-economic factors when buying cheap materials, which are produced under disputable conditions and could lead to aversive reactions with NGO’s and in due course with customers.
3. ‘Revolutionary changes’ in the way the company operates, in its products and/or in the way it helps society ‘to take care of its needs’. For instance changing from an oil producer to the production of solar cells.

Most innovations that were proposed fall clearly in the first category. These are the easiest to think off, are often already available and relatively easy to implement.

The second category contains often ideas that live already within the company but are difficult and therefore low on the priority list. Those are not easily selected nor developed further and implemented. Commonly the obstacles and risks are considered to be too many, certainly when it concerns really new technologies or ways of operating. Some innovations that can be considered as examples for this category are clearly selected because external pressure leaves no choice, for instance the reduction of transport of dangerous materials.

The last category of innovations is of course the most difficult to implement. It commonly will not ask for immediate drastic changes but any changes and innovations made now will have to fit in a direction that such ‘third level innovation’ will necessary go.

Specific examples from the pilots for the different categories.

1. Recycling of water to reduce the amount of water used. A new process with fewer reaction steps reduces energy use, use of resources and the amount of waste produced. A biodegradable plastic for packaging enabling customers to dispose waste more easily.
2. Options to reduce transport in view of costs, risks, traffic congestion, problems with the living environment of the company etc. That could lead to other ways of production, production on site, other processes involving less or less hazardous chemicals etc. Changing to biomass as raw material instead of oil or gas based resources is possible when changing to bioreactors. At the same time a new range of products is feasible. But many other changes are needed everywhere in the chain. The same is the case when striving for maximal recycling of materials.
3. No examples in this category were selected. However, an example that was discussed in this category is the following. Waste from slaughterhouses is resource for many products but it has a high potential risk because of animal diseases. That could jeopardize availability but also the use of the end products. An option is production of the specific product series through biotechnology with modified micro-organisms. That requires fundamental changes everywhere in the company. But it also offers new opportunities.

CONCLUSIONS AND REMARKS

The companies involved agreed that the approach leads to a selection of essential sustainability issues and innovation courses over a broader range of areas than they had considered before. Besides, by using this method, sustainable development was translated to something that a company 'recognizes' as vital to its core business. In that way they became much more aware of the crucial importance of sustainability issues for their strategy and future profitability. At the same time it was made clear that developing a sustainable business strategy was less complex than it appeared at first sight.

The method has a message for research and knowledge institutes as well. Better understanding the 'innovation needs' a specific company has, might lead to another focus or even a totally different scope of research. The question must be whether research time and efforts are actually spent sufficiently on what companies need and society requires from those companies, and what is needed in view of the transitions in which companies must play a role? Better insight and better focus of research in this respect could solve the innovation paradox to some extent.

ACKNOWLEDGEMENTS

The initial development of the method (under the name DOSIT approach) took place in 2004 and 2005 by a consortium consisting of TNO (the Netherlands Organisation for Applied Scientific Research), the University for Professional Education Arnhem-Nijmegen (HAN), Avans University for Professional Education (Tilburg) and Tertso Innovative Pathways for Environment and Sustainability⁴ (Berendsen 2006). The further application and development of the method, into FOCISS, has been done by the Avans Research Group Sustainable Business Operation as part of its research program aimed at 'assisting SME's to introduce effective and profitable sustainability in their business operations' (Venselaar 2005a).

⁴ the main author Jan Venselaar was partner in Tertso, adviser at TNO and professor Sustainable Business Operation at Avans in that period.

The initial development of the study was supported with a grant from the Province Gelderland in the period 2004 and 2005. The further development and use, in particular for chemistry and food SME's in the Province Brabant, was supported by the Brabant Development Agency.

The authors thank the various partners, the companies and the students, who were involved in the framework of their bachelor theses.

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