

Social LCAs

*Socio-economic effects
in value chains*

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To Marie-Noëlle

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Preface

Denis Loeillet

Assessing sustainability... a long long way from home

I am sure that you have already held a tea bag in your hand. But have you noticed on the packaging the messages praising the producer's social progressiveness? If not, this is an insult to the many communication experts who have worked for years to clean up, refine, and varnish the company's image. It also is a shame for your own sleep, which could be more restorative if your imagination dwelt on the good works of the tea. In effect, many agro-food companies are not coy about their activities in the domain of social responsibility. On their packaging, they glorify their approach by presenting their investments in building schools, dispensaries, etc. All to charm your nights with restful images and amplify your empathy for their brand. Well done! As marketing specialists say, it is an excellent way to rally to the cause – in this case, that of increasing sales – clients wishing to do good while they shop.

We arrive here at the heart of the celebration of the renowned consum'actor, someone who makes a statement while shopping. In this "commerce-consumer" pair, one can recognize up to the last link in the chain this person's honesty and desire to change things through a purchase. Of course, I am discussing here an involved, responsible consumer. One who has understood, as Paul Valéry once said, "The time of the finite world has come." One who knows that the environment is endangered and that a person is more than a production factor or a customer in a supermarket. The simple consumer, on the other hand, does not have any particular empathy for a cause, whether social or environmental. Her first and foremost priority is to optimize her purchasing power while giving herself a treat. Sustainability issues are foreign to her. She consequently has far fewer headaches than her responsible *alter ego*. For the consum'actor, the greatest problem is that, due to a lack of time and expertise, she must fall back on what companies would like to tell her, or lead her to believe. And herein is the problem. Are these allegations made in good faith?

It would be silly to place all companies in the same basket. Every commercial operator does not twist reality when it mentions its social impacts. Ethical standards (*business ethics*, *corporate social responsibility*, *corporate social responsiveness*, etc.) are widely held business values. One also must take care not to over simplify and consider all social efforts as good and all business as evil. But at the same time, it is out of the question to give oneself absolutely and swallow at face value the messages featured on the sides of packages or TV ads. Commercially speaking, the ethics market is too lucrative for companies to avoid the temptation to reduce their "sustainable" efforts to hype, in sum, marketing pure and simple.

The market is important and growing. In the United Kingdom, the sale of fair trade foods soared by 64% between 2008 and 2010. At that time, this category already accounted for 8% of all food and drink sales (Co-operative Bank, 2010). In passing, one may note that all consumers do not approach fair trade, sustainability, or social issues in the same way. The results of a 2011 Nielsen survey showed, unsurprisingly, that the environment was a major concern for 66% of those interviewed. This theme is at the top of the list for consumers in Europe, Asia-Pacific, and Latin America, but comes in only second in North America. As for consumers in Africa, they rank the environment far behind poverty, hunger, education, and potable water (Nielsen, Global Survey of Corporate Citizenship, 2011).

Environmental impacts: can do better!

It is a good thing to notice that certain companies are drifting towards excessive marketing. It would be even better to find ways to help them describe their impacts, both environmental and social. It must be admitted that there are not many tools in the tool box currently available.

The dominant approach for the assessment of value chains is environmental Life Cycle Assessment (LCA), which has been under development for the past forty years. Adopted as the basis for industrial product eco-design and redesign policies in Europe, it has spread widely throughout the business world. Although it benefits from an ISO standard, it takes numerous forms.

The LCA method consequently is unlikely to reassure companies or parties lower down the value chain. This holds even truer for agricultural products! Methodologies are being

improved all the time, but once one scratches the surface, the results at the least still leave much to be desired. Uncertainty over the results is too high when one tries to assess environmental impacts in absolute terms. To limit the extent of the uncertainty, only the results of a comparison of products (rendering the same service) should be provided, but this is not common practice. The results themselves depend strongly on the precise impact assessment method (type of software) chosen by the analyst. Furthermore, the universal scope of results is particularly undermined when impacts are attributed to a value chain because they were obtained from a value chain involving the same product but situated in a completely different context.

While LCA can boast that it is effective in strictly industrial sectors, where everything can be measured (energy, raw material, etc.), the same cannot be said for the agricultural sector. This is because the field of agriculture is unique and requires research adapted to it. The precision of standard impact calculations is sharply reduced. The situation is even worse for agricultural products from tropical regions where nothing is the same from one country to another, one soil type to another, one climate condition to another, and above all in those areas where little interest has been paid to processes that transform, for example, a unit of applied nitrogen into nitrate residues in the soil, air and water. I will not even mention the plant protection products that are taken into account in a very cursory manner in an industrial type of LCA.

Moreover, as currently practiced, LCA assesses systems by adopting the *ceteris paribus* notion (one looks at the results of a change by esteeming that everything else remains the same). This is, in reality, rarely the case. In effect, to choose and develop a process on a large scale can lead to an imbalance between supply and demand. For example, using recycled plastic instead of glass can lead to difficulties for other value chains which are not, of course, included within the perimeter of the study. This is not a new “butterfly effect” because by correctly defining the system to study, one can easily anticipate the main problems caused by this imbalance.

The choice of a perimeter thus is far from innocent. If the perimeter is too broad, the effects of a certain process will be lost in a sea of others. The opposite also is true. By reducing the scope, one excludes a certain number of processes that one does not necessarily wish to study. While the person taking this decision may esteem that the processes excluded are distant from the heart of the trade studied, they still contribute to an overall impact.

These little tweaks to the method may be condemned in principle, but they can go by unnoticed. There are unscrupulous actors who report results obtained under weakly valid conditions the moment this is to their advantage! The code of ethics nevertheless wishes that all reports released to the public are subject first to a critical examination and that the LCA study be validated. However, one may note that in this regard, practices are uneven.

To make fully informed choices – which is the least one can do when one claims to be defending one’s environment – in short, when one consumes intelligently, one must be “LCAist” and read the 300 page report that should accompany each label. A certain number of politicians, notably in Europe, are working to require environmental labeling for consumer products. Given that a consumer takes only a few seconds to choose or reject a product, one may imagine the temptation for companies to provide a deliberate misrepresentation through omission or biased information. In terms of the regulations, it is not necessarily cheating. It is, however, a clear case of excessive marketing.

Social impacts: *terra incognita*

What is the situation with regard to social impact assessment? Well, it is even worse! The sentence is a little short, but holds much truth. Let us return to the declarations found on packaging. Their contents – building schools, etc. – are certainly laudable. But what is cruelly lacking is an idea of the real consequences of these investments and practices on society. What the labels reveal pertains to performance and not impact. The company built five schools, ten dispensaries, etc. That's great! But it would be more informative, indeed indispensable, to know whether, in the case of the schools, there are teachers, notebooks, books and pens, transportation so the children can attend classes, etc. It also would be good to know if the investment increases the capability (a notion borrowed from Amartya Sen) of an individual or a group of individuals and thus increases their freedom to choose. The question is not to assess the resources but the possibilities opened by the resources put in place. The school must, for example, lead to an increase in the individual competence of a student who will thereby have the possibility to choose a better life. Setting up a dispensary will effectively be praiseworthy if the healthy life span of workers and their families increases significantly. One thereby increases what Martha Nussbaum called the rights of the individual. You must admit that here we have moved quite away from the tons of bricks and cement needed to build a school.

Social washing clearly is lurking in the wings. In the companies' defense, a methodology providing satisfactory answers to the question of impact assessment does not exist. One does what one can... or not! A fairly widespread approach, for example, consists of analyzing production chains by identifying hotspots, which should be treated as priorities if the company wishes to act positively on the "social quality" of its value chain. This is an approach inspired by Corporate Social Responsibility (CSR). The reference frames for the identification of hotspots always present a strong underlying risk of slapping their own vision of the world on a certain local practice. One must be careful not to study and judge social constructions based on one's own references! Assessing social impact above all involves defining which objectives, resulting from a clearly local aspiration, are to be achieved and to verify if, through the practices of the companies involved, these objectives are achieved.

Let us take a controversial example: child labor. The sometimes peremptory character of company social performance studies and their "northern hemisphere" vision can have very serious repercussions. The healing potion may be disastrous if no alternative is proposed to banishing children from the workplace. This is because child labor can be positive in a specific context if governed by strict rules (notably minimum age, working conditions, pay, etc.) and if accompanied by access to schooling. Children can thus contribute to family income, learn a trade, and receive a professional qualification or diploma. It is evident that the issue is complex and raises pressing questions regarding the validity of the basic indicator: "Do you employ children?: yes/no".

This work does not pretend to give a universal answer to the question of assessing the effects of a production chain. It aims simply to contribute to the discussion regarding the assessment of the sustainability of a value chain, to establish methodological foundations and to present the perspectives of practitioners. As we have seen, the social stakes are high. Both business and governments are fully aware of this. Social impacts are now like returns on an investment for a company: knowing how to assess them means knowing if money was spent in the right place and if the spending is effective. An account of profits and losses

is not the only criterion to judge how a company is run. We are betting that, like green accounting, social accounting will be recognized and integrated as a standard indicator of business management. We would like to thank those pioneering companies who have chosen this path and who are providing support for research. Let us praise the growing number of companies who adhere to what Bergmann set down in his 1989 work, *Ethique et gestion* (Ethics and Management): "Respecting a certain business ethic means awarding values to diverse consequences of economic activities and establishing priorities among them (...). Understood in this way, management ethics do not consist of a reference guide but a process: that of continuously reflecting on the multiple consequences of actions."

Let us dare to know a little more about our impacts!

As for other organizations which have shown little or no interest in the question, dramatic headline news is there to remind them of their responsibilities. How can one remain deaf to the world and refuse to act in a positive way when more than 1000 people are crushed to death in Bangladesh when their factory collapses? Who is to blame? The clothing brands, the purchasing agents, the manufacturers, the government authorities who did not know how, or were unwilling, to inspect the buildings? How many factories are likely to go up in flames or to collapse, and how many of them, without any doubt, sport plenty of certificates and labels? Questions regarding the assessment and certification methods currently in vogue also are raised. All of this is a brutal wake up call and should bring about change. Thus even if the path leading to the assessment of impacts is long and tortuous, one may recall the words of Seneca: "It is not because things are difficult that we do not dare; it is because we do not dare that they are difficult". So let us dare!

Introduction

Catherine Macombe

The idea for this book was born in 2011 at Christmas time around a restaurant table in Montpellier. We, the authors of this book, were developing a method to assess the social consequences of choices made in commercial value chains. We were each, however, focused on only one “piece” of the method. Yet we were aware that numerous “pieces” of the method had to be mastered to implement just one social LCA study. We also had observed that it was impossible to publish one or two articles about all of the required “pieces” because no scientific journal would have enough space to cover everything. We therefore decided to gather together everyone’s contributions into a book with each chapter devoted to a different “piece”.

The “pieces” of a social LCA method

- . What are the objectives of a social LCA study? examined in chapters 1 and 2
- . What is the question raised? examined in a broad manner in chapter 2, and in practice in chapter 6
- . Who is interested by a social LCA study? examined in chapter 2
- . How does a social life cycle function? examined in chapter 3
- . How does one determine the scope of a study? examined in chapter 3
- . What is the relationship with sustainable development? examined in chapter 4
- . What theory may one use to explain social LCA? examined in chapter 4 and the Conclusion
- . How does one choose the nature of the impacts/effects to assess? examined in chapters 4 and 7
- . How may one in practice implement a study for a value chain? addressed in chapter 6
- . How may one assess effects/impacts? examined in chapter 7
- . What are the limits of a study? examined in chapter 2
- . What is examined in Chapter 5 is how to integrate the issue of development, thanks to the Capability concept in social LCA.

In this book, we thus have gathered together research outputs of work that is still in the starting stages. The book consequently provides an incomplete, uneven, and partial panorama.

The work is incomplete. We do not, in effect, address all of the problems posed by the conduct of a social LCA (see chapter 2). We also do not review all of the works that contribute to the calculation of social consequences (see the conclusion with regard to this). Furthermore, our vision is sometimes simplistic as we examine certain approaches in depth to the detriment of others. We fail to present certain promising approaches that are under development. This is the case of assessments of anticipated social impacts by experts (Sironen et al., 2013), or by people involved in the project (Mathé et al., 2010). We also completely ignore the vast issue of interaction with stakeholders, such as it is addressed in Canada for example (work underway by Jean-Pierre Revéret and his colleagues on dairy value chains). It is likely that interacting well with value chain actors is much more important than the type of assessment method used. We are aware of this, but we do not pretend to address this issue here.

The work is uneven because different chapters are based on scientific research of varying degrees of completion, and which have thus been submitted more or less to peer review through scientific publications or symposium presentations. Each chapter benefits from a certain degree of progress in scientific discussion which varies from chapter to chapter. It thus is likely that in the future, certain chapters will retain their relevance while others will be called into question by experience and scientific advances. The works described in

this book are part of a cross-disciplinary research program which should – if all goes well – continue for many more years.

The overview also is biased, in the sense that it is the result of partisan choices. First, our reasoning is strongly shaped by what we have decided a priori social LCA should do according to our vision of the field. We think that social LCA should have the same fundamental quality as environmental LCA. In our opinion, its focus is to highlight wrong right answers, and therefore to avoid “impact transfers”.¹ Some other authors believe that social LCA has other objectives, and, therefore, other characteristics. We respect these works but do not discuss them in this book. Furthermore, we arbitrarily give primacy to our own ongoing research to the detriment of others. For example, in the chapter on the anticipated assessment of impacts, we insist on the need to define general mathematical relations in order to calculate what social impact is anticipated. There are, however, other solutions to anticipate impacts that we also mention, but more briefly.

The different chapters in the book present the different “pieces” of the method that allows a complete social LCA study to be implemented. All of the pieces are necessary, and numerous variations are possible within each one. For example, when we explain how to determine a social life cycle, we are receptive to any improvements or doubts our readers may suggest or raise.

This remark testifies to the state of mind in which we wrote this book. It involved submitting every suggestion to criticism, discussion and practice. The book focuses on assessing the social impacts of changes within value chains, and covers a set of issues to address when implementing a social LCA study. It clearly is imperfect, incomplete, and can be improved. We offer the book as a first draft of everything that we – researchers, practitioners, and decision makers – could build together in the years to come. We invite everyone – and in particular, students interested in social impact assessment – to join our efforts.

1. If in hoping to mitigate one form of social damage I create a new one, I “shift” the impact when one compares the former scenario with the new one.

References

Mathé S., Rey-Valette H., Chia E. (2010). « Evaluation de la durabilité institutionnelle : une innovation organisationnelle au service des politiques publiques de développement », *Innovation and Sustainable Development in Agriculture and Food (ISDA)*, 2010, Montpellier, France, <<http://hal.archives-ouvertes.fr/hal-00525374>>.

Sironen S., Hujala T., Myllyviita T., Tikkanen J., Leskinen P. (2013). « Combining experts's ratings for partly overlapping concept lists: a feasibility test with cultural sustainability indicators », *Mathematical and Computational Forestry & Natural Resource Sciences*, 5(1): 1-13.



Chapter 1

Catherine Macombe and Alain Falque

"The fundamental point of « life cycle » thinking should be that it indicates, between two alternatives, potential impact transfers between stages in the product system, or changes in the nature of impacts."

(Finnveden, 2000)

An alternative to life cycle CSR

Many managers, consultants, and researchers have heard about environmental life cycle assessment. They know that these methods allow the likely environmental consequences of a production choice to be estimated in advance. When they hear, "social life cycle assessment", they imagine by analogy that this involves estimating in advance the likely social consequences of a production choice. Unfortunately, existing methods presented as "social LCA" methods generally do not do this. In this first chapter, we will try to explain why this is the case. These traditional approaches seek something other than an estimation of anticipated social consequences due to the functioning of a value chain. One might therefore be surprised that we are discussing them here. However, they occupy the social and cultural

field under the name, “social LCA”. We must therefore clarify this situation before exploring our own proposals. We also will clarify vocabulary to avoid future confusion.

This first chapter thus is dedicated to routine approaches to social performance which are presented under the name of social LCA (social life cycle assessments). Their guiding principle is to use business approaches to social performance developed over several decades under the Corporate Social Responsibility (CSR) movement. This involves applying what one can do for a single company (a CSR diagnosis) to several companies linked by the environmental life cycle of a product. “Life cycle” thinking has been understood here in its most literal and strictest sense, putting businesses end to end in an attempt to understand an entire “life cycle”. In this book, we call these methods, “life cycle CSR”.

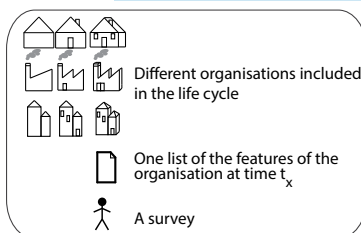
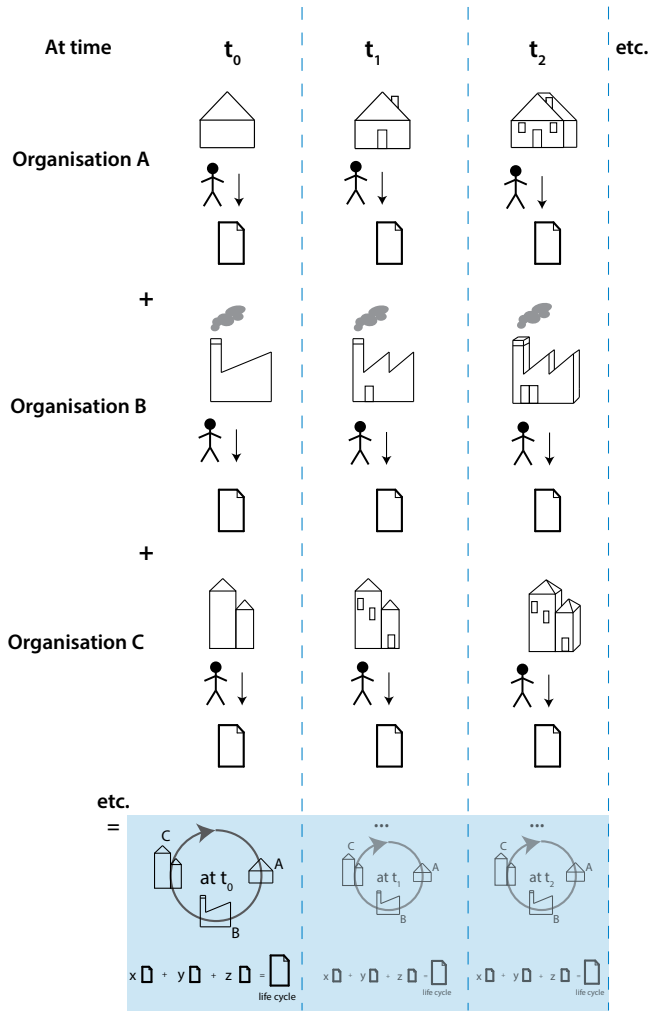
Life cycle CSR received special support in 2009. Following the work of a group brought together under the auspices of SETAC¹ (Society of Environmental Toxicology and Chemistry) and the United Nations, a general operating guide was published in June 2009 entitled, “Guidelines for the social assessment of products” (Benoît and Mazjin, 2009). Although the Guidelines assert that one method should not be privileged over another, life cycle CSR is presented as the reference model for social life cycle assessment. The work is available in English and French over the Internet. No student or researcher can overlook reading it once they are interested in social life cycle assessment. This work gives great, if not yet scientific, visibility and legitimacy to life cycle CSR.

Life cycle CSR was picked up by consulting firms under the name, “social LCA”. As we shall show, however, despite its promising name, life cycle CSR does not involve estimating the social consequences of choices regarding product life cycles.

We shall review the history of Corporate Social Responsibility (CSR) to explain the current situation (section A). We will show how CSR has taken over the field of social impact assessment in LCA (section B). The results of life cycle CSR are the social performance of a set of organizations (section C). We will present examples of the extent to which life cycle CSR is incapable of estimating the social consequences of a choice. This is not, in any event, its objective (section D). We conclude with the need to create a method to estimate the social consequences of choices regarding activities generating, using, and recycling products. The chapters that follow present the foundations for this new method.

1. Historically, SETAC has been behind the development and dissemination of environmental LCA since the beginning.

Diagram 1. The life cycle CSR



I. History of CSR

This paragraph covers the trajectory of Corporate Social Responsibility (CSR) since its beginnings up to present time. The current CSR system was greatly inspired by Anglo-Saxon culture because most contemporary multinational corporations originated in the USA. However, it also has continental roots in French-style paternalism, which was widespread in France in the 18th and 19th centuries. We will distinguish four main economic and social periods. Companies developed CSR in response to the challenges raised during these different periods. Table 1 summarizes the different periods and ideas.

Table 1. Sum up of the history of the Corporate Social Responsibility

Step	1st	2nd	3rd	4th
Name	Golden Age	Crisis	Activism	Consumerism
Big company	Social institution	Private firm	It has social performances	It must make money for shareholders
The State	Overall increase	Discovery of the welfare state	Antitrust legislation	Deregulation. the State takes action only to impose sanctions to rogue companies
Ideology	Fordism	Keynes: demand spurs supply	Political Ecology start	Chicago's school, the profits of rich people make investment
Companies' morality	Responsibility is shared between the owner and the executive functions. the profits have to be shared between all the involved people	<i>Business in Society</i> . Idea of social audit. The executives' virtue guarantees the virtuous working	Social issues must be managed (Harvard). the company has to make the proof of its good faith, by social audits	The company complies with its freely entered into internal regulations (<i>soft laws</i>).

A. The origin

The origins of CSR go back to between the 19th and 20th centuries. At the end of the Civil War, the USA, having become the first unified market in the world, experienced a boom lasting 30 to 40 years. This situation made possible a phenomenon unique in history: the emergence of large and very large companies. There was a mad dash for wealth and "Golden Age" opulence. The first very large manufacturers were quite different from their predecessors in terms of size and organization. In order of magnitude, their size grew from 1 to

100. To manage such monsters, new structures, such as the divisional structure, had to be invented.

Institutional economists would play an important role in the analysis of these changes. Berle & Means (1932) demonstrated that the large enterprise was something new. Clark (1916) declared that economic responsibility had changed. The research of institutionalists found that large enterprises had three new characteristics:

- (1) business affairs were no longer the responsibility of a single person, the entrepreneur, but were rather the collective responsibility of the firm;
- (2) due to its size, a firm was no longer a private good, it had become a social institution;
- (3) due to its large size, the functions of ownership and management were separated, diluting responsibilities.

Leaders of corporations were no longer the owners but rather management professionals. Owners consequently lost the right to recuperate all of the profits generated by the company, and it seemed reasonable to think that profits could be shared by everyone who contributing to the enterprise.

Reaction in opposition to the institutionalists was quick to follow. In 1919, the judgement was delivered on the Dodge brothers versus Ford International case, condemning Ford for “wasting” on its workers. In the academic arena, two law professors, Berle and Dodd, battled each other (1931). Dodd held that owners should no longer be the exclusive beneficiaries of profits. Berle, however, emphasized that one could not address this question under market liberalism, the only solution was thus to direct all profits to stockholders.

B. The 1929 crash

The crash of 1929 put an end to the era of triumphant capitalism. In the USA, Roosevelt's New Deal addressed the economic crisis. Keynes put forward the idea, already present in Ford's practices, that supply is determined by demand. “Fordism” spread. This was the start of the welfare state. Americans esteemed that they lived in a mixed economy, and no longer a capitalist regime. During this period, which lasted from the 1930s to the 1960s, CSR existed under the labels “Business and Society” and “Business in Society”. The idea was that an implicit moral contract existed between society and businesses, which would be tolerated as long as they respected certain boundaries. Heald wrote the first article presenting CSR theory, picking up on the ideas of Clark, followed by Davis (1960). Chester Barnard (1938) wrote an immensely popular book advocating for a balance between the interests of each. His work would remain the business bible in the USA for 50 years. On the request of Protestant churches, Bowen (1953) wrote, “Social Responsibility of the Businessman”. He emphasized the personal and moral responsibility of leaders, in the necessary respect of the mixed economy. The individual allows the engagement of the business that s/he manages. If s/he behaves incorrectly, society would restrain the business by law. Respect of the balance of interest relies on the virtue of the leader, which also is in his or her interest. Bowen was the first to explain that it is necessary to instrumentalize this responsibility. He was thus responsible for the idea of a social audit.

C. Age of activism

At the end of the 1960s, the rise of activism initiated a new phase in CSR history. This was a time of consumerism,² opposition to the Vietnam War and Apartheid,³ and the first signs of “political ecology” in the USA. The social movements of the era were learning the most effective means to oppose large firms: “name and shame”.

Threatened, large firms responded by developing a management doctrine in the belief that there was a need to learn how to confront social problems. This learning would benefit all of the large companies. A centre on business management of social issues was created at Harvard University, which took up and instrumentalized Bowen's social audit idea. The results of a social audit were to be discussed with a firm's detractors as a form of proof that the company was making an effort. Ackerman and Bauer (1973 and 1976) demonstrated the need to be reactive to social issues. They affirmed that firms must dedicate human, structural, and financial resources to address these social issues. The idea that a firm had a social performance (just like it had an economic performance) was born (Carroll 1979; Wood 1991).

The works of Pfeffer and Salancik (1978) marked a turning point. In their view, companies believed that they were self-sufficient and detached from their environment when they were in fact profoundly dependent on it. In reality, a company has to continually negotiate with everyone to secure the right to survive. It is necessary to negotiate with those who provide or who do not provide resources, and which Freeman (1984) would call, starting from 1978, the stakeholders. The result was that it was necessary to “manage the stakeholders”.

With the serious ecological and social accidents of Bhopal⁴ and Exxon Valdez,⁵ firms became proactive to forestall government implementation of regulations. They preferred to take the lead by creating internal rules or “soft laws”. The idea of corporate citizenship was born.

D. The restoration

This period begins with the end of the Vietnam War. It was a time in which the Chicago School, which upheld an economic doctrine diametrically opposed to Keynes, was triumphant. The Chicago School holds that supply should be promoted over demand because the profits of the rich are invested. From a political perspective, deregulation followed. Anti-trust⁶ laws were dismantled, and the lines between commercial and investment banks were allowed to blur. Globalization created competition between nation states. The active players -- transnational companies -- were choosing one nation over another to establish industrial plants according to the legal context on offer (for example, tax rates on profits) (Scherer and Palazzo, 2011).

On the side of business, the idea that “the social responsibility of business is to make profits”, as proclaimed by Milton Friedman in a celebrated 1970 New York Times article,

2. Ralph Nader is a lawyer who battled against the giants of the era (Ford, General Motors). The venerable Consumer Protection Committee was established during this period.

3. The fight against apartheid in South Africa consisted of asking large companies to refuse to do business in the country, otherwise the pension funds would refuse to invest their capital.

4. In 1984, a Union Carbide factory exploded in Bhopal, India, killing 3500 people on the spot, without counting the deaths due to the aftermath of the explosion.

5. An American oil tanker that sank in 1989, creating a gigantic oil slick off Alaska.

6. These laws limited the merger of, and accords between, very large companies.

was triumphant. New theories came to light. Demsetz wrote about property rights (1967); Jenssen and Mecklin (1976) published Agency Theory. It became acceptable for a business to have as its sole goal to “earn value for the share holder”. The result of this movement was the financialisation of the economy.

The Chicago School held that only the market could restrain companies. The argument was so convincing that regulation was entrusted to soft laws on a massive scale. Internal regulations started to spread (labels, standards...) with the goal that the so called best (the one holding the label) would be compensated. Only in extreme cases would companies with intolerable behaviour fall under government regulation (hard laws).

The system was based on consumerism.⁷ All labels, standards, etc evoke consumerism. The idea was that consumers' choices were effective in resolving social issues. It thus was enough for businesses to create their laws (labels etc) and for consumers to choose in order for social problems to be resolved. Society was betting on a virtuous circle: businesses would respect what was left of government regulation, and seek to improve their social performance. The leaders would be those who communicated about their initiatives. The best therefore would be awarded with quality labels, with the goal that consumers would vote for them, both by buying shares and products.

The current life cycle CSR is based on the ideology of this last period (the restoration) and uses tools provided by CSR.

II. How did CSR impose itself in LCA to address social themes?

CSR has imposed itself as the representative of social questions in the “life cycle” community since the beginning of the 21st century, despite independent research leading in a completely different direction. How did this happen? Did LCA partisans think that CSR actually offered an opportunity to anticipate the social consequences of choices? We believe that the grafting of CSR onto LCA is the result of several combined factors.

First, no method was available (or easily adaptable) to estimate the social consequences linked to the functioning of product chains. Even with regard to public policy, social effects are ill understood, and even less documented, compared with economic, financial and even environmental aspects. Some particularly forward-thinking LCA practitioners imagined developing a new method. Their efforts in this direction seem to have ceased in 2006 without further activity up to present. The members of the LCA world already were very busy with the environment.

Furthermore, it seems that they came up against new scientific domains quite removed from the natural sciences that had contributed to the development of environmental LCA. Professor Michaël Hauschild confronted the question head on. Helped by social and humanitarian scientists, he supervised two remarkable PhD theses on social LCA. He thinks that,

7. The main idea is that as consumers, people can decide social directions through their choice to finance or not companies by becoming or not becoming shareholders, and through their choice to purchase or not to purchase the products proposed.

“to build social LCA, social science researchers are necessary” (personal communication, 30 May 2010).

Another circumstance impeded LCA scientists from taking the time needed to develop a method to assess the social consequences of choices. Most LCA practitioners probably expect little from social LCA. They hope to add some indicators to environmental LCA outputs, because their culture leads them to consider that the results of case studies that really count are assessments of environmental effects. Consequently, they are not ready to invest the years of research needed in “social issues”.

Lastly, recent developments in business also have infected research – and especially in an applied domain like LCA. Immediate results are demanded. Here too, the years of research needed to develop a robust method constitute a strong disincentive.

This is why we have arrived at the present situation. Methods to assess the social performance of businesses in the environmental life cycle have flourished under the name “social LCA” (when it should be called “life cycle CSR”). However, the situation is unsatisfactory for everyone – businesses, consultants, and society. Life cycle CSR cannot anticipate the impacts that has made environmental LCA so successful. This is not even its objective.

Proper studies carried out by environmental LCA class different options according to their actual impact on the environment. In contrast, we do not know whether performance approaches can rank social effects options in the correct order. Both researchers and consultants are aware of this. The symptoms of this malaise are visible in the presentations of the practitioners themselves. Numerous symposium papers effectively finish with a declaration of the need to “complement the performance approach with research to estimate impacts”! As for scientists who are examining the method seriously, they demonstrate its incapacity to predict social impacts (Jeorgensen et al., 2010), or even refuse to consider the method to be part of LCA.

On the other hand, why did CSR fail to also impose itself in the field of environmental LCA? The main reason is that a set of accessible methods (grouped under the generic name, environmental LCA) were developed and are effective in anticipating the environmental consequences of choices. Furthermore, CSR is “weak” in the environmental field, which is not its preferred domain. There lastly is a strong chance that the large and lively community of environmental LCA researchers did not accept the intrusion. The circumstances were the exact opposite for social LCA.

III. Principles and outputs of life cycle CSR

Despite the apparent variety of life cycle CSR tools, the underlying principles are similar. They involve collecting and using characteristics of a situation to combine, compile, transform and present them in an organized manner as the supposed result of the process. It consequently is the characteristics of the existing situation (and not those of an anticipated situation) which constitute the results of life cycle CSR. Life cycle CSR is applied to existing cases to observe what already exists. The anticipative dimension of LCA is absent.

The main task of life cycle CSR is thus the choice of criteria (incorrectly called indicators) that will together define the current social situation for a certain life cycle stage. The criteria

Imagine an extremely simplistic life cycle combining 3 organizations (A, B, C) in the production stage. The following table shows how to calculate the social performance P_n for this entire production stage according to the hours worked on the product by each of these organizations, and the scores obtained in the three organizations for criterion n .

For example, to make 100 kg of product X, one assumes that 50 work hours are needed (5 h + 15 h + 30 h).

The same is true for the calculation of other social performances in the production stage. Ideally, the social performance in the consumption and possibly recycling or disposal stages also should be included, but in practice, this is difficult.

It often is possible to follow the evolution over time of the value given to each criterion. To interpret them (to know if the value obtained is correct, indifferent or incorrect), it is necessary to have a reference value. The results are presented in two formats. If the performance is quantifiable (as in table 2), it is noted that to produce 100 kg of product X, the social performance of the production stage is $P_n = 15.1$, while the desirable standard is, for example, 12. If the results are qualitative (along the lines of yes/no/undetermined): it is impossible to proceed like this. In such cases, researchers indicate the proportion of organizations involved in the stage that have the certain characteristic. The results then are similar to this: to produce product X, of the companies involved in the life cycle, 30% are ISO 26000 certified companies, 8% are not ISO 26000 certified, and the status of the remaining 62% is unknown.

Table 2. Calculation process for the performance P_n in the production step

Organisation	Into A	Into B	Into C
Work time contributing to 100 kg of X (hours)	5 h	15 h	30 h
Rate of the work time contributing to X, for each organisation	10%	30%	60%
Value of the social performance n	13	4	21
Calculation of the social performance P_n	A contributes to P_n for $10\% \times 13 = 1.3$	B contributes to P_n for $30\% \times 4 = 1.2$	C contributes to P_n for $60\% \times 21 = 12.6$
Value of the social performance P_n $1.3 + 1.2 + 12.6 = 15.1$ for 100 kg of X			

To facilitate understanding, we have provided here a simplistic picture of life cycle CSR methods, of which there are numerous varieties. However, the focus always is on calculating performance.

frequently are borrowed from those used in conventional CSR scores. Some researchers have fashioned criteria out of international labour laws. It also is frequently the case that the commissioners of a study or other partners choose the relevant criteria.

The guiding principle is to provide information for each criterion (for example, the minimum monthly salary awarded) for each organisation in the life cycle. If there are n organizations taken into account in the life cycle, for p criteria, the results are presented as n lists of p criteria given the value obtained for each organization. To give these results meaning in relation to the overall life cycle, one must be able to weigh the importance of each organization (thus of each list of p criteria) in relation to the others. In practice, one often chooses to weigh the lists in proportion of the hours worked contributing to the product (Hunkeler, 2006). The fictional case (see previous page) illustrates these practices.

In our view, the problem raised by life cycle CSR is that the approach sometimes is misused. The approach often is erroneously ascribed with properties that are the strong points of environmental LCA. This is the topic discussed in section IV.

IV. Criticism of life cycle CSR with regard to the LCA spirit

A. The four common points of confusion in life cycle CSR

On paper, life cycle CSR at times is presented to estimate the social impacts that can be attributed to the functioning of a product's environmental life cycle. (For the moment, we shall leave aside the definition of life cycles, which is addressed in Chapter 3). Yet the approach is not equipped to do this. Life cycle CSR often is misused due to four points of confusion.

- 1) one mistakes the meaning of the word, 'impact', which seems to designate both a static state and the consequence of a change.
- 2) one pretends that improvement of business social performance will lead to improved social well-being, which is not systematic.
- 3) one does not know how to assess potential effects.
- 4) one does not distinguish between what can be attributed to the product from what can be attributed to the context. Evidence of this confusion is that the descriptor of the situation is called an 'indicator' when it is not one.

1) The social effects of a project (this project may, for example, be the creation, disappearance, or modification in the functioning of a production activity) can be assessed based on the difference between the final state (when the project is achieved) and the baseline situation, also known as the reference state or initial state. It therefore is absurd to imagine that an effect or social impact may be assessed based on a sole state without having established any point of comparison. Guidelines for the social assessment of products define social and socio-economic life cycle assessment as, "an assessment technique of positive

and negative social and socio-economic impacts (real and potential) during the entire life cycle of products [-]" (Benoît and Mazjin, 2009, page 37). Unfortunately, in this work, the meaning of the word 'impact' is too broad.⁸ It includes characteristics or attributes of a situation (for example, "there is child labour") as well as the consequences of changes in production (for example, "doubling production will create 23 jobs").

2) In the Guidelines and in studies inspired by it, there often is the implication that improvement of business social performance automatically will improve the living conditions of workers and/or local populations. There is, however, no scientific basis for these allegations. Even if one may observe – based on two successive studies of the same organisation – an improvement of social performance, one will learn next to nothing about improvements in well-being. This is because there is sadly no reason that improved social performance (such as reducing the number of children working in a factory, hiring an equal number of men and women, or increasing labour unions) leads to the improved well-being of either these categories of people or of society. No direct link exists. Our Western lifestyle leads us to believe that it is better to eradicate child labour, respect gender equality, and diversify labour unions. These are laudable ideas. But in the reality of the field, one can aggravate ill-being while trying to do good. If child labour is forbidden (improved social performance) the consequence may be that the children go back to school (positive social consequence), or enter into prostitution (negative social consequence) depending on the context. As noted by Georgensen et al. (2010), there is a strong chance that the maintenance of child labour improves the well-being of families, including the children. Must gender equality be respected at all cost on an exhausting or night-time production chain? The diversification of labour unions can be a problematic and in fact weaken the rights of workers. There is no a priori link between improved social performance and well-being. It is necessary to prove that this link exists when it is the case. With our current level of knowledge, we know next to nothing.

3) Life cycle CSR does not assess potential effects because it has no forecasting dimension. The data gathered to assess "social aspects" describe an existing situation. They are not then used for predictions. Furthermore, studies often confuse two types of criteria: some describe the social effects of the existence of life cycles which have occurred, which are consequences of past choices (for example, the creation of a certain number of jobs) while others describe the current situation (for example, gender equality in a certain sector). The manipulation, aggregation with or without weighting, of such different data leads to the results losing all meaning.

4) The fourth source of confusion is that the criteria describing the situation do not allow a difference to be made between what is attributable to a product and what is attributable to a context. In effect, life cycle CSR does not analyse the cause of the state described: is it the existence of the chain, is it the socio-economic context, is it one or several other causes? This distinction is vital because what is attributable to the firm alone, independent of context, is what the firm can actually change. A firm cannot actually change what it does not control. An exporter of tropical products may ban children from working on his plantations... but he is under no illusions. He knows that he shall not thereby improve the well-being of these children because the phenomena of child labour will not disappear

8. "Here, the expression [social impact] is used in such a way as to include the notions of effects, consequences, social change and the presence of social attributes." (Benoît and Mazjin, page 69, note 46).

thanks to his decision! Driven by necessity, they will go to work elsewhere, and most likely under worse conditions.

Let us remember that according to Catherine Paradeise (2012), “the strength of an indicator lies in its ability to facilitate a comparison between commensurable identities, torn from unique situations in which they conventionally are encased and gathered together in a same class of objects. [...] they decontextualize the objects that they measure [...]”, (Paradeise, 2012, page 5). Life cycle CSR descriptors do not distinguish what pertains to the context from what pertains to the existence of a product; as such, they are not indicators.

It is undeniable that CSR studies offer information regarding the presence and evolution of certain characteristics. They often are useful for businesses and government authorities because they contribute information on a state at a given moment. However, they often are very time consuming and expensive in relation to the new information provided. Above all, they do not throw any light on the social consequence of choices between possible alternatives to obtain the same service. This is, however, the very objective of social LCA.

B. An example to demonstrate the importance of the method chosen

The following example will show the opposing conclusions that can be drawn depending on the method used: life cycle CSR on one hand, and a study of the social consequences of a change on the other. We voluntarily chose a very simple case to demonstrate that it is possible to calculate social effects very simply. Choosing life cycle CSR is not an unavoi-

Let us assume that a company wishes to compare the social effects induced by signing a contract with supplier x established in country A rather than supplier y established in country B. We hypothesize that the two suppliers only produce the material required by the client company.

In the first case, the client company compares the work related accident rates at x and y. If the company stops there, it would seem that x (2%) is better than y (3%). However, the client company knows that these rates depend on the owner of the factory, the context, the factory's equipment and work conditions, which depend themselves on the country, sector... and also the nature of the product produced. The client company wants to choose according to the actual effects caused by its choice. It thinks that if it does business with one of these suppliers, the suppliers would continue to function as they do at present. So should the client company choose x or y to improve the overall status of workers in these two factories?

In this regard, it will seek to know the average work accident rate in the sector in country A on one hand, and country B on the other. We hypothesize that the work related accident rate in x is equal to the average work related accident rate in country A, while it is 2 points better in y (3% instead of the average rate of 5% in this sector in country B). These new values signify that from this point of view, x behaves like an average supplier in this sector of country A, while y does better than the average supplier in this sector of country B.

In the absence of other, better adapted calculation methods, the client company can in this way address the effects of the life cycle functioning on the work related accident rates at x and y.

- If it accords a large new contract to x, it would have no effect on improving work-related accident rates in country A, but the effect in country B also would be zero because the company does not sign a contract with y.
- On the other hand, if the company accords the large contract to y, the effect would be to lower the work related accident rates in country B, and would have no effect on country A.

In other words, the client company could reasonably esteem that if it chooses supplier x, it would change nothing with regard to work related accidents in either country A or B. It would have no social effect. If, however, it chooses y, it will promote the activity of an enterprise where the work related accident rate is 2 points lower than the local average. Its choice of y will therefore have a real effect in bringing down the prevalence of work related accidents in country B, without affecting country A. It thus should choose y in country B. If the client company had stopped its analysis at apparent performance (respectively 2% and 3%), it would have made the opposite choice.

dable fatality necessitated by a lack of alternatives. It is possible to easily calculate social consequences.

In the preceding example, the rate of work related accidents of the potential suppliers (2% and 3%) are descriptors of the situation. They represent a “black box” for knowledge because they amalgamate the effect of the product, enterprise, sector, country, etc. in a single value. In contrast, the specific effects of suppliers x and y (zero for x, 2% better than the average for y) allow an assessment of the social effect that the client company’s choice will produce if it signs a contract with either x or y.

Conclusion

This chapter covers the common methods of life cycle CSR that are presented under the name, “social LCA”. They are in fact methods for estimating the social performance of an ensemble of companies in the manner of CSR. History and circumstances explain why life cycle CSR is presented implicitly in the Guidelines as the preferred method for assessing the social impacts of products. As we have shown, a life cycle CSR study provides social performance criteria that are more or less aggregated (neither social effects nor impacts) and does not allow one to distinguish the effects attributable to the context from those attributable to the product. Consequently, life cycle CSR does not assess the consequence of a choice, and does not highlight possible impact transfers (we will address this last point at length in Chapter 2).

In the following chapters, we will not refer much to life cycle CSR because the true aim of this book is to present proposals for – and the first research on – the building of a social life cycle assessment method. It was nevertheless necessary to explain why existing approaches are inadequate for this project.

References

- Ackerman RW. (1973). « How companies respond to social demands », *Harvard Business Review*, 51(4): 88-98.
- Barnard C. (1938). *The Fonctions of the Executive*, Harvard University Press.
- Benoît C., Mazjin B. (2009). *Guidelines for social life cycle assessment of products*, UNEP/ SETAC Life Cycle Initiative.
- Berle AA., Means GC. (1932). *The Modern Corporation and Private Property*, 2nd éd., Harcourt, Brace and World, New York, 1967.
- Bowen H. (1953). *Social Responsibilities of the Businessman*, Harper & Brothers, New York.
- Carroll AB. (1979). « A Three Dimensional Conceptual Model of Corporate Performance », *Academy of Management Review*, 4(4): 497-505.
- Clark JM. (1916). « The Changing Basis of Economic Responsibility », *Journal of Political Economy*, 24(3):209-229.
- Davis K. (1960). « Can Business Afford to Ignore Corporate Social Responsibilities? », *California Management Review*, 2: 70-76.
- Demsetz H. (1967). « Toward a Theory of Property Rights », *American Economic Review*, 57(2): 347-359.
- Finnveden G. (2000). « On the limitations of life cycle assessment and environmental systems analysis tools in general », *The International Journal of Life Cycle Assessment*, 5(4): 229-238.
- Freeman RE. (1984). *Strategic Management: A Stakeholder Approach*, Pitman, Boston.
- Friedman M. (1970). « The Social Responsibility of Business is to Increase its Profits », *New York Times Magazine*, 13 Septembre.
- Hunkeler D. (2006). « Societal LCA methodology and case study », *The International Journal of Life Cycle Assessment*, 11(6): 371-382.
- Jensen MC, Meckling W. (1976). « Theory of the Firm: Managerial Behavior, Agency Cost, and Capital Structure », *Journal of Financial Economics*, October 3, pp.305-360.
- Jeorgensen A., Lufanna CH. Lai, Hauschild MZ. (2010). « Assessing the validity of impact pathways for child labour and well-being in social life cycle assessment », *The International Journal of Life Cycle Assessment*, 15(1): 5-16, DOI : 10.1007/s11367-009-0131-3.
- Paradeise C. (2012). « Le sens de la mesure-La gestion par les indicateurs est-elle gage d'efficacité? », 9ème Conférence de l'AFD / EUDN, 26 mars, Paris (France), 21 pages.
- Pfeffer J., Salancik GR. (1978). *The External Control of Organizations: A Resource Dependence Perspective*, Harper and Row, New York.
- Scherer AG., Palazzo G. (2011). « The new political role of business in a globalized world: a review of a new perspective on CSR and its implications for the firm, governance, and democracy », *Journal of Management Studies*, 48(4): 899-931.
- Wood DJ. (1991). « Corporate Social Performance Revisited », *Academy of Management Review*, 16(4), 691-718.

Recourse to social LCA probably takes place late in the decision making process. In the field, when decision makers are planning to launch a project, they consider various alternatives (which may be nuances or variants of the same base project). Their first concern is to verify the technical feasibility of these alternatives. They then test their economic relevance. To choose between the handful of alternatives which then remain (those technically feasible and economically relevant), they can relatively easily get a consulting firm, or even their internal services, to carry out an environmental LCA. The techniques are well known. If the environmental results of the alternatives are clear cut, the decision makers will not be able to choose the worst solutions without risking reproach (from their constituents, voters, or NGOs). They will select two or three alternatives deemed to be best for the environment. We believe that it is only at this point that social LCA intervenes. Social LCA makes it possible to differentiate the main social effects of two or three alternatives which are technically feasible, economically relevant, and environmentally acceptable.

Social LCA studies remain expensive. They will only be applied to a small number of select alternatives. Perhaps it will be necessary to combine environmental and social criteria before a decision is made, but we think that this will remain an exception.

Social LCA thus is a decision support tool. The question of knowing how results generated by social LCA methods are used in decision making spheres will not, however, be addressed here. This complex question depends on the social conception of the interface of knowledge and policy (Hoppe, 2005). It is possible that one decision maker will require a social study solely to confirm his or her own decisions. Another may wish to ignore the results while yet another will trust them blindly. Likewise, we will not address the question of the effectiveness of decisions. All decisions require a theory of their effects...yet no consensus exists with regard to social effects (Petti and Campanella, 2009; Paradeise, 2012). Consequently, the following case may arise: the decision maker enjoys the benefit of an "excellent method" that provides clear results and recommendations. Yet when implemented, these recommendations fail to obtain the expected results...because the social sphere is very complicated.

With all of these reservations laid out, our discussion here will concentrate on what could be an "excellent method". In other words, we seek the qualities that must be required of the method itself in order for it to render the best service possible to decision makers. Who are the decision makers involved (section I)? What are the novel contributions expected from the method, ones which will condition how it actually is used (section II)? This leads to a discussion on the qualities that a social LCA method should have (section III). Lastly, even when an excellent method has been obtained, it will always – in its very design -- have numerous limitations (section IV).

I. Who commissions a social LCA study? Towards empathy and omniscience

This paragraph explores the distinctive qualities of the LCA spirit. This vision is reflected in a capacity to highlight three types of impact transfers in social LCA.

A. The results of an initial survey

Several years ago, a Danish research team (Jeorgensen et al., 2009) conducted a survey of 8 large Danish companies regarding their needs for tools to assess their social effects. In response to the question, “What kind of social assessment do you need?”, these companies identified four uses:

The first is to conduct a rough estimate of the working conditions in their direct suppliers to anticipate possible problems (such as forced labour, etc.). These companies generally already have at their disposal audits providing this type of data (e.g. Social Accountability).

The second is to show that the company conforms to a business partner’s requirement to follow a code of good practices. These companies themselves ask their direct suppliers to conform to this code. They already have the necessary tools.

In third place, 4 companies were interested in results comparing their products with those of their competitors on the basis of the same service rendered. They hoped in this way to set themselves apart from their competitors. Two health sector companies were interested in the positive social effects of the use of their product.

Lastly, one company had found itself in a delicate situation. It had to choose to impose different negative social effects on one or another of its suppliers, without being able to anticipate these social effects.

With the exception of the last request, the managers interviewed saw no benefit from a new method beyond standing out commercially.

Yet life cycle CSR methods (see Chapter 1) attempt to offer companies a way of standing out by describing all or part of the value chain using social criteria. However, most companies simply choose criteria based on emotion, which is effective with consumers.

B. The LCA spirit is omniscience and empathy

If one sticks with these requests and this audience, the value of developing a new social assessment method is very limited. If the goal is for companies to advertise supposed social effects (which presumably would be “good” effects because they are the only ones that would be communicated voluntarily to the public), life cycle CSR may suffice. But companies need to estimate their actual social effects (Scherer and Palazzo, 2011). Other organizations (for example, governments) are interested in the social effects of production activities. To uncover these potential study commissioners, there must be a return to the core “life cycle” spirit.

Each commissioning body logically tends to concentrate the assessment on what is directly important for them depending on their personal stakes. Yet the life cycle spirit is fundamentally different. Beneficiaries of a life cycle assessment must by necessity refocus their vision. They cannot just look at the effects under their noses, or only at those for which they feel responsible, or those which pleases them to consider. All of the effects caused by all stages in a life cycle must be examined, whether these effects are global (such as a potential increase in climate change) or local (such as the acidification of a waterway). A LCA analyst adopts an omniscient point of view without embracing anyone’s partisan interests.

But above all, the analyst adopts an empathetic⁹ vision of the world because he puts him or herself in the shoes of others (natural environments, other humans whose health may be affected, etc.). He assumes, one might say, the point of view of the entire society, nature included! “The ‘life cycle’ approach implies a kind of ‘social planner’s view on [...] issues” (Heiskanen, 2002, page 428).

C. Impact transfers

The primary reason for an LCA spirit is to avoid the wrong good solutions that shift problems elsewhere without solving them! One of the first questions addressed by life cycle assessment (Curran, 1996) was the following: is it preferable to clean car engines with a paper that can be burned, or with a cloth that can be reused after washing? The response has no validity if one forgets to check what happens at the laundry!

By nature, LCA considers the ensemble of important impacts (those that one knows how to calculate¹⁰) where they occur, and thus regardless of the actors affected.

The distinctive quality of LCA is to highlight the impact transfers that might arise due to having chosen one alternative over another. In the field of environmental assessment, these transfers may occur either because a certain impact is moved from one stage in a life cycle to another (I move the effect of increased climate change from the stage of burning the paper to the stage of washing the cloth), or due to the nature of the impacts (I aggravate “ecotoxicity” by having wished to improve the “climate change” impact).

In social LCA, these impact transfers also may take place through a transfer between stages or between the nature of the impact, but there is, furthermore, a third manner. As social effects always affect human beings, the transfer may occur by moving the effect felt by one group of people onto another group. To conduct a social LCA, one therefore must be aware of this third impact transfer mode, for example, between workers of one country and another.

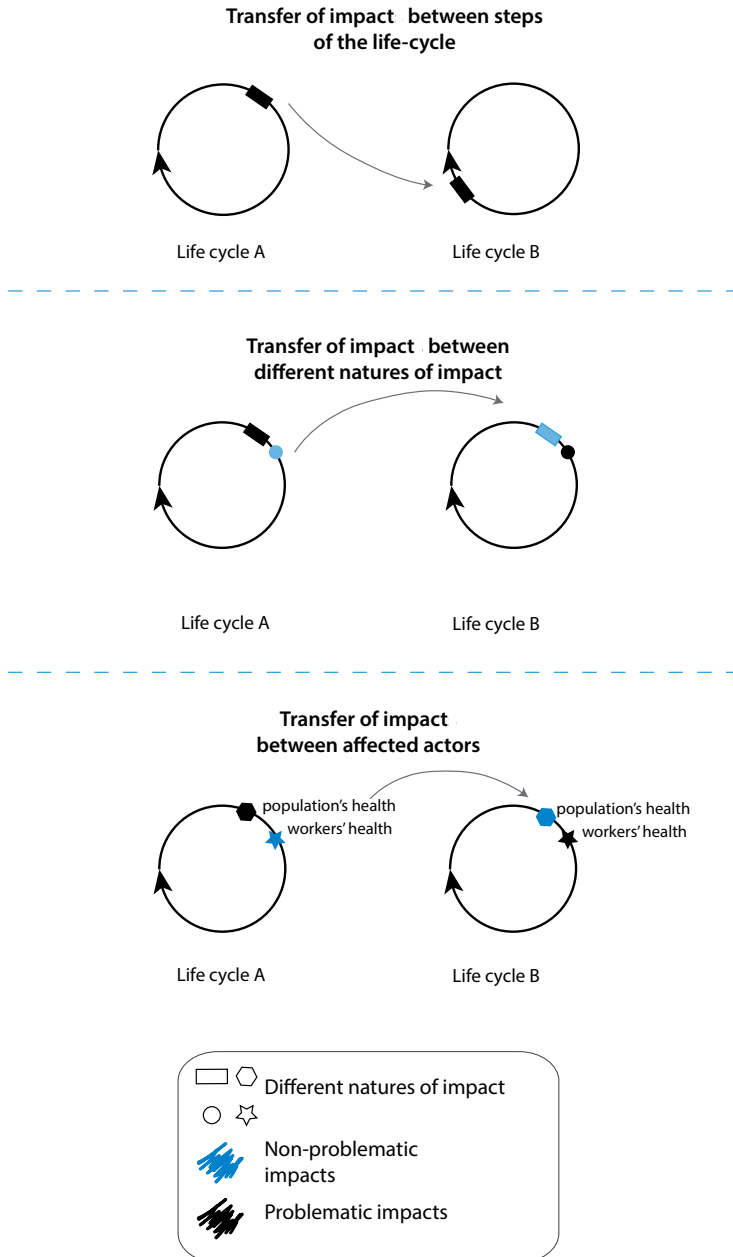
The idea of **impact transfer is key to building social LCA**, as is true for any LCA.

Consequently, we propose a first definition of social LCA through its end goals, which are to estimate by anticipation the potential impact transfers between life cycle stages, between the nature of impacts, and between actors affected.

9. If Rifkin (2011) is to be believed, our civilisations have entered the age of empathy.

10. There are major environmental impacts, such as loss of biodiversity and soil erosion, that are still assessed poorly by current environmental LCA tools. However, numerous research studies are underway. The method gradually enriches itself with the discovery of how to calculate each new impact.

Diagram 2. The three social LCA impact transfer possibilities



D. Who will commission a social LCA study in the future?

The future commissioners of social LCA consequently are decision makers who must assume an empathetic and omniscient point of view. How many of them are there?

We believe there are many of them, and they will increase in number for two reasons. The first is the evolution underway of the notion of corporate social responsibility itself, as noted by Scherer and Palazzo (2011). Due to the shortcomings of certain governments in terms of human rights, society is requiring multinational companies not only to assume their legal responsibilities, but also to remedy abuses that occur along their value chains. It is no longer enough to assess the behaviour of a large firm according to an economic logic or to what the firm contributes to society. This evolution “reflects a pro-social perspective that differs fundamentally from limited personal interest” (Suchman, 1995, page 579). The second reason comes from the example of environmental LCA. Environmental LCA has seduced policy makers, notably in the European Union, and has imposed itself on economic actors as the reference to estimate the ecological effects of production activities. It imposed itself exactly because it adopts this empathetic and omniscient point of view embodied in the term “life cycle”. Odd as it may seem at first, numerous companies have deemed it relevant to adopt this “off-centre” point of view. They have done so because it enables the discovery of previously unsuspected room for progress.

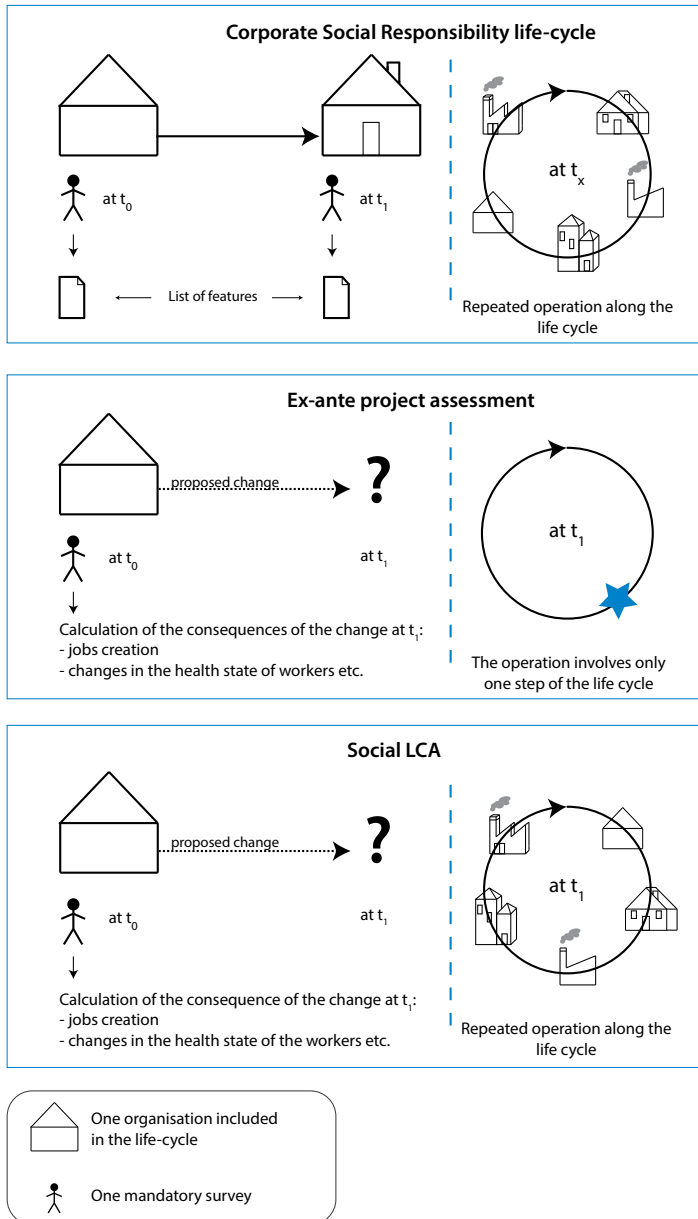
We are betting that in the future, it will be the same for social LCA provided the method also adopts an omniscient and empathetic posture. *A priori*, potential commissioners are international institutions, States and supra-national organizations that feel responsibility for the effects of their actions in the countries of their foreign partners. Non-governmental organizations also are potential major commissioners. A very large transnational company may have the same concerns as a supra-national organisation. When transnational companies appropriate a notable part of a State's creation of value (Fortanier and Kolk, 2007), they can behave like States, with comparable social consequences.

But smaller companies and public authorities such as regional governments are not excluded. Most of the characteristics of the method at the national scale are applicable or adaptable to smaller entities. Of course, a regional government will not have the same need for detail on all stages of the social life cycle of the product studied. Within the scope of the study, one must specify which stages will be analysed in detail, and give indications of the probable social effects occurring outside this perimeter. The omniscient feature of LCA must not be lost.

II. The original contributions of social LCA

Social LCA currently is a method under development. Is it different from existing methods? Will it offer other possibilities for analysis, other perspectives? It will have to offer interesting original features to elicit an enthusiasm comparable to that enjoyed by environmental LCA. As this method is still in its infancy, we will discuss the qualities that future users may expect from it. Their expectations derive from the idea that social LCA will allow results to be interpreted as they are in environmental LCA, but for social impacts instead of environ-

Diagram 3. The characteristics of social LCA in relation to project assessment and CSR



mental ones. We will return to this idea (section A). We can anticipate four possible uses of social LCA based on the uses of environmental LCA covered under the ISP 14044 standard (2006) (section B).

A. Interest of functional units

Production activities (of goods and services) are necessary because they render services to people. The role of LCAs is to weigh the services rendered against the more or less desirable effects of the activity.

In an environmental LCA study, for example, the quantities of greenhouse gas emitted are reported to a single “functional unit” of a product, service, or process under study. The functional unit is the unit of service rendered.¹¹

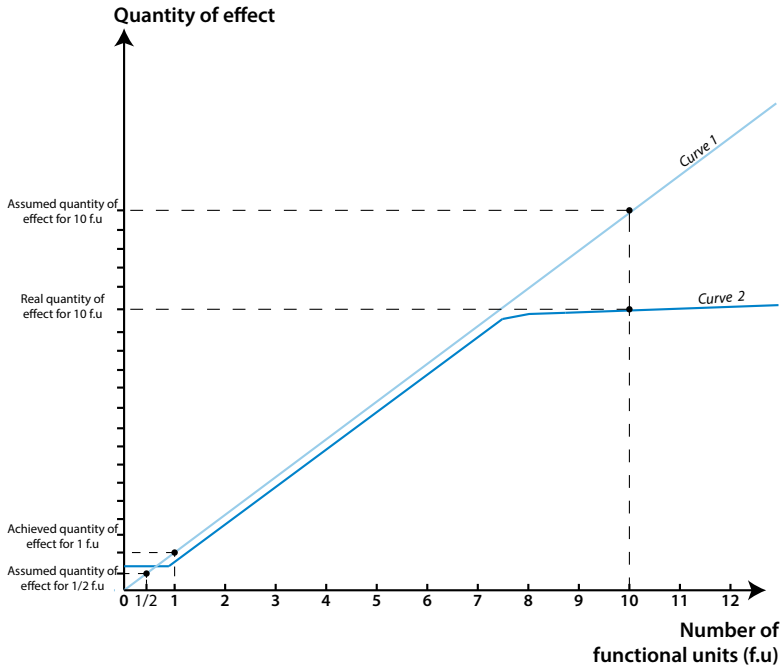
In LCA studies, the service that presides over the definition of the functional unit is rarely expressed well. One thus may find “a kilo of rice” being proposed as a functional unit, when in the strict sense, the real functional unit is, “the service rendered by one kilo of rice to the average West European consumer.” Of course, a product renders multiple services to a single user, without even counting that it renders even more services to other categories of people! However, each LCA study only takes into account a single functional unit.

The obvious advantage of using functional units is to word a problem according to a specific concern of the decision maker. Functional units effectively allow comparisons of products which are different but render the same service (or at least for which the study focuses on the same service). A decision maker thus may compare the effects of the functioning of a life cycle to obtain one kilo of rice or one kilo of wheat by using the shared functional unit reporting their protein content.

Another consequence of using functional units is the possibility of extrapolating results. This is of major interest for the decision maker, who is not particularly worried about the effects of producing one ton of rice because his decision concerns 7 720 tons annually! Expressing results (the effects of the functioning of a life cycle) per functional unit suggests that if one produces half of a functional unit, the effects will be divided in two. If 10 are produced, the effects will be multiplied by 10, etc. The response of effects to the quantity of the functional unit seems to be proportional. In environmental LCA, it is almost always assumed that the response function of effects to quantities of functional units is linear. Of course, this is true only for a certain range of values of the functional unit. In nature, most response phenomena trace a sigmoid (similar to curve 2 in diagram 4). Diagram 4 illustrates a proportional response (curve 1) and a hypothetically real response (curve 2).

There is thus an area of shared values of functional units for which the line of curves 1 and 2 are temporarily confused, at the point where the relationship effectively is proportional. Determining this area is a specific research field in environmental LCA.

11. This notion is common in “functional analysis” that developed in engineering fields in the 20th century. It aims to facilitate the creation of complex material technological objects in response to a set of specifications. Instead of fixing the nature of the object sought (an aluminium basin), functional analysis defines the services that the object must provide (contain 20 litres of water) to respect the specifications. In this way, the possible responses are much more diverse. Next to proposals for “aluminium basin” may be found “plastic basin”, or even “magnetic core”.

Diagram 4. Proportional response and real response

In social LCA, it is likely that the shape of the response curves varies as well. Most of the time, we do not know what it is. In contrast, we do know that in a precise context defined by thresholds, the proportional response relationship remains valid. This is why researchers are obliged to determine the conditions of use of each response relation highlighted. Correctly establishing the relations thus signifies not only mathematically formalizing the relationship that allows the value of effects to be forecast, but also explaining clearly what we call “conditions of use”. These are the minimum and/or maximum values of contextual characteristics for which one may legitimately hope that the proportional relationship does not betray reality. An example of a relationship accompanied by its conditions of use is given in chapter 7 (paragraph II.A).

Provided the terms of use are respected, the decision maker can extrapolate that in the case of interest, the quantities of effects will evolve in simple proportion to the quantities of the functional units used in the calculation.

B. The possible uses of social LCA

a. The four uses of environmental LCA.

The four uses of environmental LCA codified in the ISP standard (ISO, 2006) are reviewed here:

" [Environmental] LCA can contribute to:

- 1) identifying possibilities of improving the environmental performance of products at different stages of their life cycle;
- 2) informing decision makers in business, governmental and non-governmental organizations (for example, for strategic planning, establishing priorities, designing or re-designing a product or process);

LCA can contribute to:

- 3) choosing relevant environmental performance indicators, including measurement techniques;
- 4) marketing (for example, implementing an ecological labelling system, a claim regarding the environment or an environmental declaration related to a product)."

Wenzel et al. (1997) declare that (environmental) LCA serves to compare the environmental impacts of two comparable products or services (use 2) or a product or service with a standard (uses 3 and 4), or to identify the hotspots or improvement potentials (use 1) in the life cycle of a product or service. In all cases, there is a comparative dimension. There is always a baseline reference¹² (Jeorgensen et al., 2010) without which an estimation is impossible. In the terminology of Bo Weidema et al. (1999), retrospective types of environmental LCA use as a reference the situation in which the product does not exist, while so called 'prospective' LCAs compare two life cycles, with one representing the reference for the other.

b. The meaning of "environmental performance"

Before translating the uses to social LCA, it is necessary to examine the terms, "environmental performance" and "social performance". Everyone understands intuitively what is meant by the "environmental performance" of the production, use, and recycling of a product. These are the consequences of the activity of creating a product on the state of Nature in the broad sense. During these stages, the processes engaged actually emit physical flows (of gas, water, etc.) and actually use resources. The measurement or estimation of these flows is possible, and indicates that the functioning of these processes will (perhaps) have a consequence on the natural environment. There is no ambiguity in the field of environmental LCA. The emissions and consumption of these flows are the consequences of the functioning of a life cycle. In environmental LCA, practitioners make inventories of the consequences of the functioning of a life cycle!

Note!

The equivalent of the term, "environmental performance" used in standards is the term "**social consequences**" or "social effects" and not in any way "social performance". This is because the term "social performance" designates characteristics of social life in a company (such as respect for gender equality, child labour, etc.). It in no way designates the **social consequences** caused by the functioning of a life cycle. It is these last effects – and only these – which are of interest to us here.

12. Take note: this reference is a life cycle, not a criterion or a set of criteria!

But there is no equivalent of these physical flows in the social domain. The functioning of these same life cycles may create material or immaterial flows...we know nothing about it, and we have even greater difficulty estimating them. In contrast, it is clear for everyone that the production, use, and recycling of a good or service are activities that can have important effects on human well-being. They sometimes affect the health of people, or their skill level, confidence in society, etc. It is precisely these consequences for well-being (called social effects) directly imputable to a product life cycle – and to nothing else – that one seeks to estimate in social LCA.

c. The possible uses of social LCA

Transposing the suggested uses of environmental LCA to social LCA requires “the environmental performance of products at different stages of their life cycle” to be replaced with, “the social effects attributable to the functioning of the life cycle of a product”.

Under these conditions, we propose the following four uses for social LCA.

Social LCA can contribute to:

- 1) identifying possible improvements in social effects attributable to the functioning of a product life cycle,
- 2) informing decision makers in business, governmental and non-governmental organizations (for example, for strategic planning, establishing priorities, designing or re-designing a product or procedure).
- 3) the choice of relevant indicators of social effects attributable to the functioning of a product life cycle, including measurement techniques, and
- 4) marketing (for example, implementing a “social” labelling system, a social related claim).

In environmental LCA, the same method is supposed to fill these four uses. In practice, each LCA study is constructed differently according to its use, but the general framework (rules of definition of a system assessed, nature of impacts taken into account...) is the same. In social LCA, it theoretically is too – only the common framework has not yet been defined! Among other issues, the question of the nature of impacts has not been addressed. As an overall framework does not exist, diverse methods claiming to be social LCA have been designed for various uses.

We note that the manner that these four uses are articulated suggests that there are several ways to develop/design the same object or concrete service, and that one can compare the social effects of these different variants in order to choose among them. Depending on the desired use, one feature of the method will be emphasized over another.

How may a method for these four uses be built?

We will return in section III to the capacity of the method to detect the possibilities of improving the social effects evoked in use 1. We will define the functioning of a life cycle in chapter 3.

Use 2 insists on the necessity of assessing the social effects through anticipation. In effect, how may one plan, design, or redesign something without anticipating? The potential social effects (meaning those which will occur only if they find fertile ground) thus must be calculated before the life cycle starts to function. This anticipation will of course be based

on existing examples, but one also must be able to address the case of production chains that do not yet exist.

Use 3 is focused on the question of the relevance of indicators (do they truly take into consideration the social effects created by the production of a product and not something else?). The issue of the relevance of indicators was covered in chapter 1.

The issue of the reference reappears with use 4. In effect, how may one label a product with regard to its social effects without considering a reference product in relation to which the effect will be interpreted (as more or less causing a certain quantity of a certain impact)?

Let us note that life cycle CSR can suffice for use 4 if one accepts that a label based on social characteristics (existence of child labour, union liberty, etc.) informs and interests consumers. However, let us note that this information already is provided by “fair trade” certification methods. Turning to life cycle CSR adds only two other elements: to consider more companies associated in the same life cycle compared to conventional “free trade” certification, and to aggregate the results of similar social characteristics for an ensemble of different organisations.

III. The qualities required of social LCAs

The four uses raise expectations. The qualities of the method respond to these expectations.

A. Modesty

Users (consultants, experts, researchers) must remain careful and modest with regard to the capacities of the method. It is very important to help decision makers to continuously situate the contributions of the method in relation to the overall problem that they need to resolve. It is crucial to help them understand that the results are: i) incomplete, ii) relative to a reference, iii) potential and iv) cannot be interpreted in isolation.

- **The results are incomplete**

The results are incomplete because they are based on hypotheses¹³ (on what is important in the social sphere, the perimeter, etc), that do not reflect the entire real world. The only way to adopt a scientific approach is to specify the hypotheses underlying the method, and to indicate in particular which social theory one adheres to. One must also clearly lay out the perimeter of the study, in other words, which organisations¹⁴ will be examined (Chapter 3 addresses this question). Modesty also consists of emphasizing the extent to which the social effects which one may anticipate are rare. It would be heuristic to give decision makers examples of effects that probably are important, but which we do not yet – or may never – know how to assess.

- **The resulting social effects are caused by a change in relation to a chosen reference**

13. Among the hypotheses, let us emphasize the conditions of use (paragraph II.A) of the calculation of effect, which depends specifically on each effect. In this way, decision makers will know the extent to which they can extrapolate the results of the study to multiple quantities of the functional unit.

14. We will see in Chapter 3 that the choice of organisations included in the perimeter determines the choice of categories of actors affected for which the impacts will be estimated.

The change between this reference situation and the projected situation causes the social effects (for example, job creation), some of which will transform themselves into social impacts (for example, improving well-being) in contact with certain groups that are called the target populations. The difference between the reference situation and the projected situation will obviously be different depending on the departure point chosen. The choice of reference, which may be more or less arbitrary, is a determinant of the results.

- **Potential effects are assessed**

In nearly all types of scientific research, proposed calculations and estimations are based on an understanding that everything else will remain the same. The anticipated effects would be produced therefore only if nothing else changes in the world.

In LCA, however, there is an additional condition. The effects will only reveal themselves if they encounter a favourable field, in this case, people to affect. In this sense, the results are potential.

- **Results must not be interpreted in isolation**

An isolated result has little sense in decision making. For example, a potential effect of 2 additional days of life expectancy does not mean that the actual life expectancy will increase by 2 days if the change is applied, or even that it will increase. It means: in relation to the reference situation, if all of the hypotheses are realized, and if the target population is available, then this change would provoke an increase in life expectancy of 2 days. Due to all of these conditions, it is much more prudent to make a comparison with an alternative providing the same service. This second alternative is subject to the same uncertainties as the first (in relation to the reference situation, if all the hypotheses are realized, and if the target population is there). Consequently, differences in results between the two alternatives are significant.

Let us take as the reference situation the current situation where no service is rendered. Let us imagine a first situation A. In situation A, the potential increase in life expectancy calculated is 2 days (in relation to the current situation). There is an alternative, situation B, which provides the same service as A. The calculation using the same hypothesis shows that situation B would induce an increase in life expectancy of 3 days in relation to the reference situation. The results, “+ 2 days of life expectancy” and “+ 3 days of life expectancy” have little odds of actually taking place due to all of the hypotheses underlying the calculation. In contrast, the “+ 1 day of life expectancy”, which is the difference between situation A and B, is much more meaningful. It stands out and imposes itself despite the identical hypotheses imposed on A and B. It thus has more of a chance of occurring. Situation B really is better than situation A with regard to this criterion.

B. Feasibility

When one reads published life cycle CSR studies, one cannot help but be horrified by the colossal amount of work involved. Sadly, the results are not commensurate with the superhuman efforts involved if one compares them to the information that one can obtain directly by questioning production sector experts. Experts effectively can explain that human rights are a problem in such and such a country, that a certain supplier is not reliable with regards to working conditions, etc. without needed to conduct cumbersome surveys.

The immense list of indicators, and infinite refinements of “stakeholder” categories, represent an enormous amount of work. Given the lack of social theory, did the UNEP/SETAC Guidelines aim to make an exhaustive description of social issues? This plethora derives from the Guidelines trying to describe in extenso a given situation without an explicit reference to another situation. We propose, in contrast, to assess the effects of a change between two situations, with the analysis limiting itself to what has changed between the two situations.

The aim of a social LCA study is to estimate the important social effects (of those that we know how to estimate!) on the actors most severely affected by changes in behaviour of the few organizations studied within the perimeter of the system.

As one studies only what changes, only organizations strongly affected by the change are examined. All other organizations, which behave in a more or less similar way, do not merit being studied. As we shall see in Chapter 3, it is possible to determine if a certain organization will be strongly affected before conducting a survey... which saves a lot of work.

Social LCA requires much less data than life cycle CSR. It is therefore easier to carry out, for the following reasons:

- the system only includes the organizations whose social behaviour changes under the effect of the forecast change.
- one can decide if an organization falls within or outside of this system without needing to survey it first.
- one estimates a limited number of effects or impacts, of which some through general relations (see chapter 7),
- one does not bother with all of the categories of stakeholders, but only a few, targeted, most affected groups.

C. Relevance

The relevance of the method relies on a set of elements that will be presented in the chapters of this book: understanding and formulating the question, correct definition of the perimeter, relevant choice of effects estimated, etc. We will not cover all of this in Chapter 2. Here, we shall insist on three aspects of relevance: the capacity to 1) anticipate, 2) highlight impact transfers, and 3) predict the effects that count.

• Capacity to predict and data bases

One might wonder, for example, what are the main social effects of the creation of a banana value chain in a certain African country (we thus will compare the effects of the creation in relation to those that one imagines if the chain did not exist). This is an interesting, instructive *ex-post* exercise, but limited as a decision support tool. LCA is, however, a decision support tool. If one refers to uses 1 and 2 of the ISP standard, it is even an *ex-ante* decision support tool.

One therefore must be able to predict the future state of a system to decide whether one wishes (yes or no) to realize it. We always predict the future based on what we have learned from the past, and which we translate into a more or less generalized form. The best way to

predict is to have at one's disposal generalizable relations (within the limit of their conditions of use) between a variable whose value is fairly easy to anticipate and the impact sought. The accumulated knowledge to date on this phenomenon is summarized within these relations.

There are known and quantified relations between the stress of certain groups of workers and the development of cardio-vascular diseases. When one uses this relationship to estimate the "cardio-vascular disease potential" of a possible change, one implies that the effects observed in the past under certain conditions will certainly reproduce themselves in such a case because the stress observed (the trigger conditions) is the same.

However, proven relations between an easy to anticipate variable and a social effect are not always available. In this case, the solution is to turn to the value of this effect in a past case deemed to be similar. For example, one will infer the creation of new social links (impact) generated by the development of an activity in a village group based on past data on this phenomenon in a similar village group.

In each case, the data will replenish "data bases". They will give values to a certain variable of interest (for example, work related stress) with its estimation mode in such contexts. Like environmental LCA, storing the information acquired in data bases will avoid having to undertake the same study several times. However, there is a major difference between social LCA data bases and environmental LCA data bases. The data bases of environmental LCA contain outputs from quasi standardized and timeless processes,¹⁵ often per continent. Meanwhile, social LCA will use some standardized social data per country (such as gross domestic product, average life expectancy...) but also a lot of specific data (such as the value added of a certain firm in a certain year). These specific data are of little interest when considered alone. They must be associated with their surrounding context. It thus will be less relevant to reuse these last types of data in another context compared to standardized environmental LCA data.

• Highlighting impact transfers

Use 1 of the standard stipulates that LCA will help identify possible ways to improve the social life cycle. We must, however, be wary of "impact transfers". This is because we might consider improving the overall health of a population...to the detriment of a growing work related accident rate among certain workers. Once the method is able to highlight the potential impact transfers, it will automatically identify the possibilities for improvement.

• Highlighting the effects that count

Let us recall that it is always the effects of a change that one wishes to highlight in social LCA. That said, how may one determine which social effects of a change are important? All certainly merit being highlighted, but this cannot be. One therefore must present and explain one's choices of the effects that one will estimate.

Aristotle teaches us that there are three sources of arguments: emotion (this is the source of the wording on the packet of tea described in the Preface); logos (science, reasoning); and ethos (behaviour), which can itself be dictated either by habit or by opinion. In nume-

15. The need to use local or spatialized data is a source of considerable concern for environmental LCA practitioners, for example to distinguish farm procedures.

rous “social” studies, researchers draw upon ethos. They consult the people concerned by the problem studied. These people choose (through procedures which often are rigorous and democratic) the nature of the effect to be studied. We have chosen to base social LCA on logos, meaning on a theory of the social world. Even if the involvement of people concerned is desirable at certain stages, the choice of impacts is made based on a theory. For example, Claudia Reitingner and her colleagues (2011) deduced the main categories of social effects that are important for people from Finnis’ ultimate motivations theory.

There are two main advantages of relying on a theory. The first is the stability of the theory regardless of the case studied. In this way, the ensemble of studies will be conducted, everywhere and at all times, by seeking to know the same effects. Let us note that in environmental LCA, logos holds sway, the list of environmental impacts that can be estimated is the same, although of course adapted to each case study. The second advantage of using a theory is perhaps more important. The theory effectively allows each of the effects to be situated among the ensemble of effects that must be taken into account to obtain a complete picture of the social effects that count according to this theory. This thus guarantees transparency and modesty. The researcher thereby declares, “here are the effects that I assessed among those that should be assessed to give a complete picture of the phenomenon according to this theory.”

As we will see in chapter 4, social LCA can use different theories.

IV. The limits of social LCA

Social LCA has, and always will have, limits intrinsic to its role of anticipating the true social effects of a decision.

First, the method wishes to anticipate the social effects caused by changes in life cycles. Yet many social effects are not caused by changes in life cycles, but rather by changes in social conditions, institutions, civic and cultural life, etc. Numerous social effects cannot be anticipated whether social LCA is used or not!

Secondly, the method can never anticipate, within a given period, all of the social effects caused by the functioning of, or changes in, a life cycle. An exhaustive theory of the social world would be required to do so. But none exists. One must remember that social effects themselves cause social effects. This chain of effects goes on forever. Furthermore, social effects are produced at different moments in time, sometimes long after the moment that provoked them. Lastly, effects impossible to predict can occur. Like most scientific methods, social LCA announces results *ceteris paribus*, “on the condition that the remainder of the world does not change.” Yet this last condition never holds true in the real world.

As a third element to consider, one must recognize that certain effects are difficult to quantify. How may one quantify, within a population, future feelings of belonging, security, confidence? As a result, social LCA evaluations are unbalanced in favour of quantifiable effects (such as changes in life expectancy, level of financial poverty) and to the detriment of effects that are difficult to quantify. Likewise, certain calculation relations of effects are more generalizable than others. When poor populations see their national income increase in a sustainable manner, average health improves in the same way around the world

(Feschet et al., 2012). No similarly sure relation to anticipate a level of confidence is known. Social LCA therefore will ignore effects associated with relations that cannot be generalized easily.

Our fourth point recognizes that the quality of data often is mediocre, or data are simply unavailable. The time and expense necessary to acquire data can be prohibitive, even when one has a reliable method. However, the extension of the method can have unexpected effects. It could induce generalizing the systematic calculation of certain values in companies (for example, the calculation of the local value added). The pitiful lack of data at present should not discourage us for the future.

Let us finally note that certain topics examined by environmental LCA practitioners (optimization of rare procedures, or of a particular machine) are not at the scale required to submit their life cycle to a social LCA study. In effect, some relations concern quasi macro-economic topics (a value chain generating a significant economic value at the country level).

Conclusion

Social LCA aims to assess the social effects of production activities by embracing an empathetic and omniscient point of view. The commissioners of social LCA studies (here considered together with decision makers) are a priori supra national organizations, governments, NGOs, and transnational corporations. Smaller public authorities and companies also are concerned. The key is that these commissioners are interested by the empathetic and omniscient point of view. If this is not the case, they do not need social LCA.

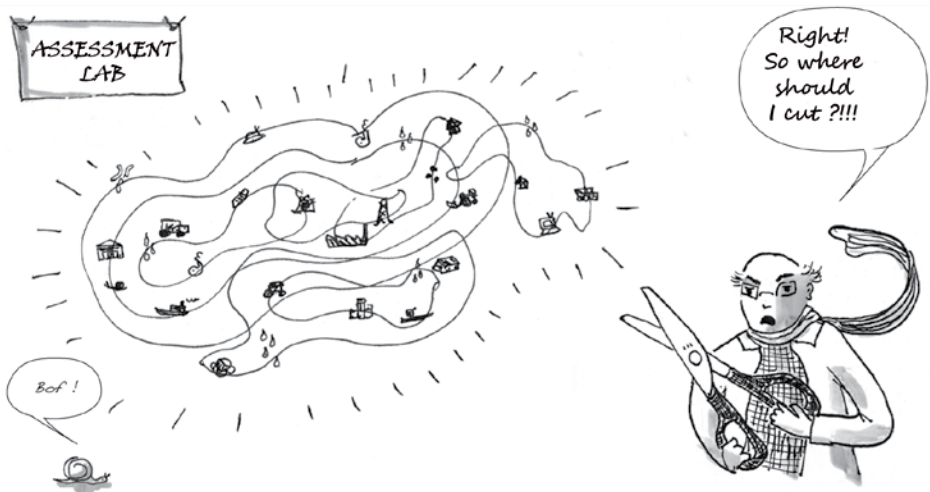
The method will highlight possible social effects transfers when the decision maker makes one choice rather than another. These transfers may shift from one step of the life cycle to another, or from one impact to another (as in environmental LCA), as well as from one group of actors to another.

We will focus on four uses of social LCA, which are the companions of uses listed in the environmental LCA standards. They highlight diverse characteristics that are developed in greater depth in the chapters which follow. Chapter 2 has focused on modesty, feasibility and relevance. Despite all of the efforts devoted to it, the method always will have intrinsic limits. The method captures the social effects linked to changes in life cycles, and only these effects. Some effects are unpredictable, most are not able to be captured in generalizable mathematic formulations. Despite all of these limitations, the method will allow social problems caused by life cycles, and therefore linked to environmental issues, to be framed differently. It will require projected changes in life cycles to be considered in terms of the health of workers, improving the well-being of populations, etc. with precise data and anticipated figures whose evolution can be followed. The reasonable objective that can be given to social LCA is to know how to rank alternatives in an order of preference reflecting the reality of their effects, at least for the social effects envisioned.

A key element of relevance is to correctly define the systems to be studied. This is the subject of chapter 3.

References

- Curran MA. (1996). *Environmental Life-cycle assessment*, Mc Graw-Hill.
- Feschet P, Macombe C., Garrabé M., Loeillet D., Benhmad F., Rolo Saez A. (2012). « Social impact assessment in LCA using the Preston Pathway - The case of banana industry in Cameroon », *The International Journal of Life Cycle Assessment*, 18(2): 490-503, DOI : 10.1007/s11367-012-0490-z.
- Fortanier F., Kolk A. (2007). « On the economic dimensions of corporate social responsibility: exploring Fortune Global 250 Reports », *Business Society*, 46: 457-478.
- Heiskanen E. (2002). « The institutional logic of life cycle thinking », *Journal of Cleaner Production*, 10: 427-437.
- Hoppe R. (2005). « Rethinking the science-policy nexus: from knowledge utilization and science technology studies to types of boundary arrangements », *Poiesis Praxis*, 3: 199-215.
- ISO (2006). *ISO 14044: environmental management—life cycle assessment—requirements and guidelines*, ISO 14044:2006(E), International Standards Organization.
- Jeorgensen A., Hauschild MZ., Jeorgensen MS., Wangel A. (2009). « Relevance and feasibility of social life cycle assessment from a company perspective », *The International Journal of Life Cycle Assessment*, 14(3):204–214, DOI : 10.1007/s11367-009-0073-9.
- Jeorgensen A., Finkbeiner M., Hauschild M. (2010). « Defining the baseline in Social Life Cycle Assessment », *The International Journal of Life Cycle Assessment*, 15(4): 376-384, DOI : 10.1007/s11367-010-0176-3.
- Paradeise C. (2012). « Le sens de la mesure-La gestion par les indicateurs est-elle gage d'efficacité? » 9ème Conférence de l'AFD / EUDN, 26 mars, Paris (France), 21 pages.
- Petti L. et Campanella P. (2009). « The social LCA: The state of art of an evolving methodology ». The annals of the "Stefan cel Mare" University of Suceava, *Fascicle of the Faculty of Economics and Public Administration*, 9(2): 47-56.
- Reitinger C., Dumke M., Barosevcic M., Hillerbrand R. (2011). « A conceptual framework for impact assessment within SLCA », *The International Journal of Life Cycle Assessment*, 16(4): 380-388, DOI : 10.1007/s11367-011-0265-y.
- Rifkin J. (2011). *Une nouvelle conscience pour un monde en crise, vers une civilisation de l'empathie*, ed. Les liens qui libèrent, Paris.
- Scherer AG., Palazzo G. (2011). « The new political role of business in a globalized world: a review of a new perspective on CSR and its implications for the firm, governance, and democracy », *Journal of Management Studies*, 48(4): 899-931.
- Suchman MC (1995). « Managing legitimacy: strategic and institutional approaches », *Academy of Management review*, 20(.): 571-610.
- Weidema BP., Frees N., Nielsen AM. (1999). « Marginal Production Technologies for Life Cycle Inventories », *The International Journal of Life Cycle Assessment*, 4(1): 48-56.
- Wenzel H., Hauschild M., Alting L. (1997). *Environmental assessment of products*, vol. 1: *Methodology, tools and case studies in product development*, 1^{ère} édition, Kluwer Academic Publishers, Norwell.



Chapter 3

Catherine Macombe and Vincent Lagarde

The functioning of a social life cycle and the perimeters of the study

Social LCA (SLCA) aims to assess the social repercussions of the functioning of a social life cycle. The idea of a life cycle invites us to follow in spirit the trials and tribulations of a product (a Swiss watch, for example) as it passes through different stages of its existence, from inception to use and up to its ultimate demise.

We see the watchmaker assembling the pieces in a factory workshop. We mentally return to its origins, seeing the mine where the metal was extracted, visiting the farm where the cow whose leather hide would serve as the watch band was raised. We see the watch travel

in a package to the store where it will be put on display. Before our eyes, we see the buyer in the jewellery shop, one who will wear the watch on his wrist for a long time. The life cycle concept also evokes the episode in which the watch, no longer usable, will be taken apart to recuperate metals in the recycling centre.

Furthermore, we suspect that the issue is not to follow the future of a single Swiss watch, but to examine thousands of watches being made, used, and recycled in this way.

What is the social life cycle? It is clearly not a real object (in contrast with our watch). It is an abstract object, deliberately and scientifically constructed with a precise goal in mind. Because a precise goal is pursued, SLCA is interested only in certain aspects of the functioning of the life cycle of the watch described above. What aspects of functioning are of interest (section II)? How may one construct the social life cycle (section I)? How may one delimit the perimeters of the study in space and time and the choice of actors affected (section III)?

First, one must remember that the objects themselves do not create social impacts. They are not alive, they do not act directly. It is human actions -- in interaction with the environment and particular objects -- that create social effects. Human activities aiming to produce goods and service are structured into organizations (businesses, government services, associations, workshops, banks, etc.), which is another way of saying that they are a condensation of rules and stable institutions. As Louise Camilla Dreyer discovered early on, organizations are the basic units of a social life cycle (Dreyer et al, 2006).

In social LCA, it is organizations which create social effects through their behaviour.

I. Defining the social life cycle

A. Definition and explanations

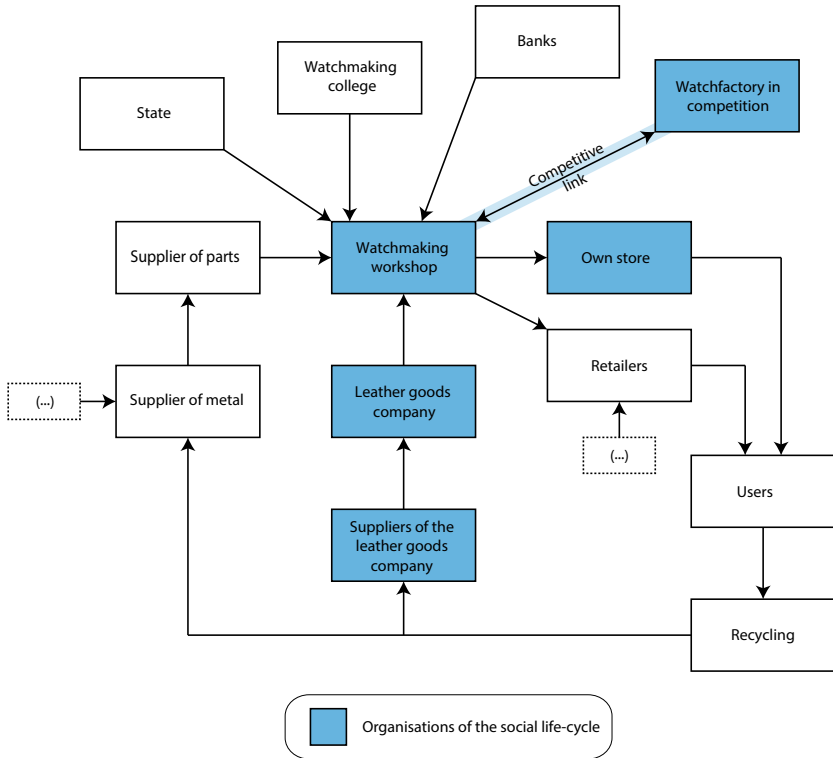
The social life cycle of a given product is a system of interacting organizations whose social behaviour depends on the existence of the product studied and causes significant social effects when the system functions normally. We shall devote section II to a discussion of "normal" functioning. We shall examine each of the remaining terms in the definition here.

The social life cycle is a system of interacting organizations. For example, the supplier of machined metal, the supplier of parts, and the watch workshop are interacting because they exchange a service (the supply of metal or metal parts) for cash consideration. The government services inspecting the working conditions in the workshop also are interacting with the workshop, as are the education services training future watchmakers. The watch workshop also is in competitive interaction with the watch factory selling Swiss watches in the same retail stores as the workshop. In fact, when one really thinks about it, the system of interacting organizations is itself connected, in one way or another, with every other organization in the world. How then can one choose the boundaries of the system?

Méthot (2005) and Dreyer et al (2006) focus their attention to the parts of the life cycle that the company commissioning the study can directly influence. This is a practical first step, but one that compromises “a result to be used for comparisons” (Weidema, 2005).

To draw a boundary between the organizations that will be included in the study (one also may say within the perimeter) and those that will not, criteria are required.

Diagram 5. The social life cycle of the Swiss watch



One must remind oneself that in a social life cycle, one is interested in a particular product. Consequently, only those organizations whose social behaviour depends on this particular product are of interest. What is social behaviour? Here are a few common examples: a company is going to hire or fire employees, change a supplier or retailer, enter a new market, etc. In fact, all behaviour of organizations that can affect collective or individual well-being are social behaviours. What then are the social behaviours that depend on the product

studied? To find out, one must imagine that the product has just disappeared. If the Swiss watch value chain was eliminated, what would happen? Most of the organizations that we have identified previously (government services, banks...) would not be affected, or if so, only slightly. Users would buy other brands, most suppliers of the Swiss workshop would not be affected because the workshop was not a large client. The same is true for the recycling centre, which recycles thousands of electronic devices and watches every year. In contrast, the workshop probably would fire staff, its store would be threatened with closure, and its competitor probably would increase production volumes and even hire staff. The leather maker which supplied the watch bands and worked exclusively for the watch workshop would be obliged to seek a new outlet. Its own suppliers may be affected. The workshop, its shop, the competing factory, and the leather workshop thus have social behaviour that all depend directly on the product studied (see diagram 5).

If their behaviour causes important social effects (such as firing or hiring, damage to workers' health), these organizations must be included in the study in order to assess the social effects that a planned change might induce. Certain organizations thus are affected by the routine functioning of a life cycle and cause important social effects. We will say that in this case, these organizations are "sensitive" to the product studied.

B. Models to help describe the social life cycle

In the preceding example, the organizations are linked by flows of materials (like the store and the workshop) that are easy to identify. However, other links exist that would be more difficult to discern because the related organizations do not belong to the workshop's value chain.¹⁶ This is the case of the factory competing with the watch workshop. More generally, there are many immaterial flows (coopetition,¹⁷ cultural effects, socio-political etc. flows), which means that one organization can depend closely on another without exchanging either material or money with the latter. These inter-dependent organizations belong to the same "arena". Researchers are beginning to build models to detect these flows, and to sketch out these arenas, in order to take them into account in the product's social life cycle. But much work remains to be done. As we learn how to model these immaterial flows, we will be able to draw increasingly relevant social life cycles, meaning all organizations dependent on the product will be included, and only these organizations.

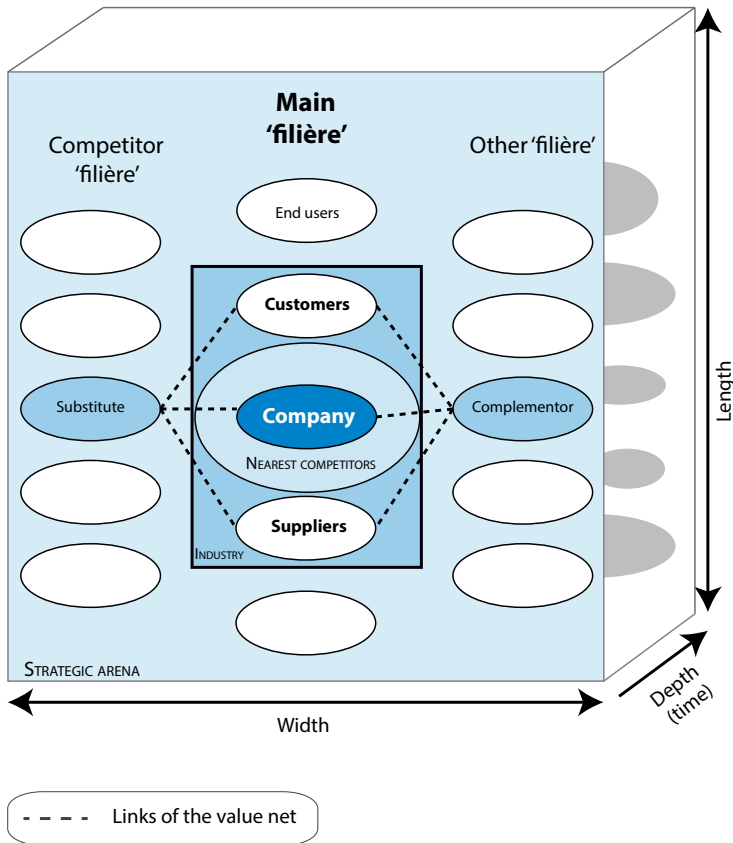
Diagram 6 presents a model of the arena of the central firm A (which makes the product studied and to which it is "sensitive"). This model is used to detect the companies in synergy or competition with the central firm, and which could be affected by a move by this central firm. Experts of the industry in question will be able to describe the strategic arena in which this change will be played out and to identify the organizations concerned.

We should note that the conclusions drawn from this diagram are only valid for a brief period of time. For a widely consumed good, it is likely that this diagram will be valid for about one year due to the instability of coopetition business relations. For equipment goods (household equipment, cars) or public goods (dams, roads, airports), the period may be longer, but this is to be verified on a case by case basis.

16. The value chain (Porter, 1985) is the ensemble of organizations linked by the antecedents of a product and the product itself and which directly contribute to the creation of the value of this product when it is finally sold.

17. Coopetition is the phenomenon where companies may compete with each other in certain markets while cooperating with each other in research activities, exchanging knowledge, and sharing resources.

Diagram 6. The systematic competition model



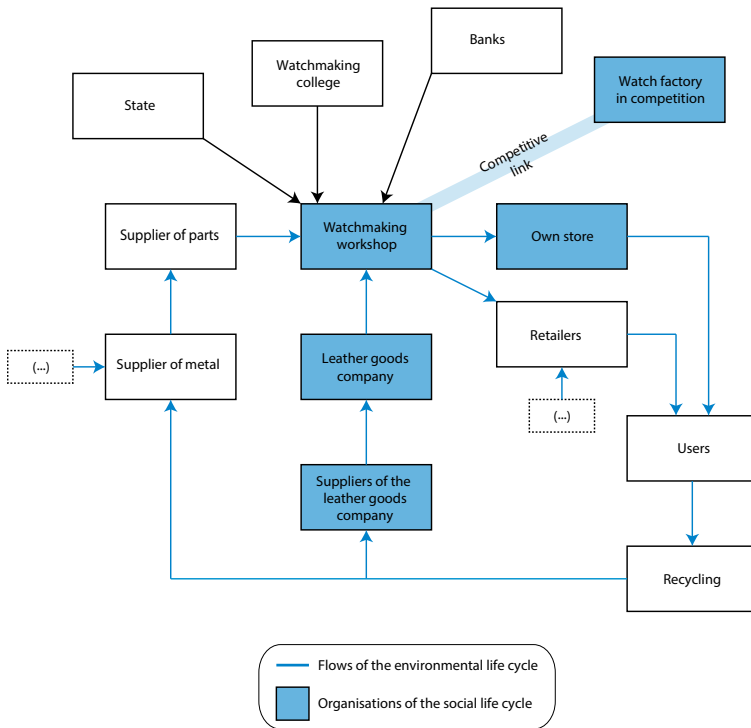
Source: according to Lagarde and Macombe, 2012

C. Environmental/social life cycle

There are significant differences between the environmental life cycle and the social life cycle. The environmental life cycle consists of the structure (or tree) of all of the base processes exchanging flows of material or energy during the production, use, and recycling of the Swiss watch. One is not at all interested in the organizations involved in these processes. This is perfectly logical because we know that the functioning of each of these processes has an effect on the environment, for example, it consumes metals, emits dust and gas, or pollutes water. These flows thus are a good basis on which to make calculations to predict potential environmental damage.

In the case of SLCA, the life cycle is composed of organizations *sensitive* to the product studied. Most of the organizations that contribute to the existence of a product, and in which the product or its antecedents (money, energy, raw material) circulate, are completely independent of the product. They are insensitive to this product. This is the case of most multi-product firms, supermarkets, recycling centres, banks, government services, energy suppliers. For insensitive organizations, everything happens as if the production of the product and its antecedents had no notable social effect because this activity is drowned in the greater mass of the organization's activities (it is a financial trickle for the bank, an infinitesimal flow of energy for the energy supplier, a miniscule activity for the multinational). It would be illogical to include these organizations in the perimeter, even if this choice may appear to be shocking. For example, an Indian business employing children may be insensitive to the products produced. The phenomenon of child labour is linked to the widespread poverty of the society, and not to the product line. The firm would employ children whether textiles, agriculture, or the production of toys was involved. Detecting and denouncing the existence of child labour is the role assumed by Corporate Social Responsibility (Capron and Quairel-Lanoizelée, 2007), which is a completely different approach. SLCA for its part constructs the perimeter of the study of product X to include only the organizations sensitive to product X, whatever the behaviour of the organizations in the value chain of X may be in absolute terms.

Diagram 7. The social and environmental life cycle of the Swiss watch



II. Defining the functioning of the social life cycle

The history of the fabrication of an industrial product begins with projects, plans, and provisional budgets. It often continues with the establishment of a factory, an additional production chain, a technical installation (dam, quarry). The chain functions for a few months, several years or even several dozen years. It experiences changes, minor incidents (breakdowns, strikes) and at times is subjected to accidents (fires, landslides). The products leaving the production chain travel in trucks or boats to warehouses, wholesalers or retailers. The tale ends with the definitive end of the chain, or even of the factory or installation, and sometimes with their dismantling.

In the broad sense, the functioning of a social life cycle could take into account this entire story. In practice, we distinguish three types of functioning:

- construction (or implantation) and deconstruction stages
- exceptional functioning
- routine functioning.

Is it worthwhile to assess all of these phenomena with the same method?

To assess the social effects through Social LCA, one must envision an average scenario. In such a case, the functioning will exclude periods of exceptional functioning. These can be anticipated and analysed using risk analysis methods, but this is not part of LCA.

Is there a point to assessing the social effects of the construction/deconstruction and routine functioning stages in the same study? The question is worthwhile asking because environmental LCA offers this possibility. In the environmental field, the flows caused by the installation (and the dismantling) are similar in nature (material and energy) as those caused by the functioning. One therefore can add the flows caused by the annual functioning with the fraction imputed annually (and determined by the choice of the amortisation period of installations) of the flows caused by the installations. However, this is not the case with social effects. The social effects of the creation of a site belong to the impacts of a project (Vancly, 2002). Most of the time, they are different from the social effects linked to the functioning of the site, and affect people other than those involved in the routine functioning. Furthermore, they do not occur at the same time.

Social LCA is able to address the social effects of routine functioning, but in general, there is little point in addressing exceptional functioning or the construction/deconstruction stages. Routine functioning is described by a precise scenario, corresponding to the average state of the system. Social LCA therefore only focuses on routine functioning.

III. Defining the spatial and temporal perimeters and the actors affected

At the very start of a Social LCA study, the problem to be resolved must be laid out clearly. The definition of the study's spatial perimeter (section A) and the temporal perimeter (section B) will flow from it. One also must specify how the actors affected will be defined (section C), meaning the groups of people who potentially will be affected by the social effects or impacts assessed in the study.

A. Determining the spatial perimeter of the study

The spatial perimeter is the delimitation of the social life cycle of the product studied in terms of the organizations included. We have seen in section I that the social life cycle is constituted by interacting organizations sensitive to the product. However, this is not enough to describe the complete spatial perimeter. To estimate the effects or impacts, we will always look at the effects of a system 1 in comparison with the effects of a system 2. In every case, systems 1 and 2 produce the same service. It is in relation to a unit of this service

that all of the results will be identified. This unit of service is the LCA's functional unit.¹⁸ This term was presented in chapter 2.

Sometimes systems 1 and 2 are different states of a same production system situated in the same country at the same moment. But one also might need to compare system 1 in country A with a similar system in country B. No matter what the case, the rule in identifying the spatial perimeter is to include all of the organizations whose sensitive social behaviour (meaning behaviour that has important social effects) differs in system 2 compared to system 1.

Here are three examples drawn from the actual concerns of a mono product transnational tropical fruit company involved in every stage of the production process from the plantation up to the fruit's arrival in Europe by boat.

In the first problem (see table 3), a government agency in country A is considering authorizing the doubling of the production of the transnational company. System 1 accounts for the actual state, system 2 the state under consideration. The spatial perimeter contains the organizations that will be affected by the doubling of production, namely: local suppliers (cartons, transport of workers), the hospital built by the company (a new wing would be built), but also the government service that collects taxes. Foreign suppliers, which are not particularly involved because the transnational company accounts for little of their turnover (for example, for the supply of pesticides), will be excluded. However, all foreign suppliers that are very sensitive to this doubling of production will be included (such as the European firm that transports and stocks the fruit in Europe). We will hypothesize that the tropical fruit market is sufficiently complex and volatile that it will not be affected over the long term (or that we are not sufficiently informed to include it in the study).

Table 3. Three types of comparison, which lead to different perimeters

The functional unit shared by all of the studies is 100 tons of X. The effects assessed are the social effects of the routine functioning of the life cycle over 20 years.

	Comparison between this system	And this system	We put in the spatial perimeter
First problem	Life cycle 1 in the country A	Setting the life cycle 2 in the country A (delivering 200 t of X)	Organisations of the country A and of foreign countries affected by the operating
Problem 2	Life cycle 1 in the country A	Setting the life cycle 3 in the country B (delivering 200 t X)	Organisations of the countries A and B, and of foreign countries affected by the operating
Problem 3	Life cycle 1 in the country A	Abandonment of the life cycle 1 in the country A in favour of the life cycle 3 in the country B	Organisations of the countries A and B, and of foreign countries affected by the operating and by the transition

18. Note that in SLCA, one cannot compare the case of system 1 with the case where it does not function because the two situations do not provide the same service! Positioning oneself in the case where system 1 does not function is a necessary exercise to identify the organizations that are or are not sensitive to the product.

In the second problem (see table 3), the transnational firm envisions implanting its activity (plantations, processing plants, transport) in either African country A or Central American country B. System 1 gathers the organizations of the social life cycle such as described in the preceding case, while system 2 gathers the organizations that would be affected by the routine functioning of the transnational in country B. The spatial perimeter of the study includes the sensitive activities that take place in country A, others that take place in country B, and possibly in their suppliers or foreign competitors.

We should note that one often studies the effects of ten, twenty, or thirty years of functioning depending on the scenario or country.

If the problem includes a transition (for example, abandoning a site), the effects of this transition must be included in the analysis. This is the case of the third problem.

Here, the transnational is hesitating between two positions: either allow its current factory to continue operating in country A, or withdraw from this country to set up a factory in country B. If the transnational withdraws from country A, the installations will be bought by someone else or closed down, staff will be unemployed or will go to work at another organization, and families living in the area probably will have to move. One cannot turn the present situation into something abstract, one cannot wipe the present clean. In the second problem, there were no costs in the abandonment of country A because nothing had yet been undertaken.

In the third problem, the spatial perimeter will have to take into account all of the organizations affected by the routine functioning which differs between the two systems, but also those that will be affected by the transition, even if this does not last long. The effects of the transition must be included in the study because this third case is not the equivalent of the second, and Social LCA must take this into account.

The spatial perimeter of an Social LCA study thus includes the parts of two life cycles (corresponding to the two systems being compared) which are not shared by the two systems, and which are sensitive to the routine functioning of these life cycles or to the potential transition.

It should be noted that the product use stage – when ordinary consumers are involved – poses a separate problem. This is the only stage through which the product passes that does not have an organizational structure. But above all, this use stage occupies a unique position in the study. This is because one always compares two cases in order to estimate the social effects resulting from the passage from one to the other (see table 3). Yet these two cases frequently are compared on the basis of the same service rendered to consumers. As this service is identical, the use stage is considered to be identical, and will be excluded most of the time from the perimeters of the study for the reason that the change studied does not modify it.

B. Choosing the temporal perimeters

Studying thousands of watches blurs the gap in time between production and recycling. One consequently is interested in a continuous time, and not specific actions as would be the case if one followed the fate of a single watch!

There are several temporal perimeters to establish in a social LCA study. These are to be discussed with the study commissioner, according to his or her interests, but the commissioner's preferences are not the only element to be taken into account.

The duration of the period of routine functioning envisioned will condition the occurrence or not of certain effects. For example, the life expectancy of poor populations reacts to the injection of new revenue into the country, but on the condition that this activity is maintained over several years (Easterly, 1999). It seems as if this supplementary revenue needs to be distributed over several years for part of this new manna to reach the poorest of the poor (Pritchett and Viarengo, 2010). Certain social effects are immediate (job creation or suppression) but many social impacts on health are only revealed once a number of years have passed. For these effects to emerge, the life cycle must function routinely for a certain period of time.

Another question concerns the *temporal horizon at which one will assess the impacts*. With regard to job-related diseases, for example, some are triggered rapidly, others only after 20 years of activity. Ideally, one should give oneself a temporal horizon adapted to each impact by taking into account the most up to date scientific knowledge about the temporal manifestations of this impact. Likewise, it often is asserted that the effects of consumer products on consumers is very different depending on whether one examines them over the short term or over 30 years of regular consumption.

Temporal horizon and duration...of the social LCA study

In paragraph I.B, we wrote that the description of an organization's competitors often holds true for only a short period (for example, one year for consumer products). If the case includes a transition between two states, one must verify that: i) the transition could take place over a period shorter than the duration of the validity of the arena (otherwise the estimation of effects based on the arena would be useless) and ii) the duration of the social LCA study remains reasonably proportionate to the duration of the validity of the arena. In effect, what would be the point of a social LCA transition study that provides conclusions at the end of six months when at that point in time the arena in which the transition takes place has already changed?

The choices of the study's temporal horizons must be made explicit from the start of the study.

C. Identify the perimeter of the effects

a. Identify the most affected groups of people

Social impacts are felt by people or groups of people. Finding the perimeter of effects means defining which groups of people are the most severely affected by selected effects of the change studied. The goal of the study is to best capture the impacts that would be felt by these groups if the envisioned change takes place. If indirect effects are taken into account, the numbers of groups affected are potentially infinite (Jeorgensen et al. 2010). What should one do?

One must first admit that there always will be a subjective dimension to the choice of actors affected due to the fact that they are *more or less affected, and that one cannot know this if*

one does not first take an interest in them. In practice, the commissioner of the study can give his or her opinion and express his or her interest in one or another group. The practitioner conducting the study will try to respond to this request.

Let us also note that there are scientific methods (long and cumbersome) that can be implemented to identify the stakeholders¹⁹ concerned by an issue (Mitchell, Agle et Wood, 1997). By considering that the issue is the change envisioned, one can interrogate these “stakeholders” and ask them: who are the actors who will be most affected by the change?

However, to avoid recourse to this cumbersome method, we suggest some rules to help identify the actors affected.

The first is that the *perimeter of effects depends on the spatial and temporal perimeters*. The remark seems trivial. However, if an organization is excluded from the spatial perimeter, no one will examine the possible drop in work-related diseases among its workers provoked by the change. Likewise, when one includes a competitor over a period of 10 years, one will examine the group of farmers working as sub-contractors for the competitor over this period. If one wishes to make the correct choice of actors affected, one must first, in a rigorous and relevant manner, identify the organizations affected and assess the period of time in which the impacts manifest themselves, in other words, choose the spatial and temporal perimeters.

The second rule is that the *perimeter of effects depends on the types of impact estimated*. Let's be realistic. The current state of knowledge on predicting impacts limits our options. We know how to assess only a few social effects, and each concern a particular group (workers of a certain unit, the population of a certain country or region). For example, we do not yet know how to assess the social impacts of consumer products on consumers. As we gather new knowledge, we will be able to expand our nomenclature of actors affected.

We therefore propose to identify the groups affected based on the sensitive organizations within the temporal perimeter chosen.

b. Superposition of actors affected and aggregation of results.

One should note that certain categories of actors may partially overlap. Workers in a certain factory are part of the population of their country. But as the study has a comparative objective, this is not an inconvenience. It is critical that results be labelled in relation to the same impacts affecting the same groups in the two situations under comparison.

Likewise, we think that the results of all of the affected groups should not be aggregated. The value of the results often lies in discriminating between the different groups of affected actors. Table 4 shows how the results of an social LCA study may be presented. They clearly identify the affected groups, as well as the temporal horizons starting from which effects can be observed.

19. We note that the stakeholders are not the actors affected. They are the actors concerned by the problem, and we suggest here that they can provide information regarding who the most affected actors are.

Table 4. Simulation of social LCA results

The case is the comparison of two water purification systems. The results are given per functional unit (provision of 1 000 m3 of quality X water per year). The reference is the present situation, without an organized purification system.

Impact or effect	Temporal perimeter	System A 30 years operating	System B 25 years operating
Workers health (step U28)	In the short term	+ 250	0
	In the long term	- 6 000	- 4 200
Workers health (step U12)	In the long term	+ 800	+200
Users health	In the short term	+ 1 258	+ 1 258
	In the long term	+ 5 600	+ 5 600
Capacity to make a decent living (local population Z)	At a term of three years	+ 400	+ 500
Etc.			

Conclusion

The social life cycle is a system of interacting organizations whose social behaviour depends on the existence of the product studied and causes significant social effects. When an organization is dependent on a product to the point that a change in the functioning of the life cycle induces within it a change of behaviour with important social effects, this organization is *sensitive* to the product.

The definition of the problem, a prerequisite of any social LCA study, will guide the determination of the spatial and temporal perimeters and the choice of the affected actors that will be taken into account. One often will have to include certain organizations within the perimeter even though they fall outside the field of interest of the study commissioners. The temporal horizons depend above all on the nature of the social effects that the researchers are able to calculate. To clearly identify the most affected actors, the spatial and temporal perimeters must first be defined correctly. The nature of these groups also depends on the nature of the social effects estimated.

A product chain can be described on different scales and to varying degree of detail: like a tree of companies (or more broadly of organizations), or like the arborescence of sectors, or even as an arborescence of sectors from different countries. The description's degree of detail depends on the decision level (a company, a region, a country) the study's results are

intended. In effect, different decision levels consider product chains at different degrees of detail, and are interested in different social impacts (Macombe et al., 2013). In turn, the social effects that one knows how to calculate do not apply to all of the possible degrees of detail. Changes affecting the health of poor populations concern a nation (due to a lack of data and of relations known at smaller scales), while certain effects of work stress concern the workers in a certain group within a factory.

All levels of decision and description appear relevant, from the world to the region and including multinationals, the moment the level of decision corresponds to a real power in the value chain (Dreyer et al, 2006). All of these change processes are capable of leading to interlaced social impacts. Social LCA studies often aim to design or redesign value chains to improve their social effects. This is “socio-design” (see the 2nd use of LCA in the ISP standard discussed in Chapter 2). Due to the interlaced effects of different levels, if the ultimate objective is socio-design, studies should be conducted simultaneously at different levels of responsibility. This is for example what Elghali and his colleagues (2007) illustrate and advise for policies to develop bio-energy systems in the United Kingdom.

We have set down what a social LCA study should be able to achieve (chapter 2). Thanks to Chapter 3, we now know how to construct the “social life cycle”. This helps us order the concrete elements that are important for the study’s implementation. But we have not yet discussed which social effects/impacts are to be assessed. To address this question, we put social LCA back into its social context, which we present as a quest for sustainable development. Chapter 4 reports the progress to date, and proposes a grid for the presentation of effects/impacts based on the Multiple Capital Model (MCM).

References

- Capron M. et Quairel-Lanoizelée F. (2007). *La Responsabilité sociale d'entreprise*, n° 477, coll. « Repères », La Découverte, Paris.
- Dreyer LC., Hauschild MZ., Schierbeck J. (2006). « A framework for social life cycle impact assessment », *The International Journal of Life Cycle Assessment*, 11(2): 88-97, DOI : 10.1065/lca2005.08.223.
- Easterly W. (1999). « Life During Growth », *Journal of Economic Growth*, 4(3): 239-276. DOI : 10.1023/a:1009882702130.
- Elghali L., Clift R., Sinclair P., Panoutsou C., Bauen A. (2007). « Developing a sustainability framework for the assessment of bioenergy systems », *Energy Policy*, 35(.): 6075-6083.
- Jeorgensen A., Finkbeiner M., Jeorgensen M., Hauschild M. (2010). « Defining the baseline in social life cycle assessment », *The International Journal of Life Cycle Assessment*, 15(4): 376-384, DOI : 10.1007/s11367-010-0176-3.
- Lagarde V., Macombe C. (2012). « Designing the social life cycle of products from the systematic competitive model », *The International Journal of Life Cycle Assessment*, 18: 172-184, DOI : 10.1007/s11367-012-0448-1.
- Macombe C., Leskinen P., Feschet P., Antikainen R. (2013). « Social Life Cycle Assessment of biodiesel production at three levels- literature review and development needs », *Journal of Cleaner Production*, 52(1): 205-213, DOI : 10.1016/j.jclepro.2013.03.026.
- Méthot A. (2005). « A green and socially responsible venture capital fund », 26th LCA Swiss Discussion Forum, *Presentation on the Life Cycle Approaches for Green Investment*, June 7th, Lausanne (Suisse).
- Mitchell RK., Agle BR., Wood DJ. (1997). « Toward a theory of stakeholder identification and salience: Defining the Principle of Who or What Really Counts », *Academy of Management Review*, 22(4): 853-886.
- Porter M. (1985). *Competitive Advantage: Creating and Sustaining Superior Performance*, Free Press, New York.
- Pritchett L., Viarengo M. (2010). « Explaining the cross-national time series variation in life expectancy: income, women's education, shifts and what else? », *Human Development Research Paper*, 2010/31, United Nations Development Programme, New York.
- Vanclay F. (2002). « Conceptualising social impacts », *Environmental Impact Assessment Review*, 22: 183-211.
- Weidema B. (2005). « ISO 14044 also applies to Social LCA », *The International Journal of Life Cycle Assessment*, 10(6): 381.



Chapter 4

Pauline Feschet and Michel Garrabé

Social LCA and sustainable development

Numerous life cycle assessment authors consider their research to be part of sustainable development efforts. Authors working to develop social LCA generally consider it to be a *complement* of environmental and economic life cycle assessments, in other words, as a third component in the evaluation of sustainable development. Zamagni (2012) recently referred to “life cycle sustainability” assessment. Sustainable development thus seems to lie at the heart of life cycle thinking. Nonetheless, all authors do not approach the issue in the same way.

Jeorgensen et al. (2010) examines the intergenerational character. Sustainable development relies on stocks of capital which must be maintained or improved from one generation to another. This conception of sustainability involves four forms of capital (natural,

human, social, and produced physical capital). This idea is already present in the work of Schmidt et al. (2004), who propose an instrument to measure and improve the eco-efficiency and the socio-efficiency of a given product. For these two teams of authors, the capacity of future generations to meet their needs and satisfy their well-being depends on the evolution of capital stocks.

Reitingen et al. (2011) are not directly concerned with sustainable development. These authors propose a conceptual framework based on Sen's Capabilities Approach to address the question of what truly counts in human life.

LCA practitioners assess product life cycles according to "Areas of Protection" (AoPs). These are "domains" that must be preserved and which indicate the categories of impacts that hold value for the society. In environmental LCA, there is a consensus regarding the nature of AoPs (human health, natural resources, natural and man made environments). In social LCA, Dreyer et al. (2006) propose introducing another AoP, that of "human dignity and well-being". Weidema (2006) distinguish two AoPs: "human health", which possesses an intrinsic value, and "human productivity" which is instrumental. However, Jeorgensen et al. (2008) emphasize that no theoretical work on an underlying model has been undertaken. This lacuna is the source of much confusion. In the absence of an underlying model, it is impossible to define what is important in the social world or to identify the nature of impacts. Each researcher therefore must choose a list of indicators based on his or her experience, resulting in heterogeneous lists that differ from one approach to another. Lastly, it is not possible to articulate AoPs in order to obtain a dynamic reading of the sustainability status of a life cycle because AoPs are designed as clearly dissociated and independent objects.

There probably are several ways by which social LCA could be endowed with a theoretical framework. The focus is on improving the living conditions and well-being of people. Here, we have chosen an economic theory. We shall investigate the concept of development and the notions of well-being and quality of life (section I). The concept of development has evolved to take into account new ecological challenges. We shall discuss theories of sustainable development because it is this social phenomenon that the theory should explain, as it seems to be at the heart of life cycle thinking (section II). We adopt the conception of well-being developed by Sen, the Capability Approach, which revolutionized the way development is considered (section III). We shall consider development as an articulation of different forms of capital. We shall present the Multiple Capital Model (MCM) (section IV), considered as a potential conceptual framework for social LCA, by articulating the notions of Capabilities and multiple capitals (section V).

I. What is development?

A. Distinction between growth and development

The concept of development has evolved over the last few decades. Today, the idea of development includes well-being and quality of life. *"As it is generally accepted, the term development can be considered as a synonym of 'social (or societal) progress', a term in use since the Enlightenment, in the sense that 'the society of tomorrow can be better than that of today' (Comélieau, 2007).*

With the expansion of the economic system, economic theory associated economic growth with development for many years in an almost mechanical fashion, to the point that the two notions often were confused (Tremblay, 1999 ; Vivien, 2003, 2005).

Rostow (1963) defined the universal development process of nations as being based on growth. In his view, economic development starts from a certain stage in the history of societies. Societies then experience self-maintained growth, called "*sustainable growth*", which becomes the "*normal function of the economy*" (Vivien, 2003). Development signifies the achievement of significant economic growth over a long period of time. It is measured through changes in the Gross Domestic Product (GDP) per inhabitant.

After the Second World War, while the new global economic order was taking shape, numerous countries in Africa and Asia became independent. The Third World emerged. Some authors then would study the specific features of "non-development" (Vivien 2003). The work of pioneers aimed to allow developing countries to achieve Western style modernity (Berr and Harribey, 2006). It then became apparent that growth in production does not necessarily mean improvement in well-being, the emancipation of populations, nor banishing domination phenomena (Harribey, 2004).

In reaction to liberal positions other authors (Vivien, 2003; Berr and Harribey, 2006), would emphasize the distinction between growth and development. "Growth is the sustainable increase of the size of a simple or complex economic unit achieved in changes in structures and eventually of a system and accompanied by variable economic progress. [...] Development is the combination of mental and social changes in a population that renders it apt to increase in a cumulative and sustainable manner its real and total product." (Perroux, 1966, pp.239/240).

Under prompting from humanists, the idea progressively took hold that economic development does not suffice for development. Initially, development was considered to concern only countries of the South. This thinking gradually would evolve (Billaudot, 2004). Third World schemas were called into question by the crisis of the 1980s. The end of thirty years of economic prosperity in the North reduced the gap between the North and South. Industrial societies rediscovered within their own borders under-development; and with this the phenomena of exclusion, marginality, informal relationships and multiple cultural references (Hugon, 2004). Development returned to being a process generally seen as concerning all countries, both in the North and South (Billaudot, 2004).

B. Development as a reflection of well being: definition and measurement

The notion of development is not limited only to the material dimensions of social progress: it also calls into question the value systems, the diverse goals pursued by individuals and the human species, as well as the multiple means to their self-fulfilment (Comélieau, 2007). The notion of a "good life" has interested the greatest philosophers. It is the subject of numerous definitions covering a large range of elements: feelings of belonging and achievement, self-image, autonomy, feelings and attitudes of others, etc. However, none of these propositions are universally agreed upon, and each corresponds to a very precise school of philosophical thought (Stiglitz et al., 2009). The challenge is not so much to precisely define these notions, but rather to know how to measure them in a rigorous manner.

Three main theories of well-being are commonly used in economic analysis. These are: 1) well-being defined as a satisfaction of preferences, 2) well-being as the happiness or satisfaction felt, and lastly 3) well-being such as conceived of in the Capabilities approach developed by Sen.

The first approach, welfarism, constitutes the most widely held position among economists. It consists of identifying the well-being of a person based on a utility function representing the order of his or her preferences. This utility function is expressed through the resources held by the individual, estimated in terms of monetary income, goods, or even the individual consumption of goods and services (Stiglitz et al., 2009). This approach has been criticized widely insofar as assessments based solely on the propensity to pay can reflect in a disproportionate manner the preferences of better off people to the detriment of the least fortunate. The second approach, subjective well-being, considers that individuals are best equipped to judge their own situations and therefore that well-being is the equivalent of the happiness or satisfaction that they feel. This assessment based on the utility experienced remains within the normative framework of welfarism. The third conception of well-being developed by Sen, the Capabilities approach, joins criticism of the moral value of decisions or experienced utility to compare well-being between individuals (Tessier, 2009). Sen proposes the use of concepts of Capabilities and functioning to consider individual well-being (Sen, 1999). We will present this approach in paragraph III.

C. Development during the “Golden Years”: an economic, social, and ecological upheaval

The expression, the “Golden Years” (1945-1973), designates the thirty year period following the end of World War II. The majority of Western industrialized countries underwent strong economic growth based on technological innovations (electronics, computers), the availability of abundant and cheap energy (hydrocarbons) and sustained demographic growth.

The first doubts regarding this perpetual growth began to be expressed in the 1950s. In 1951 and 1954, the International Union for the Conservation of Nature (IUCN) established a catalogue of threats menacing both animal and plant species. In 1952, Alfred Sauvy invented the expression, the “Third World” (Sauvy, 1952). In 1962, René Dumont denounced the pillage of natural resources in Africa for the sole benefit of industries in the developed world, awakening the general public to the reality of areas of poverty, and highlighting the obstacles that kept populations trapped in misery (Dumont, 1962).

Starting from the 1970s, debates on the perennity of growth became louder. The 1973 and 1979 petrol crises and environmental and industrial catastrophes influenced public opinion. They raised awareness that natural resources were diminishing and societies were vulnerable. Authors such as Dumont, Illich, Georgescu-Roegen and Latouche denounced the ecological impasse of our development model. The critical points raised concerned the draining of natural resources (raw materials, fossil energies), the scarcity of fresh water, the destruction of ecosystems (destruction of tropical forests), as well as the reduction in biodiversity and climate change (due to greenhouse gases) and, in general, pollution due to human activities. It is estimated that the global ecological

footprint surpassed the capacity of the Earth to reconstitute itself somewhere in the mid-1970s (WWF, 2010). Since then, this trend has continued to reinforce itself. In 2007, humans used the equivalent of a planet and a half!

The issue of development thus joined that of sustained growth. Indeed, countries of the South did not benefit from the economic growth of the post-war period. The realization of the multiple aspects of this social and ecological crisis crystallized in the concept of “sustainable” development, which emerged as the new ideal to be attained.

II. Sustainable development as the reference model?

The post-World War II period profoundly modified nearly every society in the world with the unprecedented persistence of economic growth. Doubts raised about the perenity of this growth led to the emergence of the idea of “sustainable development”, which became a key policy objective.

A. The emergence of the sustainable development concept

The concept of sustainable development appeared first as an international policy notion. The Meadows report (Meadows et al., 1972) entitled, *The limits to Growth*, was published in 1972. This report warned of the danger of economic and exponential demographic growth with regard to the depletion of non-renewable resources, pollution, and the over-exploitation of natural systems. Despite numerous critiques – in particular from neo-classical economists – this report popularized the idea that existing economic systems could not last.

The first United Nations conference on Humans and the Environment was held in Stockholm in 1972. The focus was on the vulnerability of the planet and the interdependence of ecological, economic, and social phenomena. The aim of the conference was to define the models of collective behaviour that could enable civilizations to continue flourishing. The expression, sustainable development, was cited for the first time in a UNDP report on biodiversity published by the International Union for the Conservation of Nature in collaboration with FAO, UNESCO and WWF (UICN et al., 1980). This document sought to reconcile objectives of human societal development with those of nature conservation. In 1987, the World Commission for Environment and Development, presided over by Gro Harlem Brundtland, institutionalised the term, sustainable development. The definition made then is still commonly accepted today: “development that responds to the needs of current generations without compromising the capacity of future generations to meet their own needs.” (WCED, 1987, p.51).

The term, sustainable development, was enshrined during the 1992 Earth Summit in Rio de Janeiro. However, the initial definition, which focussed on environmental preservation and the prudent consumption of non-renewable natural resources, was modified by the definition of “three pillars” that must be reconciled in a sustainable development perspective: economic progress, social justice, and environmental conservation. The notion of sustainable development has since become omnipresent in political discourse.

B. A concept struggling in its role as catalyser

Despite bubbling scientific discussions, no consensus on the concept has been reached. Instead, the notion is becoming increasingly criticized. It is above all the unclear character of “sustainable development” that is denounced (Ekins, 1992; Comélieau, 1994; Gendron and Révéret, 2000; Vivien, 2005). In particular, the link with development theories that it is supposed to replace is ambiguous. However, above all else, it appears that the ecological imperative is superseding social sustainability.

“With this omission [leaving out social issues], sustainable development no longer makes sense. It is reduced to the natural order, and is concerned, not with development, but conservation or preservation or even with precaution” (Mahieu, 2009). Zuideau (1995) and Figuière (2006) question the growth of inequality in the South and in developed societies. What will be the consequences in terms of the social perenity of systems? For Figuière (2006): “the prevailing consensual or Bruntland version of sustainable development does not allow a renewed discussion of the problem of development in countries of the South. To the contrary, it appears that by pointing to environmental problems facing everyone, this version tends to regulate the problems of well-being faced by many to the back burner” (p. 14).

This opposition between ecological and social issues dims the prospects of improving living conditions for everyone. In the view of those denouncing it, the conceptual blur is the result of semantic confusion between development and growth, the absence of a univocal definition of development, and the amalgam between notions of development and sustainability. However, scientific sustainable development literature continues to advance, as does the list of sustainable development indicators.

C. Sustainable development models

Varied approaches claim to draw from sustainable development. One may use a preliminary classification to place the models into four categories of approaches (Boulanger, 2004): 1) sectoral, 2) resources; 3) well-being, and 4) standards.

The first approach refers to the traditional “three pillars” sustainable development model, which results from the articulation of economic, social, and environmental spheres.

The second is based on the transmission of enough total productive capital stock per head to allow future generations to produce the goods and services needed for their well-being. One finds in this category most of the composite environmental indicators such as the ecological footprint, ESI (Environmental Sustainability Index), EWI (Ecosystem Well-being Index). It is based on a conception of “strong sustainability” (the substitutability of economic and natural capital is very limited). The genuine savings indicator, which seeks to measure the true degree of enrichment of a national economy, also draws from this approach.

The third approach focuses on human beings, their needs and their well-being. It takes over in particular the research initiated by Sen on the capability concept. The concepts of human development and social sustainability stem from this approach. The following indicators also are found: HDI (Human Development Indicator), ISEW (Index of Sustainable Economic Welfare), GPI (Genuine Progress Indicator), MDP (Measure of Domestic Progress), the Sharpe and Osberg indicator of economic and social well-being, and HWI (Human Well-Being Index).

The last approach considers all forms of social action meeting standards and/or procedures to be sustainable development. These standards may involve effectiveness, participation, equity, efficiency, or resilience. Such an approach has the advantage of being adapted to all levels of action and different types of subjects. It also may apply to systems such as companies, production and consumption modes, national economies, etc. However, it is hard to translate such a perspective into measurable and observable indicators. This is undoubtedly why it is rarely used to develop lists of indicators.

This approaches cover development and sustainability issues differently. With the exception of the standards approach, none is complete. The sectors/systems and the resources/capital approaches deal specifically with the issue of sustainability through genuine savings and ecological footprint concepts. The human being approach is clearly focused on the issue of development, expressed by the Capabilities, functioning, and well-being concepts (Boulanger, 2004).

The three pillar concept of sustainable development is the most widespread. However, it has considerable shortcomings and is not considered to be a reference model. A combination of well-being and resources seems to be the best compromise to guide a process aiming to build an information system on sustainable development. In this context, the works of the economist Amartya Sen and the multiple capital approach have particular resonance.

III. The contribution of Amartya Sen

The work of Amartya Sen (1998 Nobel Prize winner in economics) revolutionized the way development is considered. Sen challenged the economic approach to “well-being” based on his reading of the philosophical works of Rawls. He proposed a new vision of well-being founded on Capabilities.

A. Discovery of Capabilities

Based on his reading of Rawls (1971), Sen (Sen, 1977a) challenged the conventional approach to well-being, and more specifically the welfarism approach (Bertin, 2005). His criticism has two parts.

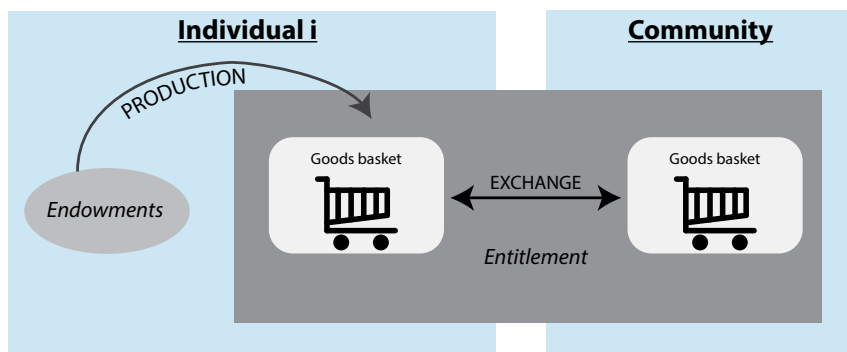
The first concerns the utility hypothesis which considers the same utility function and, consequently, the same ranking of preferences, for all individuals. Sen argues instead for a principle of diversity among human beings and defines a hierarchy of “utilities” obtained by

the use of goods derived from Rawls' analysis. He thus asserts that there are different types of preferences (Sen, 1977b).

His second criticism concerns the measurement of well-being which prioritizes income. Well-being thus is seen as an increasing and continuous satisfaction function measured by consumption. Yet human nature cannot be reduced to the pursuit of material goals and consumption. Other components of well-being are not material.

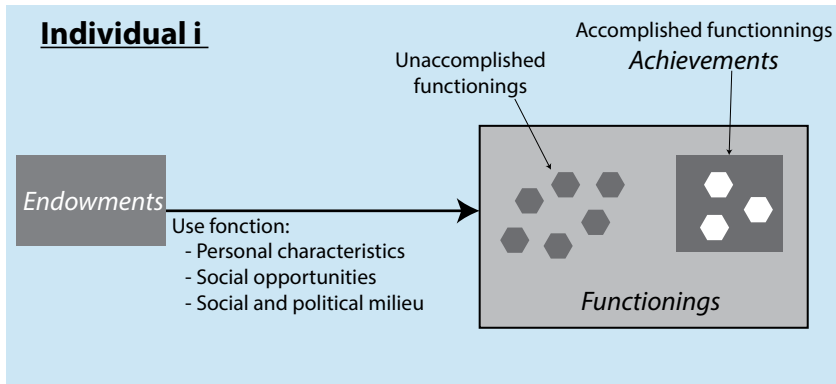
The capability idea is based on the study of famines, poverty, and inequalities. In the case of famine (Sen, 1981), the problem is not so much a lack of food as a lack of access to food. Sen considers that an individual has endowments that s/he can convert, or use to produce, a basket of goods that can be exchanged with others in a community for other baskets of goods. The ensemble of these goods constitutes trading rights (*entitlements*). In the analysis of famine, a person suffers hunger either because s/he does not have the capacity to procure food, or because s/he does not use this capacity. The person's menu of entitlements does not allow him or her to exchange his/her endowments for food (Bertin, 2005). Diagram 8 illustrates these ideas.

Diagram 8. Representation of Sen's *endowments* approach



Sen continued his work on poverty and inequality, which he also does not consider in their economic dimensions, but as the incapacity to procure oneself the means to control one's endowments.

According to this approach, an individual can convert his or her endowments into achievements through a use function that depends on the individual's personal characteristics and those of his or her social, economic, and political environment. These achievements are what the individual is capable of achieving, his or her functionings, which are defined as, "*the different things that a person can aspire to be or do*" (Sen, 1999, p.82). The individual has a set of functionings, named Capabilities, from which s/he will choose. S/he will realise some depending on the value s/he accords them and his or her constraints. Diagram 9 illustrates the relationships between endowments, Capabilities, and achieved and unachieved functionings.

Diagram 9. Representation of Sen's Capabilities approach

The capability of a person is thus defined as a range of actual possibilities held by an individual to do and to be.

Poverty is thus considered here as a privation in terms of:

- 1) *endowments*,
- 2) *entitlements*, and
- 3) freedoms to choose fonctionings (*Capabilities*) (Bertin, 2005) (p.393).

The analysis of poverty, famine, and inequality would lead Sen to consider non-development as a phenomenon of multi-dimensional privation.

B. Development: expression of individual liberties and Capabilities

The Capabilities approach considerably modified the view of development as an analysis of inequalities in living conditions (Liechti, 2007). The conventional approach through resources/endowments was replaced by the approach of converting endowments into achievements. Sen considers development as the extension of the Capabilities of everyone (Bertin, 2005).

More precisely, *"the Capabilities approach thus allows the goals of economic analysis to be broadened by emphasizing, beyond needs expressed in terms of consumption or the accumulation of goods, capacities for action and the freedom of people."* (Rajaona Daka and Dubois, 2008, p.24).

Sen (1993) also shows that equality of Capabilities is a criteria of basic justice (Rajaona Daka and Dubois, 2008). This approach even recasts the conception of sustainable development. In effect, the question is to enable an equitable distribution of Capabilities within each

generation while ensuring that the improvement of Capabilities of one generation does not diminish those of following generations.

The authors therefore proposed development models that integrate the notion of Capabilities and respect inter and intra-generational sustainability criteria.

Collaborative work with Martha Nussbaum (Nussbaum and Sen, 1993; Nussbaum, 2000) would orient the capability concept towards that of freedom. Sen affirms: "Development consists of overcoming all forms of non-freedom restricting people's choices and reducing their capacity to act" (Sen, 1999, p.12). Development consists of a "process of expanding real liberties enjoyed by individuals" (Sen, 1999, p.15) The question thus is no longer one of increasing wealth alone.

IV. A development model: multiple capital

Of existing economic development models, we have chosen to present the Multiple Capital Model (MCM), certain variations of which have integrated the notion of capability.

A. Origins of MCM

This model is rooted in classical economic theory with regard to the economic, social, and environmental conditions of the pursuit of wealth over the long term. Growth models are an expression of this.

The founders of modern political economy, Adam Smith and David Ricardo, view economic growth to be the result of the accumulation of capital, meaning the quantity of instruments ("man-made means of production" according to Smith) available to workers. The increase of per capita wealth is derived from that of per capita capital (Guellec and Ralle, 1996).

In the 1940s, Keynesian economists Harrod and Domar focused attention on the instability of the capitalist dynamic "rooted in difficulties in coordinating savings and investment decisions" (Vivien, 2005, p.33). In the middle of the 1950s, neo-classical economists responded with the Solow model, which recognizes two factors of production, capital and labour. This growth model is, however, inadequate. Countries do not grow as predicted: for example, African countries have not caught up with Western economies, and Argentina and Russia are not following the standard growth trajectory of the Solow model. Above all else, this model does not take into account the finished character of natural resources. The doubts thrown on the model are behind the extension of the concept of capital in economic theory.

Beginning in the middle of the 1980s, numerous empirical studies were conducted. They considered a production function involving physical capital, human capital (assimilated with qualified labour) and unqualified labour. They found that human capital has the same quantitative importance as physical capital in explaining growth! One author (Barro, 1991) demonstrated that another variable (rate of primary and secondary school attendance

in 1960) had a positive influence on growth. With a colleague, he estimated the effect of variables measuring the role of governments (Barro and Lee, 1993). Considerable research was devoted to human capital.

The endogenous growth models produced by this research were meant to better take into account the variety of actual growth trajectories followed by countries compared to the Solow model (Vivien, 2005). The diverse sources of growth evoked are investment in physical, public, and human capital; learning through practice; division of labour; research and technological innovation (Guellec and Ralle, 1996).

Growth appears here as a combination of variations in the quantities of these different kinds of capital.

B. MCM as a response to multiple criticisms

The MCM approach was inspired by the debate that led to the extension of the analysis of factors contributing to growth and development. MCM goes beyond the economic and monetary interpretation of these phenomena. Ekins (1992) was the first to propose a four capital wealth creation model.

In a context where GDP is increasing criticized as an indicator of well-being and development (Gadrey and Jany-Catrice, 2005), certain authors and institutions (World Bank 2006, Aglietta 2011) are adopting the MCM approach to translate the complexity of the wealth of nations. This implies radically changing national accounting systems to encompass all assets contributing to social well-being. Attached to this approach is the concept of *adjusted net savings* or *genuine savings*, which measures the surplus of resources available to an economy at the end of an annual production and consumption cycle following capital depreciation. Adjusted net savings is calculated like gross savings (production less consumption) derived from the national accounts, less the consumption of fixed capital (depreciation of economic capital), plus education expenses (consumption reclassified as investment in human capital) less damage to natural assets (depreciation of natural capital).

The sustainable livelihoods approach adopted by international development organizations and certain large NGOs under programmes to combat rural poverty in the late 1990s also put an emphasis on the resources, strengths and assets available within populations, as well as on Capabilities. These populations could adopt livelihood strategies aiming to increase income, improve well-being, reduce vulnerability, improve food security, or use natural resources in a sustainable manner (Ashley and Carney, 1999).

The MCM approach also is at the heart of research reconsidering the measurement of sustainable development (Ekins and Medhurst, 2006; UNECE et al., 2008). The concepts of stocks and flows are particularly suited to transcribe levels of resource consumption and note when thresholds are exceeded, and thus to translate the sustainable character of systems. Studies of the conditions sustaining well-being and the measurement of quality of life (Smith 2008; Stiglitz et al., 2009) are extensions of this approach.

The MCM approach thus reconsiders development, sustainability, accounting and national wealth.

C. Composition and advantage of MCM

Literature on the subject generally recognizes just four forms of capital in MCM: economic, natural, social and human capital. However, while it remains controversial, the concept of institutional capital is increasingly recognized. We will consider it in this approach.

Economic/technical capital includes all constructed production capacities constituting the structures and infrastructures in which work is organized and where most market and non-market production takes place. Financial stocks and assets also are a part.

Natural capital designates the ensemble of natural resources, renewable or not, with present and future use value, used individually and collectively, as well as existence and heritage value. Preventing it from being wasted, protecting its renewal, or even restoring natural capital contributes to its sustainability, and therefore to the sustainability of economic and social development.

Human capital is made up of an ensemble of human resources, accumulated and structured, including health (physical qualifications), knowledge (cognitive qualifications), skills (applied cognitive qualifications), and certain non-cognitive intellectual and social qualifications such as various personal abilities (interpersonal relations and intellectual innovations).

Social capital refers to connections between individual and collective networks, and the standards of reciprocity and trust characterizing them (Putnam, 2000). However, social capital should not be reduced to the existence of simple networks. It also represents shared standards, values and convictions (Knack, 2001).

In the view of Helliwell (2001), **institutional capital** is composed of public and private economic and political institutions. In our view, institutional capital represents a dynamic network of formal and informal institutions, complimentary in nature and working together, constituting the founding structure organizing relations between individuals and organizations within economic and social production processes (Garra  , 2008). In this sense, we will speak of institutional equipment.

These five forms of capital thus group together the essential resources of the sustainable development process.

One may ask what such an approach can contribute. Indeed, for the moment, we do not have adequate models to explain the articulation between the different forms of capital. Also absent are analyses and measures that could establish what should, depending on the situation, be the relative shares of accumulation of each of these forms of capital. There is even less knowledge available regarding the functional relations linking these different forms of capital. However, MCM has the advantage of placing all contextual estimations in the perspective of estimating positive and negative variations in *flows and stocks*, and not simply flows. These two notions address the issue of development while the issue of sustainability is addressed thanks to the concepts of stocks and thresholds.

MCM does not share the same view as the resources approaches presented in paragraph II.C, which adopt a 'strong sustainability' perspective. Given the unknowns, MCM is not completely formalized. The notions of threshold and respect of sustainability conditions are fundamental. The debate concerning the value accorded to each type of capital and their substitutability remains unresolved.

V. Articulation of capitals and Capabilities

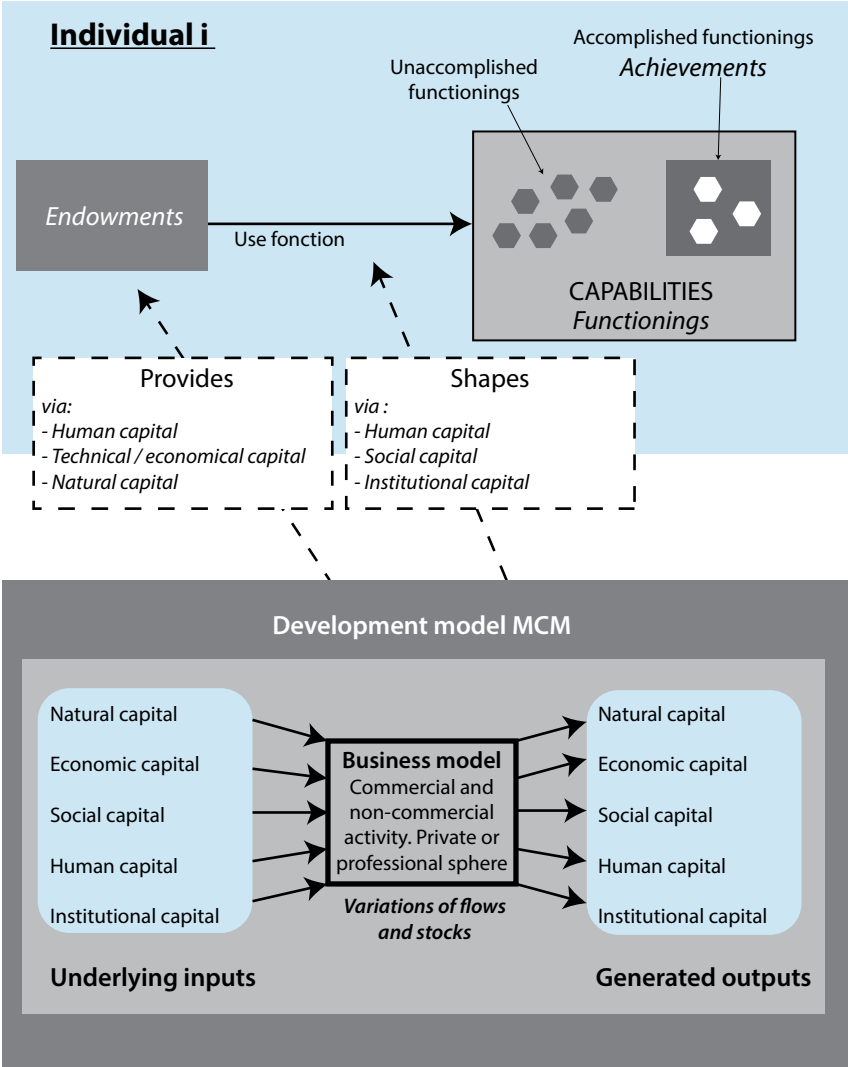
Capital designates the resources that can be mobilized and which are produced during a production activity (economic or social, public or private). The objective is to have endowments allowing the Capabilities of individuals to be increased, and – when this is achieved – to improve people's state of well-being. These resources also shape (through human, social and institutional capital) the use function as defined by Sen, included as a transformation vector (diagram 10). If an individual does not, for example, have sufficient knowledge, s/he will not be able to transform his or her stock of economic endowments (land, seed, etc.) into an agricultural production activity.

The Capabilities concept is closely linked to human capital. The mobilization of this form of capital effectively requires building access capacities, or capabilities. As we have seen, basic capabilities (Sen, 1993) correspond to the fact that a person can accomplish certain basic acts, move, ensure his or her nutritional needs are met, participate in the social life of the community. From this point of view, capabilities constitute a stock of access skills.

The Capabilities approach proposes an assessment framework of *individual situations*. Social systems and social organization are considered through their capacity to promote human capabilities, but they are not considered as such. Yet there are social relationships and institutional structures (e.g. corruption) which are harmful with regard to development and well-being.

In relation to other sustainable development or corporate social responsibility approaches, capability is a liberating concept. In other words, it allows information to be translated in a homogenous manner – whether the information is discontinuous, quantitative, semi-quantitative or qualitative – in terms of increasing or diminishing capabilities. We propose here to retain the essence of this notion but to *extend it to the other components of MCM*. The term capacity thus is preferable to that of capability to avoid confusion and to mark the difference.

Diagram 10. Articulation of the Capabilities approach and MCM



Conclusion

The Multiple Capital Model proposes a theoretical foundation drawn from economics. It homogenizes the nature of the required indicators (here, capacities) to take into account variations of effects and social impacts. However, it still does not allow a list to be established of the impacts that count, nor does it to determine all of the relationships between potential and the achievement of capacities. Further research should enable these difficulties to be overcome. For the time being, the content of data banks allowing a passage from potential to real effects is insufficient for numerous forms of capital. Furthermore, if one wishes to transfer data from a past case to a new case, one risks doing so by betraying the true context of the new case.

Theoretical models other than the MCM also can be used. One could draw them from other social sciences outside economics.

Chapter 5 is an extension of chapter 4, focussing on a specific case. It describes in detail how one may combine a sector analysis with a multiple capital approach (with five classes of capital). The analysis of the social life cycle which results was baptized here capacities social LCA. Chapter 6 also is a continuation of chapter 4 with the implementation of a field survey. It addresses all practical field questions, including the heuristic use of MCM, in the presentation of results to actors.

References

- Aglietta M. (2011). « Croissance durable: mesurons-nous bien le défi ? », *Revue d'économie du développement*, 25(2): 199-250, DOI : 10.3917/edd.252.0199.
- Ashley C., Carney D. (1999). « Sustainable livelihoods: Lessons from early experience », UK Department for International Development (DFID), Londres (UK).
- Barro RJ. (1991). « Economic growth in a cross section of countries », *Quart. J. Econ.*, 106: 407-443.
- Barro RJ., Lee JW. (1993). « Losers and winners in economic growth », *NBER Working Paper* n°4341.
- Berr E., Harribey JM. (2006). « Introduction générale », in Berr E. and Harribey JM. (dir.), *Le développement en question(s)*, Presses universitaires de Bordeaux, Pessac.
- Bertin A. (2005). « Quelle perspective pour l'approche par les capacités? », *Tiers-Monde*, 2(182) : 385-406, DOI : 10.3917/rtm.182.0385.
- Billaudot B. (2004). « Développement et croissance. Les enjeux conceptuels des débats actuels », Premières journées du développement du GRES, *Le concept de développement en débat*, Université Montesquieu-Bordeaux IV, 16-17 Septembre, Bordeaux (France).
- Boulanger PM. (2004). « Les indicateurs de développement durable : un défi scientifique, un enjeu démocratique », Séminaire Développement durable et économie de l'environnement, Institut du développement durable et des relations internationales (IDDRI), Juillet 2004, Paris (France).
- Comélie C. (1994). « Développement du développement durable, ou bocages conceptuels? », *Tiers-Monde*, 35(137): 61-76.
- Comélie C. (2007). « Le concept de développement durable » in *L'Encyclopédie du développement durable (4D-Dossiers et Débats pour le Développement Durable)*, <<http://encyclopedie-dd.org/encyclopedie/developpement-durable/1-1-de-l-eco-developpement-au-le-concept-de-developpement.html>>.
- Dreyer L., Hauschild M., Schierbeck J. (2006). « A Framework for Social Life Cycle Impact Assessment », *The International Journal of Life Cycle Assessment*, 11(2): 88-97, DOI : 10.1065/lca2005.08.223.
- Dumont R. (1962). *L'Afrique noire est mal partie*, Le Seuil, Paris.
- Ekins P. (1992). « A Four-Capital Model of Wealth Creation », in P. Ekins P. and Max-Neff M. (dir.), *Real-Life Economics: Understanding Wealth Creation*, Routledge, Londres, pp.147-155.
- Ekins P., Medhurst J. (2006). « The European Structural Funds and Sustainable Development. A Methodology and Indicator Framework for Evaluation », *Evaluation*, 12(4): 474-495, DOI : 10.1177/1356389006071294.
- Figuère C. (2006). « Sud, développement et développement durable : l'apport de l'économie politique », *Vertigo, la revue électronique en sciences de l'environnement*, 7(2), DOI : 10.4000/vertigo.2287.
- Gadrey J., Jany-Catrice F. (2005). *Les nouveaux indicateurs de richesse*, éditions La Découverte, Paris (France).
- Garrabé M. (2008). « Note sur l'existence du capital institutionnel », Workshop Université de Montpellier 1 - Université de Sherbrooke, 23-24 Juin, 23p, <<http://www.michel.garrabe.com>>
- Gendron C., Revéret JP. (2000). « Le développement durable », *Économies et Sociétés*, Série F, n° 37, pp.111-124.

Guellec D., Ralle P. (1996). *Les nouvelles théories de la croissance*, La découverte, collection « Repères », n°161, Paris (France).

Harribey JM. (2004). « Développement n'est pas nécessairement croissance », première partie in *Le passant Ordinaire*, n°49, juillet-septembre, deuxième partie in *Le Monde diplomatique*, juillet, <<http://harribey.u-bordeaux4.fr/travaux/soutenabilité/developpement-croissance.pdf>>.

Helliwell JF. (2001). *The contribution of human and social capital to sustained economic growth and well-being*, *International Symposium Report*, OECD, Paris.

Hugon P. (2004). « Peut-on parler d'une crise ou d'un renouveau de l'analyse économique du développement ? », Premières journées du développement du GRES, *Le concept de développement en débat*, Université Montesquieu-Bordeaux IV, 16-17 Septembre, Bordeaux (France).

Jeorgensen A., Le Bocq A., Nazarkina L., Hauschild M. (2008). « Methodologies for social life cycle assessment », *The International Journal of Life Cycle Assessment*, 13(2): 96-103, DOI : 10.1065/lca2007.11.367.

Jeorgensen A., Finkbeiner M., Jeorgensen M., Hauschild M. (2010). « Defining the baseline in social life cycle assessment », *The International Journal of Life Cycle Assessment*, 15(4): 376-384, DOI : 10.1007/s11367-010-0176-3.

Knack S. (2001). « Can human and social capital explain differences in productivity, economic growth and well-being between OECD countries? », in Helliwell (Dir) *The contribution of human and social capital to sustained economic growth and well-being: International Symposium Report*, OECD, Chapter 9. Liechti V. (2007). *Du capital humain au droit à l'éducation*, thèse de sciences économiques et sociales, Université de Fribourg (Suisse).

Mahieu JF. (2009). « L'insoutenable sociale du développement durable? », Working paper FREE, n°3, Fonds pour la Recherche en Éthique Économique, Paris.

Meadows D., Meadows D., Randers J., Behrens W. (1972). *The Limits to Growth. A Report for the Club of Rome's*. Universe book, New York.

Nussbaum M., Sen A. (1993). *The Quality of Life*, Clarendon Press, Oxford (UK).

Nussbaum M. (2000). *Women and Human Development. The capabilities approach*, Cambridge University Press, Cambridge (UK).

Perroux F. (1966). « Les blocages de la croissance et du développement. La croissance, le développement, les progrès, le progrès (définitions) », *Tiers-Monde*, 7(26): 239-250, DOI : 10.3406/tiers.1966.2200.

Putnam RD. (2000). *Bowling alone. The collapse and revival of American community*, Simon and Shuster, New York (États-Unis).

Rajaona Daka K., Dubois JL. (2008). « L'intérêt de l'approche par les capacités pour le développement socialement durable », *Qualitative*, n°202, pp.23-26.

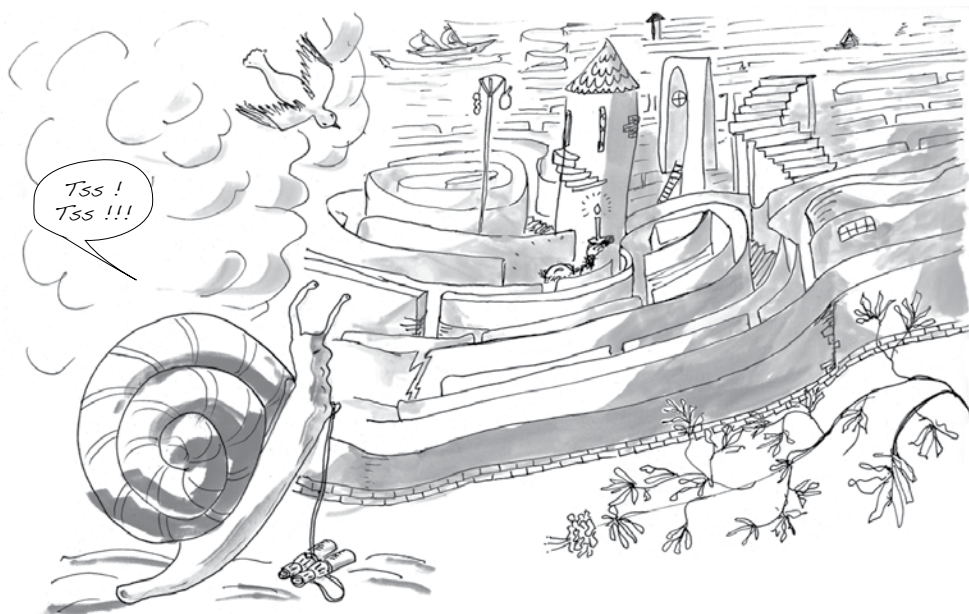
Rawls J. (1971). *A Theory of Justice*, Belknap Press of Harvard University Press, Cambridge (États-Unis).

Reitinger C., Dumke M., Barosevic M., Hillerbrand R. (2011). « A conceptual framework for impact assessment within SLCA », *The International Journal of Life Cycle Assessment*, 16(4): 380-388, DOI : 10.1007/s11367-011-0265-y.

Rostow WW. (1963). *Les étapes de la croissance économique. Un manifeste non communiste*, Édition du Seuil, Paris.

Sauvy A. (1952). « Trois mondes, une planète », *L'Observateur*, 14 août 1952.

- Schmidt I., Meurer M., Saling P., Kicherer A., Reuter W., Gensch CO. (2004). « Managing Sustainability of Products and Processes with the Socio-Eco-Efficiency Analysis by BASF », *GMI*, 45: 79-94.
- Sen A. (1977a). « Social choice theory: A re-examination », *Econometrica*, 45(1): 59-89.
- Sen A. (1977b). « Rational fools: a critique of the behavioral foundations of economic theory », *Philosophy and Public Affairs*, 6(4): 317-344.
- Sen A. (1981). *Poverty and famines: An Essay on Entitlement and Deprivation*, Oxford University Press, Oxford (UK).
- Sen A. (1993). *Ethique et économie. Et autres essais*, PUF, Paris.
- Sen A. (1999). *Development as freedom*, Odile Jacob, Paris (France).
- Smith RB. (2008). « Measuring the sustainability of well-being: a capital approach », 30th General Conference of the International Association for research in income and wealth, August 24-30, Portoroz (Slovenia).
- Stiglitz J., Sen A., Fitoussi JP. (2009). *Rapport de la commission sur la mesure des performances économiques et du progrès social*, Ministère de l'économie, de l'industrie de l'emploi, Paris.
- Tessier P. (2009). « Harsanyi, Sen ou Bentham: Quelle perspective adopter pour l'évaluation du bien-être en santé ? », *Revue Economique*, 60(6): 1309-1333, DOI : 10.3917/reco.606.1309.
- Tremblay S. (1999). *Du concept de développement au concept de l'après-développement : trajectoire et repères théoriques*, collection «Travaux et études en développement régional», Université du Québec, Chicoutimi.
- UICN, WWF, PNUE (1980). *Stratégie mondiale de la conservation : la conservation des ressources vivantes au service du développement durable*.
- UNECE, OECD, Eurostat (2008). *Measuring sustainable development*, Report of the Joint UNECE/OECD/Eurostat Working Group on Statistics for Sustainable Development, United Nations, New York et Geneva.
- Vivien FD. (2003). « Jalons pour une histoire de la notion de développement durable », *Mondes en développement*, 1(121): 1-21, DOI : 10.3917/med.121.0001.
- Vivien FD. (2005). *Le développement soutenable*, La découverte, collection «Repère», n°425, Paris (France).
- WCED (1987). *Our common future*, report of the World Commission on Environment and Development chaired by Bo Harlem Brundtland, Oxford University Press, Oxford (UK).
- Weidema B. (2006). « The Integration of Economic and Social Aspects in Life Cycle Impact Assessment », *The International Journal of Life Cycle Assessment*, special issue, 11(0): 89-96, DOI: 10.1065/lca2006.04.016
- World Bank (2006). *Where is the wealth of nations? Measuring Capital for the 21st Century*, The International Bank for Reconstruction and Development/The World Bank, Washington (USA).
- WWF (2010). *Rapport Planète Vivante 2010 - Biodiversité, biocapacité et développement*, WWF International, Gland (Suisse).
- Zamagni A. (2012) « Life cycle sustainability assessment », *The International Journal of Life Cycle Assessment*, 17(4): 373-376, DOI : 10.1007/s11367-012-0389-8.
- Zuindeau B. (1995). « A propos du développement durable : quelques réflexions », *Société française*, 51(1): 22-34.



Chapter 5

Michel Garrabé and Pauline Feschet

A specific case : Capacities social LCA

In practice, social life cycle assessment (SLCA) is a tool used to compare estimated social (and economic) impacts of production chains. The methodology has not yet been finalized. The UNEP/SETAC Guidelines (2009) rendered it possible to propose a methodological framework by recognizing that numerous issues remained unresolved. Literature on the subject is less than ten years old and is beginning to sketch out the principal approaches.

Two of these appear today to be in opposition. The first, social life cycle attributes assessment (SLCAA), in line with works on corporate social responsibility (CSR), does not allow a real measurement of social impacts because it focuses only on the internal performance of a company, and therefore offers the view of the producer of social actions. The second, "pathways" analysis (cause-effect relationships), seeks statistically significant relations between

factors and impacts. The first is a micro/meso approach and reveals only the vantage point of value chain operators. The second approach is meso/macro but ignores the specific characteristics of local conditions. We propose a third approach, that of capacities SLCA, but with a regard towards its articulation with pathways SLCA.

I. General problem set of capacities SLCA

An SLCA study aims to identify the consequences of the provision of additional production (marginal analysis) in an economic, social, and institutional space of a determined human environment, excluding the natural environment, which is the focus of a conventional environmental LCA (ELCA). The marginal deformation of this socio-economic space is analysed as a modification of its current and future sustainable development conditions, meaning the ensemble of its production and accumulation capacities. The production and accumulation capacities are in turn analysed based on their breakdown in differentiated modes of capital (in our thinking, forms other than natural capital): economic, human, social, and institutional capital.

The problematic of capacities SLCA is to construct indicators allowing the measurement of the impact of companies' actions (for each level in a chain, for each category of actor and for each category of capital) on the transformation of individual endowments into additional functioning capacities. The ranking of intermediary and final indicators, to measure the consequences of the life cycle of a production, is only interesting if it allows different levels of consequences to be identified.

If the variation of current functioning possibilities is retained as an indicator, and if one postulates that the concrete freedom to choose is a fundamental societal principle, then capacity could constitute the category of pertinent indicators to retain. Variation in capacity already is a form of impact because it represents an active variation for an actor, but it is not yet an end point. According to the nature of the actors, these variations in assets will concern the different forms of capital identified. They will constitute as many measures of capacity effects following a productive change.

At the moment (the current state of development of our approach), the estimation of variations of capacity poses the difficulty of not being able to be systematically quantified in all circumstances, which leaves open room for debate. However, capacity analysis has the advantage of homogenizing the nature of the indicators sought, and progress in its estimation techniques may be expected.

II. General principles of capacities SLCA

Some might consider the multiple capital approach (Multiple Capital Model, MCM) inappropriate for use in a Social Life Cycle Assessment (SLCA). The desired objective is to respect the context of the functioning of an activity and the intertwined economic, human, social, and institutional implications of this activity. Standard SLCA cannot ignore the economic dimension, but in its protocol, it is methodologically "postponed". However, the use of

MCM in SLCA is not only possible, but desirable. In so doing, one does not limit oneself to simply respecting the protocol constraints of an SLCA, one can instead contribute a certain number of additional possibilities in the conduct of assessments.

The principle of capacities SLCA is to articulate a sector analysis with a MCM approach by retaining only five of the classes of capital with the exclusion of natural capital, this in order to measure the variations of actors' capacities produced by the social practices of companies. The task is not to measure social, or societal, behavioural performance, but to measure an impact on potential and effective capacities, or even the actual capacities, of actors. These capacities are likely to increase or decrease. They constitute variations affecting the different capital stocks that we have retained in our methodology. As we already have emphasized, the difference between performance and impact is the difference between an internal measurement and a combined internal-external measurement.

For example, offering a training programme to employees is a performance indicator for CSR, while for us, it would only be a condition of a potential capacity effect. First, it is not certain that offering a training programme means that it will be followed. Furthermore, the fact that an employee attends this training does not mean that s/he will effectively increase his or her knowledge (problem of effectiveness of education: E.Duflo (2010). If that was the case, the increase of his or her knowledge would cause only the appearance of a Potential Capacity Effect. There is no assurance that an effective increase in capacity is involved, as this would result from the transformation by the actor of knowledge into an acquired skill.

In this example, the first advantage of capacities LCA seems to be that it allows a distinction and estimation to be made of different situations, which are: the training proposed, the training attended, the enabling training, and the importance of the capacity acquired. The second advantage is to study and estimate variations of potential effects of capacity for all capital types and not only for human capital.

III. Overall schedule of capacities SLCA

Below, we identify the different stages involved, the details of which will be provided later.

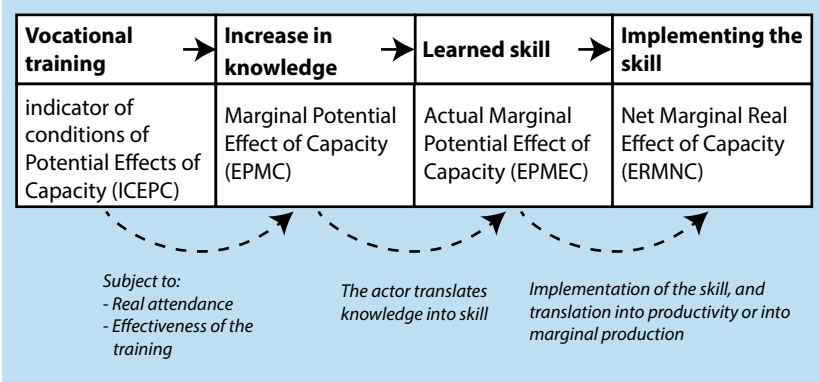
- 1) Identification of classes and sub-classes of capital (SCC).
- 2) Identification of classes of potential capacities effects (PCE).
- 3) Identification of indicators of conditions of potential capacities effects (ICPCE).
- 4) Identification and collection of internal information.
- 5) Identification and collection of external information.
- 6) Diagnostic of variations of potential capacities effects.
- 7) Estimation of variations of potential effective capacities effects (effective marginal potential capacities effects).
- 8) Passage from potential capacities effects to real effects.

Care should be taken to distinguish in the approach what we call a potential marginal capacity effect and a real effect. For example, in the case of an action concerning a human asset:

- a training proposed by a company in the framework of the production studied would, in our terminology, be an indicator of conditions of potential capacity effects (ICPCE),
- the acquisition of knowledge (if this happens), becomes a potential marginal capacity effect (PMCE),
- when this knowledge becomes a proven skill, then we speak of an effective marginal potential capacity effect (EMPCE),
- lastly, the use of this skill and its translation into productivity or marginal productivity will turn it into a real marginal net capacity effect (RMNCE).

From this point of view, real marginal net capacity effect is a well-being effect.

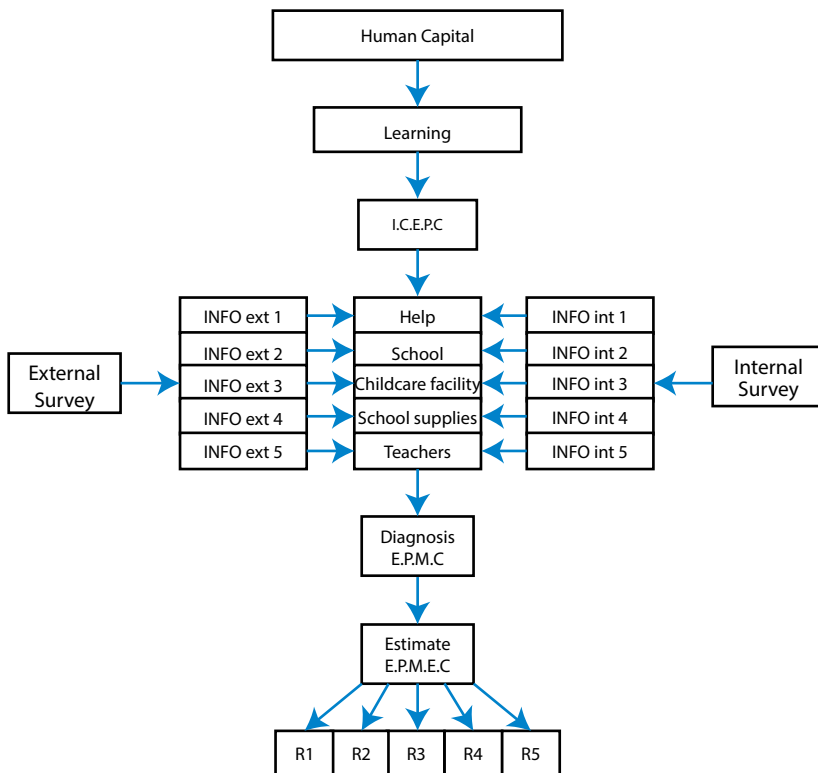
Diagram 11. Articulation of different levels of assessment



The real capacities effect derived from a training attended by an employee is measured by the employee's increased productivity or increased capacity to adapt etc... However, ad hoc studies are needed to establish a link between increased knowledge and increased productivity and/or versatility. These studies are known as pathways (J.Parent). An effective marginal potential capacities effect is not automatically translated by a real productivity effect. For this to be possible, certain technical conditions must be fulfilled, such as the availability of material or the adjustment of the employee's position. We could consider other examples with other forms of capital. The articulation between the capacities approach and the pathways approach is discussed later.

We can provide a graph of the method, the following figure represents sheet 1.1 (see below Table n°2). There are approximately (depending on the context) one hundred sheets like this, one for each level of the value chain under study).

As we will explain, the questionnaires used in the internal and external surveys share the same basis when the external survey relies on an interview, but other sources of external information are possible (see diagram 13).

Diagram 12. Illustration of the sheet 1.1

IV. Identification of classes and sub-classes of capital

The identification of different classes of capital results from our choice to use five classes of capital: human, technical, financial, social, and institutional. Natural capital pertains to ELCA and will not be examined in SLCA. The choice of sub-classes is dictated by the essential components that we esteem should be present in a SLCA study and which regroup under human and social (in part) capital the concerns (requirements) of organizations such as GRI (global reporting initiative), the ISP 8000 and 26000 standards, the Global Compact, OECD, the green book (COM 2001) etc.

For the other sub-classes of capital, their number and components respond to the need to identify the important levels for which variations in assets have the greatest consequences on development and growth and therefore, all else being equal, on variations of capacity and thus well-being.

We shall retain here a generic class of sub-classes, which can be considered as a basic grid with which to work. The sub-classes of institutional capital correspond to the distinctions proposed by D.Rodrik (2000).

Table 5. Sub-classes of capital

Capital categories	Capital sub-categories	
Human capital	1	Education
	2	Working conditions
	3	Health
	4	Security
	5	Parity
Technical capital	6	Company
	7	Infrastructures
	8	Information
	9	Market
	10	Administration
Financial capital	11	Subsidies
	12	Equities
	13	Saving
	14	Public funds
	15	Credits
Social capital	16	Justice/ fairness
	17	Participation
	18	Trust
	19	Integration & culture
	20	Social networks
Institutionnal capital	21	Rules of protection
	22	Rules of monitoring
	23	Rules of regulation
	24	Rules of coverage
	25	Rules of arbitration

V. Identification of classes of potential capacities effects (CPCE)

In each stage, it is necessary to identify the main categories of effects that each sub-class of capital is likely to generate. Again, the context should guide the identification of relevant indicators. For the sub-classes of human capital selected, we propose below categories of effects generally expected of an action relating to this type of capital.²⁰ It is a set of generic categories that can be discussed and validated by a control group of actors and organizations. These categories can also evolve over time to take into account societal priorities. One must be aware that the decision to retain numerous classes of potential capacities effects (CPCE) multiplies the internal and external information that must be sought.

One may define a “potential capacity effect as a variation of an asset resulting from an action having an impact on the choices of an actor”. To illustrate this, the following table presents a certain number of CPCE related to sub-classes of human capital. Here again, the CPCE must consider the sectoral and geographic context, but the comparability constraint of results postulates that once chosen, these classes must be identical for the value chains and levels of value chains studied.

Table 6. Classes of potential capacities effects (CPCE)

	HUMAN Capital sub-category	Categories of Potential Effects of Capacity (C.P.E.C)	
1	Education	1.1	To receive training (M-W)
		1.2	To receive an internal qualifying training (M-W)
		1.3	To receive a qualifying and graduate training (M-W)
2	Working conditions	2.1	To have a normal working time (days, weeks...) (M-W)
		2.2	Have breaks in their work (M-W)
		2.3	Do not suffer at work (M-W)
		2.4	Do not bear risks at work (M-W)
		2.5	To have an employment contract (M-W)
		2.6	Do not work before the legal age (M-W)
		2.7	To receive a regular salary (local & industry standards) (M-W)
		2.8	Do not be forced into illegal labor practices (M-W)
		2.9	To be respected in the workplace (M-W)

20. For all classes of capital, refer to the studies listed in the bibliography.

	HUMAN Capital sub-category	Categories of Potential Effects of Capacity (C.P.E.C)	
3	Health	3.1	Do not have a reduced life expectancy (M-W)
		3.2	Do not suffer from occupational diseases (M-W)
		3.3	To be subject to preventive measures (M-W)
		3.4	To have care if necessary (M-W)
		3.5	To eat in suitable conditions (M-W)
4	Security	4.1	To have insurance at work (M-W)
		4.2	To have housing for migrant workers
		4.3	To be lawfully in the territory
		4.4	To have the protection of every citizen
5	Parity	5.1	Not be discriminated against as a woman
		5.2	Not be discriminated against as an older worker
		5.3	Not be discriminated against as a foreign
		5.4	Not be discriminated against for political reasons
		5.5	Not be discriminated for religious reasons

VI. Identification and collection of internal information

To each class of potential capabilities effects (1.1 ; 1.2), it is generally possible to attach several Indicators of Conditions of Potential Capacities Effects (ICPCE) which allow the forms of action chosen by the company to be identified. These ICPCE correspond to performance indicators in attributes SLCA; they are identifiable actions that can generate or not variations of capacities depending on the situation.

The identification of these ICPCE results in the breakdown of indicators into sub-classes of capital. We have retained the principle of five indicators per level. The question of their number is open to discussion, but this number should be the same for all sub-classes (1.1; 1.2....) so that the results are sufficiently homogeneous to be synthesized. The collection of information concerning the ICPCE results from an internal survey carried out in each of the companies selected as actors in the value chain. There can be many classes of indicators, at times one hundred or more, for the five categories of capital retained. Several indicators are identified for each class. We provide a reference list (see annex 1), but this naturally must be adapted to the local context to take into account the specific structural and functional characteristics of companies.

As an example, the following table proposes ICPCEs for sub-classes of human capital. We selected five different possible types of information to be collected for each class of indicator in this reference table. Internal information is collected from resource actors in each company. It is stored in a spreadsheet that can be recuperated by software under development.

Table 7. Example of an internal survey on ICPCE

Indicators of Conditions of Potential Effects of Capacity (ICPEC)			I1	I2	I3	I4	I5
1	1.1	Aids, schools, nursery, equipment, teacher, etc.	No aids	No school	-	-	-
	1.2	Type, nature, duration, internal skills training	Low training	Teacher	5 hours	Non-qualifying	-
	1.3	Type, nature, duration, qualifying and graduate training	No	-	-	-	-
2	2.1	Working hours per day, per week (standards, ratios)	9 hours / day	6 days / week	> indus. average	-	-
	2.2	Type, nature, duration of breaks	Lunch	1h	No break	-	-
	2.3	Position, temperature, speed, repetition, etc.	Crooked	35°C on average	Yes	Yes	-
	2.4	Number, nature, severity of accidents	5 by season	Knock	Wound	-	-
	2.5	Type, nature (written, oral), legality of terms	Written	Brief	No guarantee	-	-
	2.6	Number of children, age, type of work, remuneration	No	-	-	-	-
	2.7	Salary men-women, average salary: sector, local (ratios)	M: 500/ week	W: 300/ week	< industry	<local	-
	2.8	Type, frequency, risk	No	-	-	-	-
	2.9	Type, disrespect, frequency, consequences	Yes	Shout	Insults	Frequent	-

Indicators of Conditions of Potential Effects of Capacity (ICPEC)			I1	I2	I3	I4	I5
3	3.1	Duration, activity effect on life expectancy	Yes	No effect			-
	3.2	Type, duration, incapacitating nature, compensation	Yes	Potential allergies	Invalidating	Without compensation	-
	3.3	Nature, frequency, effects	No	-	-	-	-
	3.4	Health center, equipment, staff	No	-	-	-	-
	3.5	Canteens, pause for meals, financial assistance for meals	No canteen	1h	No	-	-
4	4.1	Type, coverage/ reserve ratio , duration, compensation	No	0	-	-	-
	4.2	Type, size, conveniences, price	No	-	-	-	-
	4.3	Identity verification, legality/regularity of the personal situation	Yes	No	-	-	-
	4.4	Police protection, safe travel	Yes	Yes	-	-	-
5	5.1	Parity 1: recruitment, salary, working hours, promotion, hardness	No	<M	= M	<M	<M
	5.2	Parity 2: recruitment, salary, working hours, promotion, hardness	No	-	-	-	-
	5.3	Parity 3: recruitment, salary, working hours, promotion, hardness	Yes	-	-	-	-
	5.4	Parity 4: recruitment, salary, working hours, promotion, hardness	No	Syndicated	-	-	-
	5.5	Parity 5: recruitment, salary, working hours, promotion, hardness	Yes	-	-	-	-

Source: Étude Tomate Turquie, rapport ANR Flonudep, 2012

Legend:

< : less than

> : more than

When it is the case (frequently) that a company in the value chain manufactures multiple products, the ICPCs are assumed, except for special cases, to constitute the actions incarnating company policy. When certain actions concern only certain products, then it is appropriate to retain the appropriate actions. By emphasizing the contextualization of ICPCs, the method takes into account this requirement.

VII. Identification and collection of external information

The context is the subject of investigation of the external survey. The objective of this survey is to cross-check the internal information collected, the quality of which is not sufficient to adjudicate on an effective potential variation of capacity in actors. The insufficient quality of internal information most frequently arises because the person interviewed ignores the variation of impact for the actor concerned.

What explains the potential variation of capacity is the interaction of the “social” action of the company and a context. But the question then is: what is a context? A context is a situation characterized by its own form of accumulation of different types of capital at a given moment (t) and in a given place (y).

The information collected through a survey in a company renders it possible to identify the actions undertaken but not their impact. Identifying how these actions are concretely translated into impacts involves multiple detailed surveys of the different actors who are the subjects of the impacts. Faced with the difficulty of undertaking all of these surveys, one chooses to rely on:

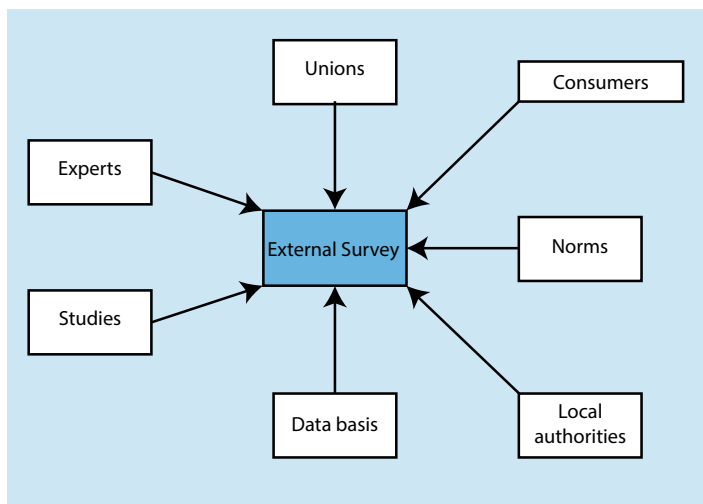
- ad hoc complementary surveys,
- available outside studies (local or transferable data),
- and interviews with experts. Recourse to experts can be necessary at both the level of information collection and that of interpreting consequences.

The main question raised at this point in the protocol is the identification of external information sources. One may identify a certain number of them. Diagram 13 proposes to distinguish seven among the most important.

One of the important questions in collecting external information is the status of the standards to which one can refer. There are sectoral and local standards that are the result of observed practices, and standards produced by legislation or authorized bodies (ILO, WHO, etc.). UNEP (2009) refer to “Performance Reference Points”, which are a kind of benchmark allowing the detection of threats to well-being and equity. In our view, the standard should be understood as being information about a sensitive capacity threshold which must be considered, but which must also be associated with other contextual information. The standard cannot itself represent a kind of “justice of the peace of impacts”. First, because the only possible value it may have is contextual (it can even not be enabling, this may be the case for child labour when the banning the practice, without considering the context, deprives children the chance to learn and additional family income). Furthermore, because

what is “normal” may very well have nothing to do with well-being: consider, for example, corruption...

Diagram 13. Main sources of external information



The external information can be heterogeneous both in terms of quality and nature. The goal is to collect external information to compare with internal information. In the preceding example of child labour, only external information could clarify the social and economic context of the situation and avoid caricaturing a fact. The heterogeneity of quality of this external information raises the issue of its validation. One difficulty that one may encounter in collecting and validating this external information is the emergence of contradictions between sources. Still using the preceding example of child labour, contradictions may emerge from interrogating the Standards, Labour Unions, and Studies sources, for example. In the current state of the methodology, appreciation of the estimation will result from the analysis of the convergence (or divergence) of sources.

VIII. The diagnosis of Marginal Potential Capacity

What we are seeking is the estimation (assessment) of the existence of an *effective potential capacity effect*. The internal and external information allows us to envision carrying out a diagnosis of the effective potential capacity effect, meaning to identify an increase or decrease of potential capacity effect (PCE) by level of indicator. The neutrality of the dia-

gnosis, which is critical in the analysis, is contingent on the quality of information being cross-checked.

This diagnosis allows the identification of the transformation of a flow of services into a stock of assets. Thus the provision of a training (internal information), followed, adapted, effective, verified (external information 1) is translated by the emergence of a *savoir-faire*, a new skill (external information 2) constituting a new genuine potential value of the human capital asset of the actor trained.

The following stages are part of the capacities diagnosis process.

- 1) Set out external information next to that obtained from the company.
- 2) Validate this information.
- 3) Cross-check the internal information (company survey) against the external information.
- 4) Explore the possible consequences of this cross-checking.
- 5) Select the most likely consequences.
- 6) Interpret the important effects identified in terms of variations in capacity.

When one or more standards exist (working hours, minimum working age, minimum wage, etc.) the passage from ICPC to EMPCE may be facilitated. However, as we have noted, it would be appropriate to question the enabling power of the standard. Simply meeting a standard does not automatically signify an enabling effect. This is an important difference between capacities SLCA and performance SLCA.

For example, child labour is governed by an ILO standard (Conventions n°138 and 182: www.ilo.org) which stipulate that all labour, even light work, is forbidden for those under 12 years old. "This core convention sets the minimum working age at 15 years (13 for light work) and the minimum age for dangerous work at 18 years (16 in certain strictly defined conditions). It foresees the possibility to first set the minimum age at 14 years (12 for light work) when a country's economy and schools are not sufficiently developed". Regarding light work, it is specified: "... provided this does not threaten health or safety, school attendance, or the children's participation in orientation or professional training programmes."

The key lies in the conditions under which work is carried out, and this consequently requires information that goes beyond simply respecting the authorized age, and which only an external survey is capable of providing. It should be noted that the authors of the standard were themselves aware of the fundamental importance of context because they include not one but six ages 18,16,15,14,13,12) in their definition.

The diagnosis is an intermediary stage allowing the potential capacity effect to be described as real or effective (see diagram 12).

Table 8. Examples of diagnosis

N°	Increases of Potential Effects of Capacity	Decrease of Potential Effects of Capacity
1.1		No means, relative lack of skills
1.2	Low training, targeted effects , low capacitating	
1.3	No participation to a qualifying training (0)	No participation to a qualifying training (0)
2.1		Duration higher than industry average, in hours and days
2.2		Lunch break < standard, break time < standard
2.3		Four negative conditions met
2.4		Accidents>standard, seriousness > standard
2.5	Even brief a contract is "capacitating"	
2.6	No children employed (0)	No children employed (0)
2.7		Inequality M/W, lower than 2 references
2.8	No demand for illegal practices	
2.9		Four criteria checked: very incapacitating
3.1	no effect (0)	no effect (0)
3.2		Non-invalidating allergic risk but without recourse
3.3		No health surveillance = potential risk

N°	Increases of Potential Effects of Capacity	Decrease of Potential Effects of Capacity
3.4		Not legal, potentially serious risk
3.5		Equal, little incapacitating
4.1		Illegal, serious
4.2		Medium incapacitating
4.3		Contradiction: contract & illegality
4.4	Area security : low control	
5.1		M/W inequality problem
5.2		Discrimination in hiring but not for wage and working conditions
5.3	No discrimination (0)	No discrimination (0)
5.4		No union members
5.5	No discrimination (0)	No discrimination (0)

Source: Étude filière tomate Turquie, Rapport ANR, Flonudep, 2012

IX. Estimation of effective variations in potential capacity

A. Ranking method

A working hypothesis in the methodology in its present state is the introduction of three levels to characterize an increase of PCE, and three levels for a reduction of PCE. One also must add the possibility of a level 0. The number of indicators for each class of ICPCPE retained must be identical (we retained five in our example in Table 3, but we only retained three levels of estimation because certain indicators cannot always be calculated). It thus is appropriate to assess their relative importance before estimating the variation of marginal potential effective capacity. The intensity of PCE is qualified by (A1, A2, A3,) for the increase and (D1, D2, D3,) for the decrease.

The value 0 signifies the neutrality of the effect of the action on the effective variation of potential capacity of an actor. The value of the intensity retained will depend on the degree of potential capacity identified through cross-checking internal and external information as an impact of the action. For each class of indicator, it is possible, and even probable, that one observes estimates of both enabling effects and disabling effects. The total of observations in one direction or another could serve to characterize the direction of the resulting capacity effect.

For example, if one considers the class (2.2) in table 8, we observed a lunch break in the internal survey but no “coffee” breaks. If one or several external pieces of information allows us to consider the absence of coffee breaks as incapacitating (diagnosis stage), then the analyst will have to determine the relative weight of each contradictory piece of information to propose a synthesis value for the estimation of variation of capacity.

Table 9. Example of Variations in Effective Potential Capacity Effect

N°	Increases in Effective Potential Effects of Capacity (I)	Decrease in Effective Potential Effects of Capacity (D)	Effect	A	D
1.1		No participation to a general training : low « incapacitating »	<		D1
1.2	Low training, targeted effects , low capacitating		>	A1	
1.3	No participation to a qualifying training	No participation to a qualifying training	0		
2.1		Duration higher than industry average, in hours and days	<		D2
2.2		Lunch break < standard, break time < standard	<		D1
2.3		Four negative conditions met	<		D3
2.4		Accidents>standard, seriousness > standard	<		D2
2.5	Even brief a contract is “capacitating”		<	A2	
2.6	No children employed (0)	No children employed (0)	0		
2.7		Inequality M/W, lower than 2 references	<		D3

N°	Increases in Effective Potential Effects of Capacity (I)	Decrease in Effective Potential Effects of Capacity (D)	Effect	A	D
2.8	No demand for illegal practices: strongly "capacitating" in the given context		>	A3	
2.9		Four criteria checked: very incapacitating	<		D3
3.1	No effect (0)	No effect (0)	0		
3.2		Non-invalidating allergic risk but without recourse	<		D2
3.3		No health surveillance = potential risk	<		D1
3.4		Not legal, potentially serious risk	<		D3
3.5		Equal, little incapacitating	<		D1
4.1		Illegal, serious	<		D3
4.2		Medium incapacitating	<		D2
4.3		Contradiction: contract & illegality	<		D1
4.4	Area security : low control		>	A1	
5.1		M/W inequality problem	<		D3
5.2		Discrimination in hiring but not for wage and working conditions	<		D2
5.3	No discrimination	No discrimination = "capacitating" for the context	>	A2	
5.4		Unions refused	<		D3
5.5	No discrimination	No discrimination = "capacitating" for the context	>	A2	

Legend

< : Less than

> : More than

In practice, this method is very demanding and sometimes risky with regard to the neutrality of estimates. It is in principle possible to maintain the scale of ordinal classification proposed but it requires heavy processing of information to limit subjective interpretation. We have tested another practice for this point which figures in Table N°6 in the following paragraph.

B. Scoring

a. First question: is scoring necessary?

It corresponds to the need to rank the importance of impacts in the production of potential capacities effects. This being the case, thought should be given to synthetic but relevant indicators of results to communicate the latter.

Furthermore, information also should be provided on the corresponding effects on the whole of the value chain, and on this basis, aggregations are necessary.

b. Second question: how may one score ?

- 1) One could proceed by adding the levels estimated previously. In our case, we get A=11 and D=35. Aggregating the levels of variation of capacity has little meaning for the transformation of the level of the estimated asset because its different components can be assigned differently for an equivalent score
- 2) One may proceed by aggregating levels by class, which is more satisfying but which leads to the production of massive amounts of information. In our case 2A1,3A2 and 1A3 on one hand and 5D1,7D2, and 6D3 on the other.
- 3) The preceding classification is very burdensome because it includes many classes. A simple classification, for example, in five classes, could take its place.

The following example proposes an “estimation-scoring” of variation of potential capacities for a producer X.

Table 10. Example scoring

Number of +	31	62%
Number of ++	5	10%
Number of -	5	10%
Number of --	2	4%
Number of 0	7	14%

Source: Scoring EPEC – Capital Humain – ASCV des capacités Tomates industrielles en France, Rapport N°4, ANR-Flonudep. Garrabé M., Pedemay A. , 2012

The result is the following: 72% of the actions identified as related to the company's policy lead to a positive variation in human capital involving an effective increase in potential capacity.

4) It also is possible to propose results by sub-classes of capital. Thus in our example (Table 9):

- Education = 0, 1A1, 1D1
- Work conditions = 0, 1A2, 1A3, 1D1, 3D2, 3D3
- Health = 0, 1D1, 1D3
- Safety = 1A1, 1D1, 1D2, 1D3
- Parity = 2A2, 2D2, 1D3

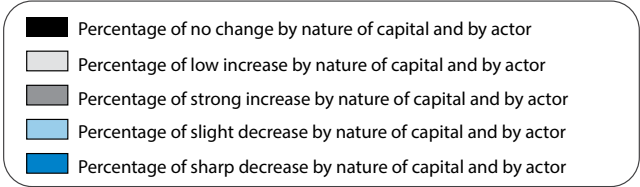
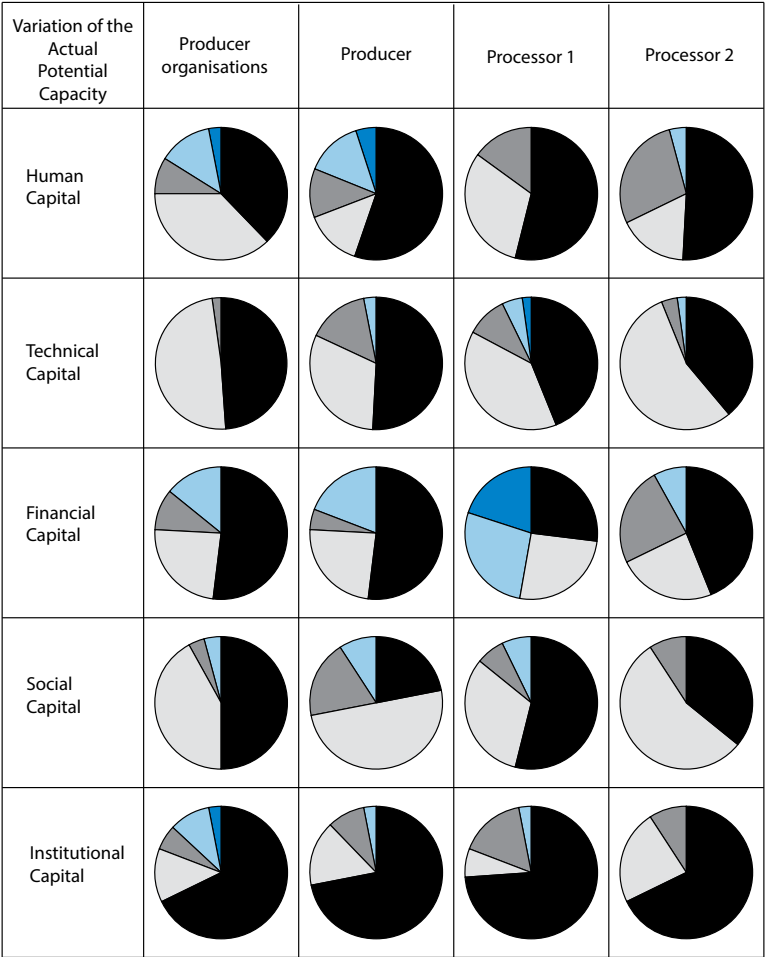
One must not forget that the protocol presented here is described using the example of human capital, but it applies to all forms of capital and to all companies identified as relevant in the value chain. This reinforces the search for information.

X. Agregation of PCE for the value chain and system indicators

One of the primary advantages of the method is that it allows one to move beyond a conventional SLCA approach, which focuses only on human aspects (often only partly social) to estimate the impact of a meso-economic production process on human, technical, financial, social, and institutional characteristics.

A. An overall view of results using a matrix approach

Diagram 14. Variations of Effective Potential Capacity (VEPC) in Capital



Source: ASCV des capacités Tomates industrielles en France Rapport N°4 Flonudep. M.Garrabé, A.Pedemay (2012)

B. A view of VEPC according to the Régnier abacus principle

The following table aggregates the effective variations of potential capacities identified by adding the different levels per actor and per sub-class, without compensating for positive and negative variations.

This provides the following presentation, for a study of the Turkish-French export tomato sector.

In table 11 we use the following terms for the sub-classes of capital.

Human Capital	Technical Capital	Financial Capital	Social Capital	Institutional Capital
E: Education	Com: Companies	Sbd: Subsidies	Jus: Justice / equity	PR: Protection rules
WC: Working conditions	I: Infrastructure	SE: Shareholders' equity	Par: Participation	MR: Monitoring rules
H: Health	Info: Information	Sav: Saving	Con: Confidence	RR: Regulatory rules
Sec: Security	M: Markets	WA: Wages	IC: Integration / culture	CR: Coverage rules
P: Parity	BA: Business administration	PR: Public resources	SN: Social networks	AR: Arbitration rules
		C: Crédit		

In the far left column P corresponds to producers, T to transformers and L to transport. The advantage of this representation is the visualization of results in the presence of a large amount of information that has furthermore already been regrouped.

Table 11. Variations of Effective Potential Capacity (VEPC) in Capital.

TURKEY

Human Capital					Technical Capital					Financial Capital					Social Capital					Institutional Capital					
E	WC	H	Sec	P	Com	I	Info	M	BA	Sbd	SE	Sav	WA	PR	C	Jus	Par	Con	IC	SN	PR	MR	RR	CR	AR
P1	2+	4+	2+	0	0	4+	2+	0	0	0	6+	2+	0	0	1+	0	1+	0	2+	2+	0	1+	0	2+	0
P2	2+	4+	4+	2+	0	4+	4+	0	0	0	6+	0	0	0	1+	0	1+	0	2+	2+	2+	0	0	2+	0
P3	2+	4+	2+	0	0	0	2+	0	0	0	6+	0	0	0	1+	0	0	0	0	2+	2+	2+	0	0	0
P4	0	4+	2+	0	0	0	2+	0	0	0	6+	0	0	0	1+	0	1+	0	2+	0	2+	1+	0	2+	0
P5	0	4+	2+	0	0	2+	2+	0	0	0	6+	2+	0	0	1+	0	0	0	2+	2+	0	1+	0	2+	0
P6	0	4+	2+	0	0	2+	2+	0	0	0	6+	2+	0	0	1+	0	1+	0	0	2+	2+	1+	0	2+	0
P7	0	4+	2+	0	0	2+	2+	0	0	0	6+	2+	0	0	1+	0	1+	0	2+	2+	2+	1+	0	0	0
P8	0	4+	2+	2+	0	6+	2+	0	0	0	6+	0	0	0	1+	0	0	0	2+	2+	2+	1+	0	2+	0
P9	0	4+	2+	2+	0	6+	2+	2+	0	0	6+	0	0	0	1+	0	1+	0	2+	2+	2+	1+	0	2+	0
P10	0	4+	2+	0	0	2+	2+	0	0	0	6+	0	0	0	1+	0	1+	0	2+	2+	0	1+	0	0	0
T1	5+	9+	7+	3+	5+	10+	5+	6+	6+	3+	3+	6+	4+	2+	2+	0	7+	7+	5+	4+	6+	9+	6+	4+	3+
T2	3+	8+	3+	5+	3+	4+	5+	7+	4+	5+	2+	3+	3+	1+	2+	3+	2+	2+	2+	1-	2-	6+	4+	2+	3+
T3	4+	12+	6+	3+	3+	7+	5+	1+	6+	2+	6+	2+	3+	2+	4+	5+	6+	4+	3+	4+	6+	4+	3+	2+	3+
T4	1+	4+	5+	2-	4+	5+	3+	9+	4+	1+	3+	6+	6+	1+	2+	4+	4+	1+	2-	4+	2+	4+	3+	1+	2+
T5	3+	2-	5+	4+	3+	6+	4+	6+	1+	5+	2+	3+	4+	2+	1+	2+	0	6+	3+	2-	4+	1+	4+	3+	1+
L1	5+	10+	7+	5+	7+	10+	8+	8+	7+	2+	3+	6+	2+	2+	3+	7+	6+	5+	4+	5+	7+	4+	2+	2+	4+
L2	5+	10+	7+	3+	7+	10+	8+	4+	0	2+	4+	6+	6+	0	2+	0	7+	3+	4+	1+	3+	5+	4+	2+	4+
L3	0	7+	3+	2+	3+	4+	2+	3+	2+	2+	2+	4+	6+	0	2+	0	5+	2+	4+	1+	3+	2+	0	2+	3+

C. Comparative results of value chains

Two studies allowed us to apply the capacities MCM-SLCA approach to the industrial tomato sector in France and Turkey.

We had more surveys on this sector in Turkey than in France. For Turkey, we therefore chose the four actors or groups of actors that were the most representative to have an ensemble of information that could be compared with the French sector.

For it to be possible to compare results obtained for different value chains, it thus is important that items be harmonized, and that the number of observations be the same. This question may run up against the requirement of contextualization that we identified previously.

In assembling the following tables, we aggregated on one hand positive variations, on the other negative, first by level (+ and ++), then between levels (1+ and 2+=3+). Other procedures are possible.

There is no, however, compensation between positive and negative levels because they are neither in the same direction nor is there the same value at the equivalent level (the Kahneman and Tversky (1979) principle of irreversibility of the utility function, see below).

Lastly, we propose an aggregation of results by taking into account this same principle, but this is only a suggestion. The aggregation of results is only illustrative because nothing indicates that the values of expansion levels and those of diminution levels are equivalent as assumed in the proposition of Kahneman and Tversky. The question of the value of levels is for the time being unresolved.

TURKEY

	Human Capital					Technical Capital					Financial Capital					Social Capital				Institutional Capital								
	E	WC	H	Sec	P	Com	I	Info	M	BA	Sbd	SE	Sav	WA	PR	C	Jus	Par	Con	IC	SN	PR	MR	RR	CR	AR		
P1	2+	4+	2+	0	0	4+	2+	0	0	0	6+	2+	0	0	1+	0	1+	0	2+	2+	2+	0	1+	0	2+	0		
AP	2+	4+	4+	2+	0	4+	4+	0	0	0	6+	0	0	0	1+	0	1+	0	2+	2+	2+	2+	0	0	2+	0		
T12	1+	4+	5+	2+	4+	5+	3+	9+	4+	1+	2+	1+	3+	6+	6+	1+	2+	4+	4+	1+	2+	4+	2+	4+	3+	1+	2+	2+
T2	3+	2+	5+	4+	3+	6+	4+	6+	1+	5+	2+	3+	4+	2+	1+	2+	0	6+	3+	2+	4+	1+	4+	4+	3+	1+	2+	3+

FRANCE

	Human Capital					Technical Capital					Financial Capital					Social Capital				Institutional Capital												
	E	WC	H	Sec	P	Com	I	Info	M	BA	Sbd	SE	Sav	WA	PR	C	Jus	Par	Con	IC	SN	PR	MR	RR	CR	AR						
P1	2+	1+	7+	8+	2+	4+	3+	1+	3+	8+	4+	0	3+	3+	0	1+	1+	2+	1+	3+	5+	1+	5+	10+	5+	3+	1+	2+	4+	2+		
AP	2+	1+	11+	3+	1+	1+	0	7+	2+	4+	6+	3+	2+	3+	0	5+	0	2+	2+	1+	2+	3+	1+	0	4+	4+	1+	2+	4+	2+		
T12	4+	8+	8+	4+	4+	7+	7+	4+	2+	6+	0	2+	3+	4+	1+	2+	1+	3+	4+	1+	4+	1+	4+	3+	2+	4+	1+	2+	4+	2+		
T2	4+	1+	7+	1+	12+	10+	10+	11+	8+	7+	1+	15+	4+	4+	2+	6+	3+	4+	1+	5+	4+	6+	1+	9+	6+	4+	10+	3+	9+	5+	4+	6+

The two following tables are the results of protocols applied to the French and Turkish value chains with the chosen principles of aggregation. The other two tables were obtained by applying the principle of Kahneman and Tversky.

Caution should be exercised in the analyses. A slight variation of effective potential capacity can have relative effects that are more important than a strong variation if the starting capacity level is lower.

Human Capital	Technical Capital	Financial Capital	Social Capital	Institutional Capital
51	49	50	41	32

Human Capital	Technical Capital	Financial Capital	Social Capital	Institutional Capital
97	109	19	80	61

If one hypothesizes that the losses of capacity are similar to losses of utility, one may then apply the principle of asymmetry of gains and losses derived from the behavioural research carried out by Kahneman and Tversky. According to their observations, one can estimate that on average, the value of the disutility of a loss is double that of the utility of a gain of the same amount. In this case, the configuration of the French value chain will be affected more than the Turkish one. The use of the Kahneman and Tversky result renders possible the aggregation of estimates of variations of effective potential capacities.

TURKEY

	Human Capital					Technical Capital					Financial Capital					Social Capital					Institutional Capital							
	E	WC	H	Sec	P	Com	I	Info	M	BA	Sbd	SE	Sav	WA	PR	C	Jus	Par	Con	IC	SN	PR	MR	RR	CR	AR		
P1	2+	4+	2+	0	0	4+	2+	0	0	0	6+	2+	0	0	1+	0	1+	0	2+	2+	2+	0	1+	0	2+	0		
AP	2+	4+	4+	2+	0	4+	4+	0	0	0	6+	0	0	0	1+	0	1+	0	2+	2+	2+	2+	0	0	2+	0		
T1	1+	3+	5+	4+	4+	5+	3+	9+	4+	1+	2+	1+	3+	6+	6+	1+	2+	4+	4+	1+	4+	2+	2+	4+	3+	1+	2+	2+
T2	3+	4+	5+	4+	3+	6+	4+	6+	1+	5+	2+	3+	4+	2+	1+	2+	0	6+	3+	4+	4+	1+	4+	4+	3+	1+	2+	3+

FRANCE

	Human Capital					Technical Capital					Financial Capital					Social Capital					Institutional Capital												
	E	WC	H	Sec	P	Com	I	Info	M	BA	Sbd	SE	Sav	WA	PR	C	Jus	Par	Con	IC	SN	PR	MR	RR	CR	AR							
P1	4+	1+	7+	1+	2+	4+	2+	9+	2+	3+	8+	4+	0	3+	6+	0	1+	2+	1+	2+	3+	5+	2+	5+	10+	5+	3+	2+	2+	4+	2+		
AP	4+	1+	11+	3+	2+	1+	0	7+	2+	4+	6+	3+	3+	2+	6+	0	5+	0	2+	2+	2+	3+	2+	0	4+	8+	2+	2+	4+	2+	2+		
T1	2+	4+	8+	8+	4+	4+	7+	4+	7+	4+	4+	6+	0	2+	6+	8+	2+	2+	2+	6+	8+	2+	4+	2+	4+	3+	2+	4+	2+	4+	2+		
T2	4+	2+	7+	2+	12+	10+	10+	11+	8+	7+	2+	15+	4+	4+	4+	6+	3+	2+	4+	2+	5+	4+	6+	2+	9+	6+	4+	10+	13+	9+	5+	4+	6+

The aggregation of gains and losses of effective potential capacity is thus in principle possible, even if it would be appropriate to remain cautious. For the two countries, the results are positive for all types of capital but differences appear significant.

Human Capital	Technical Capital	Financial Capital	Social Capital	Institutional Capital
43	49	50	37	32
Human Capital	Technical Capital	Financial Capital	Social Capital	Institutional Capital
89	103	-8	73	54

XI. Effective Potential Capacities and Real Capacities

A. Principles

A variation of real capacity is attested by a variation of production, productivity, or all other forms of assets. For example, a marginal effective potential human capital capacity becomes a real capacity when the subject (the holder of the variation of capital) puts to use the skill that had been acquired but not yet used. The expected variation of well-being, which is the end point sought, can result only from a veritable variation of capacity. But this is contingent on an ensemble of conditions. It is possible that an effective potential capacity does not become a real capacity immediately, or even ever at all. In this case, the potential capacity can deteriorate and not lead to an increase in well-being.

The passage of variations of potential effects to variations of real effects depends on the socio-economic conditions of the context in which the effective potential capacities put at the subject's disposal are used. These constraints mean that there is not an automatic relationship between an effective potential effect and a real effect. This does not mean that one does not observe real effects produced by a variation of effective potential in a given context and without recourse to a generic pathway (this is the case of an attested acquired skill used in a job with a superior, higher income earning status).

Numerous empirical studies attest to strong relationships between certain forms of assets (in the different forms proposed). We evoke here a few to serve as examples. When strong relationships exist between two forms of variations of assets, then it is possible to reasonably infer that the variation of one of them will lead to a veritable variation in the other. Many research studies have demonstrated real and likely links between different categories of assets. These studies thus can be references allowing one to attest to real effects by the observed potential effects.

B. Some examples

a. Concerning the human education asset

- The relationship between human capital and growth is probably one of the best known and has been documented extensively. Pioneering works on education include Mincer (1958, 1974), Schultz (1961) and Becker (1964, 1975), up to the works of Romer (1986, 1988), Lucas (1988), Barro and Lee (2001), and numerous others such as Aghion and Cohen (2004).
- An Insee study shows, for example, that the “social” yield of one year of additional education is estimated at 7% on average for OECD countries and 10-11% for France (2005).
- Education usually is correlated with empowerment, in particular of women (other form of human capital). In Bangladesh (N.Kamal, and K. M. Zunaid. (2006), in Ethiopia (Legovini.A.(2006), in India (Gupta, K., and P. P. Yesudian. (2006)), and in Russia (Lokshin, M., and M. Ravallion. (2005)).
- Education has a positive effect on longevity (health). This has been observed in numerous countries, notably Bangladesh (Hurt, L. S., C. Ronsmans and S. Saha. (2004), in South Korea (Khang, Y., J. W. Lynch and G. A. Kaplan. (2004)) and in the USA (Cutler, D., and A. Lleras-Muney. (2006)).
- However, apparently paradoxical results also have been noted: In countries that experience negative economic growth between 1970 and 2010 (RDH 2010 chapter 3), life expectancy improved on average by 11 years, the gross school enrolment rate by 22%, and the literacy rate by 40%.

b. Concerning the human health asset

- Studies show that the average state of health in developing countries seems to be correlated with average income levels (RDH 2010). Variation in life expectancy also seems to be a good indicator of variation in the level of health. Canning, D. (2010).
- Increased mortality is correlated with income inequality: G.B.Rodgers (1979)
- Increased life expectancy is correlated with a drop in the Gini index: R.C.Wilkinson (1992)
- Reduced inequality is correlated with increased levels of average health and the state of individuals' health improves with economic status (and therefore income): A.Deaton (2001); A.Wagstaff and E.Van Doorslaer (2000)
- Health is an increasing function of income under a concave relationship (increasing function to diminishing returns): H.Gravelle (1996).
- In a recent article (Fleschet et al. (2012)), the authors tried to establish a relationship between the evolution of an economic activity generated by the functioning of a production chain and the evolution of the state of health of the population in the country where the economic activity took place. The test was carried out in Cameroon.

c. Concerning social capital

- The social capital indicators used by R.D.Putnam (1995) are good predictors of the different life expectancies found between American states (Kawachi I.et al (1997)).
- Democratic transition is translated by an increase in life expectancy and a reduction in infant mortality (RDH 2010).

- There is a strong relationship between gender equality and economic growth (D.Acemoglu and J. Robinson (2002)).

d. Concerning institutional capital

A study based on individual data collected in 28 African countries shows that children had greater chances of survival after a democratic transition in their respective country. (2001)). This analysis covered children born to the same mother before and after the democratic process in order to eliminate family differences. The 2010 Human Development Report defines democracy in a minimalist fashion (Cheibub, J. A., J. Gandhi and J. R. Vreeland. (2009)): "Countries are considered to be democratic if the head of the government and the legislative assembly are elected, if more than one political party participates in elections and if a party hands over power if it loses an election. Outside these criteria, countries are classed in the category of dictatorships."

C. The robustness of overall Cause-Effect (generic pathways) relationships

An *effective potential capacity effect* (for example, a proven skill) can very well become a real capacity effect without recourse to a "generic" pathway between training and employment or training and income. In effect, one can observe that an enabling training leads to a more gratifying and better paid job within or outside the company (and without degrading other variables). This means that the attested potential effect can become a real effect without a "generic" pathway. This limits such a pathway approach to a "short-cut" approach (allowing savings on the context when the transfer conditions are acceptable, which is far from always the case). To be more precise, the generic pathways approach is in reality most often "multi-context" in so far as it is not as easy to characterize "socio-economic arrangements" as it is to identify technical arrangements of a production function.

What seems possible to assert today is numerous studies exist which report proven relations (generic pathways). However, one should be cautious about inferring real effects from potential effects. The reason is that even when they are proven, the relations between variations in assets can be contingent on a situation or period and therefore difficult to systematically transfer.

More research studies should, however, allow these difficulties to be overcome. For the time being, however, the content of data banks allowing a passage from potential to real effects is insufficient for numerous forms of assets. The transferability of data also often takes place to the detriment of the contextualization of situations.

The estimate of marginal effective potential capacities approach thus remains a relevant and realistic means to identify and estimate the effects of potential variations of well-being, particularly as one can use locally estimates of variations in utility and not simply variations in activity. The estimate of variations of real effects also can lead to in-depth local investigations if the accounting system allows.

References

- Aghion P., Cohen E. (2004). *Éducation et croissance*, Rapport du C.A.E., avec la collaboration de Dubois E. et Vandenbussche J., éd. La Documentation Française.
- Aglietta M. (2011). « Croissance durable : mesurons nous bien le défi ? », *Revue d'Économie du Développement*, 25(2): 199-250.
- Acemoglu D., Robinson J. (2002). « The political economy of Kuznets curve », *Review of Development Economics*, 6(2): 183-203.
- Andrews E., Lesage P., et al. (2009). « Life Cycle Attribute Assessment », *Journal of Industrial Ecology*, 13(4): 565-578.
- Barro RJ. (2001). « Education and Economic Growth », in Helliwell JF. (dir.), *The Contribution of Human and Social Capital to Sustained Economic Growth and Well-Being*, OECD, chapter 3, pp.14-41.
- Barro RJ., Lee. JW. (2001). « International Data on Educational Attainment: Updates and Implications », *Oxford Economic Papers*, Academic Research Library, 53(3): 541-563.
- Becker G. (1964). *Human Capital*, Columbia University Press, New York.
- Becker HA. (2001). « Social impact assessment », *European Journal of Operational Research*, 128(2): 311-321.
- Benoît C., Norris G., Valdivia S., Ciroth A., Moberg A., Bos U., Prakash S., Ugaya C., Beck T. (2010). « The guidelines for social life cycle assessment of products: just in time! », *The International Journal of Life Cycle Assessment*, 15(2): 156-163, DOI : 10.1007/s11367-009-0147-8.
- Berlin I. (1969). *Four Essays on Liberty*, Oxford University Press, Oxford.
- Blanchflower DG., Oswald AJ. (2005). « Happiness and human development index. The paradox of Australia », NBER Working Paper N° 11416. .
- Boulanger PM. (2004). « Les indicateurs de développement durable : un défi scientifique, un enjeu démocratique », Séminaire Développement durable et économie de l'environnement, Institut du développement durable et des relations internationales (IDDR), Juillet 2004, Paris (France).
- Canning D. (2010). « Progress in health around the World », *Human Development, Research Paper 43*, UNDP-HDRO (BRDH du PNUD), New York, RDH 2010.
- Cheibub JA., Gandhi J. et Vreeland JR. (2009). *Democracy and Dictatorship Revisited Dataset*, University of Illinois at Urbana-Champaign, <https://netfiles.uiuc.edu/cheibub/www/DD_page>.
- Cutler D., Lleras-Muney A. (2006). « Education and Health: Evaluating Theories and Evidence », in Schoeni RF., House JS., Kaplan GA. et Pollack H. (Dir), *Making Americans Healthier: Social and Economic Policy as Health Policy*, Russell Sage Foundation, New York.
- Deaton A. (2001). « Health inequality and economic development », *NBER Working Paper* n° 8318.
- Duflo E. (2010). *La politique de l'autonomie*, tome I et II, Seuil, Paris.
- Ekins P. (1992). « A Four-Capital Model of Wealth Creation », in Ekins P. and Max-Neef M. (dir.), *Real-Life Economics: Understanding Wealth Creation*, Routledge, Londres, pp. 147-55.
- Ekins P., Medhurst J. (2006). « The European Structural Funds and Sustainable

Development. A Methodology and Indicator Framework for Evaluation », *Evaluation*, 12(4): 474-495, DOI : 10.1177/1356389006071294.

Finnveden G. (1997). « Valuation methods within LCA-Where are the values? », *The International Journal of Life Cycle Assessment*, 2(3): 163-169.

Finnveden G. (2000). « On the limitations of life cycle assessment and environmental systems analysis tools in general », *The International Journal of Life Cycle Assessment*, 5(4): 229-238.

Feschet P., Macombe C., Garrabé M., Loeillet D., Rolo Saez A., Benhmad F. (2012). « Social impact assessment in LCA using the Preston pathway. The case of banana industry », *The International Journal of Life Cycle Assessment*, 18(2): 490-503, DOI : 10.1007/s11367-012-0490-z.

Garrabé M. (2008). « Note sur l'existence du capital institutionnel », Workshop Université de Montpellier 1- Université de Sherbrooke, 23-24 juin, 23p, <<http://www.michel.garrabe.com>>.

Garrabé M., Requier-Desjardins M., Chassagny JP. (2012). « Quelques conditions clés d'une procédure d'évaluation économique », *Revue Sécheresse*, 23(3) : 158-167.

Gravelle H. (1996). « How much of the relation between population mortality and unequal distribution of income is a statistical artefact », *British Medical journal*, 316(.) : 382-385.

Gupta K., Yesudian PP. (2006). « Evidence of Women's Empowerment in India: A Study of Socio-Spatial Disparities », *Geo Journal*, 65(4): 365-80.

Helliwell JF. (2001). *The contribution of human and social capital to sustained economic growth and well-being: International Symposium Report*, OECD, Paris. Hurt LS., Ronsmans C. et Saha S. (2004). « Effects of Education and Other Socioeconomic Factors in Middle Age Mortality in Rural Bangladesh », *Journal of Epidemiology and Community Health*, 58(4): 315-20.

IDD Québec (2009). *Les indicateurs de développement durable - Document de consultation publique*, modifié le 12 juin 2009, <<http://www.mddep.gouv.qc.ca/developpement/indicateurs/index.htm>>.

Industrie Canada (1997). *La mesure du développement durable : étude des pratiques en vigueur*, Document hors série Ottawa, Canada.

Jeorgensen A., Le Bocq A., Nazarkina L., Hauschild M. (2008). « Methodologies for social life cycle assessment », *The International Journal of Life Cycle assessment*, 13(2): 96-103, DOI : 10.1065/lca2007.11.367.

Jeorgensen A., Hermann IT., Morgensen JB. (2010a). « Is LCC relevant in a sustainability assessment? Letter to the editor », *The International Journal of Life Cycle assessment*, 15(6): 531-532, DOI : 10.1007/s11367-010-0185-2.

Jeorgensen A., Lufanna CH. Lai, Hauschild MZ. (2010b). « Assessing the validity of impact pathways for child labour and well-being in social life cycle assessment », *The International Journal of Life Cycle Assessment*, 15(1): 5-16, DOI : 10.1007/s11367-009-0131-3

Jeorgensen A., Finkbeiner M., Jeorgensen M., Hauschild M. (2010b). « Defining the baseline in social life cycle assessment », *The International Journal of Life Cycle Assessment*, 15(4): 376-384, DOI : 10.1007/s11367-010-0176-3.

Jusot F. (2003). *Revenu et mortalité : analyse économique des inégalités de santé en France*, Thèse EHESS, 12/12/2003.

- Kamal N., Zunaid KM. (2006). « Education and Women's Empowerment in Bangladesh », Working Paper n°11, Centre for Health, Population and Development at Independent University Bangladesh, Dhaka.
- Kahneman D., Tversky A. (1979). « Prospect Theory: An Analysis of Decision under Risk », *Econometrica*, 47(2): 263-291.
- Kawachi I. et al. (1997). « Social capital, income, inequality and mortality », *American Journal of Public Health*, 87(9): 1491-1498.
- Khang Y., Lynch JW., Kaplan GA. (2004). « Health Inequalities in Korea: Age- and Sex-Specific Educational Differences in The 10 Leading Causes of Death », *International Journal of Epidemiology*, 33(2): 299-308.
- Knack S. (2001). « Can human and social capital explain differences in productivity, economic growth and well-being between OECD countries? », in Helliwell (dir.) *The contribution of human and social capital to sustained economic growth and well-being: International Symposium Report*, OECD, Chapter 9.
- Kruse SA., Flysjö A., Kasperczyk N. (2009). « Socioeconomic indicators as a complement to life cycle assessment- an application to salmon production systems », *The International Journal of Life Cycle Assessment*, 14(.): 8-18.
- Labuschagne C. and Brent A. (2006). « Social Indicators for Sustainable Project and Technology Life Cycle Management in the Process Industry », *The International Journal of Life Cycle Assessment*, 11(1): 3-15, 13 pages + 4.
- L'Angevin C., Laïb N. (2005). *Éducation et croissance en France et dans un panel de 21 pays de l'OCDE* (Insee), Doc de travail n°G2005/08.
- Lake DA., Baum M. (2001). « The Invisible Hand of Democracy: Political Control and the Provision of Public Services », *Comparative Political Studies*, 34(6): 587-621.
- Legovini A. (2006). « Measuring Women's Empowerment in Ethiopia: The Women's Development Initiatives Project », in Alsop R., Bertelsen M. et Holland J. (dir.), *Empowerment in Practice: From Analysis to Implementation*, Washington, DC Banque Mondiale.
- Lokshin M., Ravallion M. (2005). « Self-Rated Power and Welfare in Russia », in Narayan D. (dir.), *Empowerment: Cross-Disciplinary Perspectives Measuring*, Washington, DC Banque mondiale.
- Lucas RE. (1988). « On the mechanics of economic development », *Journal of Monetary Economics*, 22(1): 3-42.
- Macombe C. (2010). *Construire l'ASCV des pathways*, Working Paper, 19p.
- Mincer J. (1974). *Schooling, Experience, and Earnings*, Columbia University Press, New York.
- Monet (2009). *Mesurer le développement durable*, Les indicateurs présentés selon les 12 thèmes du système Confédération Suisse Office fédéral de la statistique, <<http://www.bfs.admin.ch/bfs/portal/fr/index/themen/21/02/01.html>>.
- Naussbaum M. (1990). *Love's Knowledge*, Oxford University Press.
- Norris G. (2006). « Social Impacts in Product Life Cycles - Towards Life Cycle Attribute Assessment », *The International Journal of Life Cycle Assessment*, special issue, 11(1): 97-104.
- Parent J., Cucuzzella C., et al. (2010). « Impact assessment in SLCA: sorting the sLCIA methods according to their outcomes », *The International Journal of Life Cycle Assessment*, 15(2): 164-171.

- Pedemay A. (2012). *Analyse sociale du cycle de vie : le cas de latomate transformée en France*, M2 Ingénierie de projets, septembre.
- PNUE-SETAC (2009). *Lignes directrices pour l'analyse sociale du cycle de vie*, ©PNUE.
- Putnam R. (1995). « Bowling alone: American's declining social capital », *Journal of democracy*, 6(.): 65-78.
- Putnam R. (2000). *Bowling alone; the collapse and revival of American community*, Simon and Shuster, New York.
- Rawls J. (1971). *A Theory of Justice*, The Belknap Press of Harvard University Press.
- Rodgers GB. (1979). « Income and inequality as determinants of mortality: an international cross-section analysis », *Population Studies*, 33(.): 343-351.
- Rodrik D. (2000). *Development strategies for the next century*, Harvard University, <www.harvard.edu/rodrik/devstrat>.
- Romer P. (1990). « Endogeneous Technical Change », *Journal of Political Economy*, 98(.): 71-102.
- Sen A.K. (1992). *Inequality Reexamined*, Clarendon Press, Oxford.
- Sen A. (1993). *Ethique et économie. Et autre essais*, PUF, Paris.
- Sen A.K. (2010). *Un nouveau modèle économique : développement, justice, liberté*, Odile Jacob, Paris.
- Stiglitz J., Sen AK., Fitoussi JP. (2009). *Rapport de la Commission sur la mesure des performances économiques et du progrès social*, 324p, Documentation Française, Paris.
- Schmidt I., Meurer M., Saling P., Kicherer A., Reuter W., Gensch CO. (2004). « Managing Sustainability of Products and Processes with the Socio-Eco-Efficiency Analysis by BASF », *GMI*, 45(.): 79-94.
- UNECE, OECD, Eurostat (2008). *Measuring sustainable development*, Report of the Joint UNECE/OECD/Eurostat Working Group on Statistics for Sustainable Development, United Nations, New York et Geneva.
- Van Schooten M., Vanclay F. (2003). « Conceptualizing social change processes and social impacts » in Becker HA., Vanclay F. (dir.), *The International handbook of social impact assessment*, Cheltenham, Edward Elgar, pp.74-91.
- Wagstaff A., Van Doorslaer E. (2000). « Income inequality and health: what does the literature tell us ? », *Annual Review of Public Health*, 21(.): 543-567.
- Wilkinson RC. (1992). « Income distribution and life expectancy », *British Medical Journal*, 304(.): 165-168.
- World Bank (2006). *Where is the wealth of nations? Measuring Capital for the 21st Century*, The International Bank for Reconstruction and Development/The World Bank, Washington (USA).
- Yildirim H. (2013). *Analyse sociale du cycle de vie de la tomate transformée exportée de la Turquie vers la France*, Thèse Master of Sciences Iamm-UM1, Juin.



Chapter 6

Charles Gillet and Denis Loeillet

Social life cycle value chain analysis practices

This chapter presents concrete examples of the application of the method presented in this book, including using the Multiple Capital Model (MCM) described in chapter 4. However, we must note that the concrete cases discussed here are not the comprehensive Social Life Cycle Assessment (SLCA) studies that one day we hope to achieve. As shown in chapter 7, all of the calculations of impacts (or pathways) required to conduct a comprehensive SLCA are not yet known.²¹ However, we already can obtain a considerable amount of valuable information on the likely social effects of a change through field investigations. As our knowledge of “pathways” improves, SLCA studies will produce increasingly sophisticated results.

21. The three types of calculations of impacts or “pathways” will be defined and described in chapter 7.

The cases presented here involve a life cycle linked to a value chain. The commissioner of the study faces one or several options to make a change in this value chain. S/he must make a choice. S/he is interested in a clearly defined territory. This territory usually only represents one part of the geographic area covered by the social life cycle.

It is possible to practice an environmental LCA study at the same time without changing in any way the practices presented here.

a. SLCA for a value chain

This chapter is meant for professional advisors and researchers who wish to construct a SLCA of alternatives involving a value chain (see diagram 15). The example presented here involves an agricultural product value chain, but it can be applied to all other types of value chains.

In principle, a value chain (Malassis, 1983) induces a progression -- presented vertically -- of a raw material from the top to the bottom, and indicates those who are directly (suppliers, sub-contractors, clients, etc.) and indirectly involved (lenders, government services, etc.). The value chain describes the physical flows of services and their monetary consideration. The result is a quantitative assessment of flows of goods, prices, and added values, using the accounts of each agent. The value chain concept often is an interesting foundation on which to base the modelling of a system submitted to social analysis.

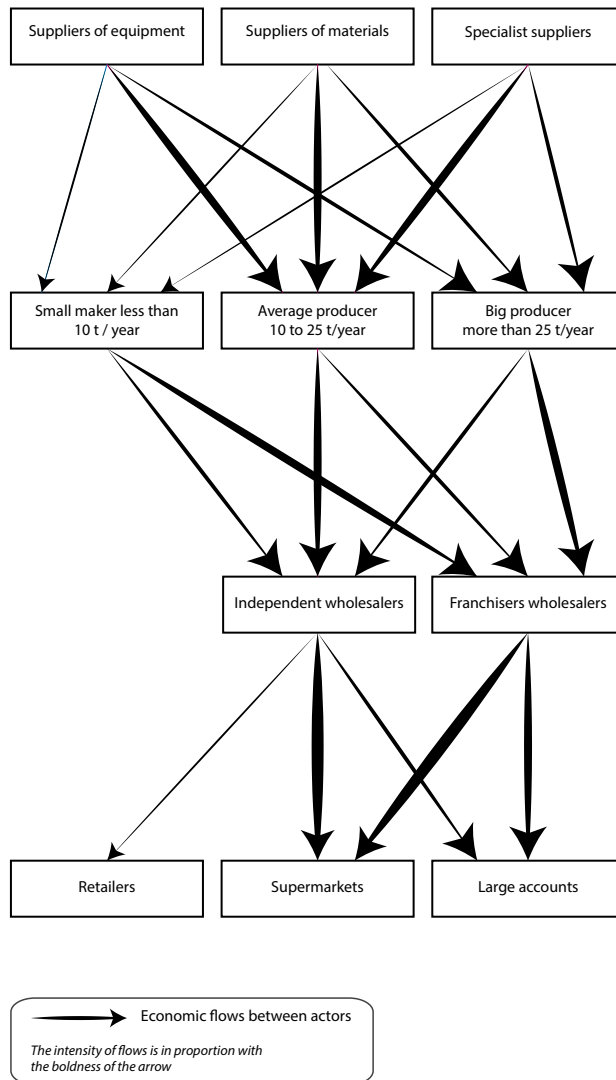
Diagram 15 is simplified, yet it nevertheless presents a large amount of information. The challenge is to distinguish which actors are dominant and proactive and which are followers (Lagarde and Macombe, 2012).

The analysis of a value chain requires one to conduct several studies: 1) an institutional analysis (which institutions are involved, which are created by value chain actors?); 2) a functional analysis to identify the technical functions of each process (for example, what quantity of milk is technically needed to make 1 kg of a certain cheese); 3) a strategic analysis (what are the issues at stake for the actors?).

Knowing the value chain allows one to outline with precision the diagram of actors and flows. The following spot checks are advised:

- Each stage in the value chain must correspond to a single, simplified task.
- The distinct activities managed by the same actor should be broken down by stage.
- The stages identified must describe activities that have actually been observed.
- All of the companies involved in each stage of the value chain must be counted and stratified according to the same criteria and objectives.

The strategic analysis aims to identify the conditions of access to the market for each professional, as well as the degree to which the value chain is concentrated horizontally and vertically. However, it is particularly important to identify the companies or company that dominate(s) the chain, in other words, which impose their trade rules on the other economic actors. This often is the firm that was described in chapter 3 as the “central firm”.

Diagram 15. Simplified example of a value chain**b. Note regarding the evaluator's position**

As described at length in chapter 2, SLCA seeks to produce reliable and relevant information to assist decision-making. The evaluator must position him or herself clearly in relation to all of the actors involved. His or her independence is the primary condition to realizing

this objective. The evaluator must be a mediator, as neutral as possible, between the study commissioner and the ensemble of actors. This condition is not always easy to respect (difficult access to information, absence of information, divergent rationales of actors...). The evaluator often is led to make proposals or to choose hypotheses that naturally influence study results.

The method is guided by the pursuit of public interest and not the particular interest of a single actor or group of actors. This is a fundamental hypothesis. It was presented in Chapter 2 as an intrinsic element of the "life cycle" spirit. It involves developing an omniscient viewpoint and adopting an empathetic world vision.

Chapter 6 first describes the ensemble of questions involved in the definition of the problem from a practical point of view (section I). We then specifically address the conduct of a survey (section II), the objective of which is to create life cycle Economic Accounts. Section III addresses the articulation between the Multiple Capital Model (MCM) presented in chapters 4 and 5 and the social life cycle Economic Accounts and discusses the nature and significance of results, and compares these results with those of a more conventional socio-economic approach before closing with the conclusions of the chapter.

I. Practice of problem definition

The first paragraph (section A) explores the aim of the study, the next (section B) raises practical questions related to the choice of the functional unit, while the last (section C) discusses the perimeters of the study.

A. Determine the aim of the study

Often perceived as being evident, the determination of the study's aim nevertheless raises two questions: 1) Who defines the aim of the study, meaning, who asks the question? 2) What is one seeking to show?

a. Who asks the question?

The analysis must be made in the perspective of public interest. However, the actor or group of actors that choose the aim of the study directly influence, consciously and unconsciously, the results obtained. Furthermore, one often finds gaps between the officially stated and actual aims of the study commissioner. It is important to take note of this as early as possible. We advise conducting a detailed analysis of the relevance and coherence of the objectives that are set. Table 17 presents an example.

Table 17. Analysis of the objectives' relevance and consistency

Items		Nature	Opinion	Constraints
Human resources	internal	3.5 FTE	normal	no framework
	external	1 FTE	normal	no framework
Raw material		information	risky	difficulty of access
Technical means	internal	specific software	normal	
	external	no	no	
Financial means		euros	normal	
Needs	public stakeholders	steering committee	normal	
	private stakeholders	steering committee	normal	
	professionals	survey	normal	
	consumers	not deal with	failure	only final price is taken into account
Objectives	political	executive director	very clear	
	strategical	executive director	very clear	
	operational	adviser	clear	some issues are not defined
	actions	not defined	not defined	analysis failure
Consistency of Human Resources			+	To strengthen management
Consistency of raw materials			- - -	To find other sources
Consistency of methods			+ +	Nothing to say
Consistency of technical means			+ + +	Nothing to say
Consistency of financial means			+ + +	Nothing to say
Strategical relevance			+ + +	Nothing to say
Operational relevance			-	To strengthen communication

FTE: Full time equivalent, unit for measuring available human resources

Normal: means that operating in normal regarding the objectives and context

If the objectives pursued only include some of those which should be covered (these are determined from an empathetic and omniscient point of view), one should reassess the situation. The evaluator must ask the study commissioner whether it is possible to broaden the scope of the study or, to the contrary, abandon certain objectives. Unfortunately, the choice of objectives often is dictated by budgetary concerns and the quality and accessibility of information. These considerations should not hinder the evaluator from carefully noting what s/he will not be able to study in detail due to a lack of data or resources.

b. The aim of the study is the study's purpose

The study may aim, for example, to assess the impact of different crop management techniques for growing a certain fruit, or to choose between producing a good locally or importing it. The aim also may be to assess the impact of a new industrial process on production and distribution etc.

It is unlikely that all of the actors accord the study the same goals because they are naturally pursuing their own objectives. Verifying the coherence of their vision is a delicate task because one frequently finds that different actors understand the same word in different ways. These damaging misunderstandings are even more likely to occur when a high number of diverse actors are involved. To avoid unpleasantness, it is useful to establish a comparative lexicon of terms and concepts related to the objective of the study. This preliminary work can save a lot of time and avoid conflicts once the mission has begun.

B. Choice of a Functional Unit in practice

The choice of the functional unit was discussed in a theoretical manner in Chapter 2. The choice depends first of all on the product or service lying at the heart of the question to be addressed. The question may concern the principal product (ex: beef) of the value chain, one part of the principal product (ex: rump steak), a co-product (ex: keratin-based bovine body parts) or a comparison between substitute products²² (ex: pork meat if the value chain under comparison is beef).

Depending on the context, the same actual product may be considered as a principal product or as a co-product. How may this be settled? The distinction is determined by the companies' investment strategies. Investment choices are based on the principal product. Co-products are only annexes to the production cycle. While co-products may often be commercially valuable, they do not directly influence investment choices.

When the functional unit is expressed as a certain quantity of the principal product, the analysis of the value chain, from the cradle to the consumer, is a valuable tool. Data from the value chain will relate directly to this product (data will, for example, be expressed in tons of milk). Furthermore, the product is clearly identified by all of the professionals in the value chain, facilitating communication.

When the functional unit is expressed as a quantity of one part (ex: rump steak) of the principal product, data collection becomes very tricky (ex: rump steak represents on average 6% of the total weight of a beef carcass). Professionals rarely have such detailed technical and economic information on hand. Recourse to hypotheses based on "expert opinion" then is necessary.

When a functional unit is expressed as a quantity of a co-product, the value chain of the principal product no longer provides an adequate picture. The value chain of the co-product and its possible substitutes must be reconstituted.

When the functional unit is expressed as a quantity disconnected from the principal product (or example, a quantity of calories), all of the value chain data must be converted

22. A substitute product is a product that has characteristics similar (in connection with the problem posed) to those of the principal product, but under different economic conditions (ex: butter versus margarine).

because they would have been collected in quantities of the principal product. This type of functional unit often is used when obvious substitute products exist, and which therefore should be included in the study (for example, the study may consider a move from beef to pork consumption).

It is recommended to choose a functional unit that corresponds to a quantity of a product (available at a certain place at a certain time) the moment the opportunity arises.

C. Choice of perimeters

We will discuss now practical aspects of setting perimeters in space and time, as well as the perimeter of effects. SLCA often provides more detail on the social effects caused in a specific place (the territory of interest for the study commissioner) while still taking into account the complete life cycle of the product.

a. Choice of a spatial perimeter

The spatial perimeter encompasses all of the organisations that should be taken into account in the study (meaning those that would provoke social effects following an envisioned change). These organisations must be geographically located. For each stage of the value chain, one will specify the location of inflows and outflows. Specifying location usually consists of describing each stage as local, regional or inter-regional, national, international. In certain cases (border areas, islands), this segmentation is tricky. It sometimes is better to describe the geographic location using other elements: geographic or topographic characteristics, concentric circles...

Variations

What should one do when one finds different variations of organisations participating in the same stage? In environmental LCA, it often suffices to take into account only the variation esteemed to be the most representative. In contrast, social analysis focuses on studying the different variations. There are three reasons for this. First, one can thereby identify the performance, strengths and weaknesses of the different strategies. This request frequently is expressed by the commissioner of a study. Second, this exhaustive survey will give an estimate of the share contributed by each product management technique to total production. Lastly, important social effects can emerge through interactions between the variations. If the equilibrium is broken during an envisioned change, one of the types can supplant the others. To estimate the effects of all of the activities of a stage, one thus must often use organisation typologies. Table 18 illustrates the case of a cheese value chain that has two types of variants at the farm stage.

Table 18. Distinction between two variations for processing the cheese C, in the region A.

Variation	A 1	A 2
Cows breeds	Simmental and Montbéliarde	Holstein pie noire
Average milk individual quota for farms	100 000 litres	360 000 litres
Feed	Mainly on hay	Mainly on maize and grass silages
Processing of milk	In dairy focussed on cheese (4 000 t of milk / year) 10 kg of milk for one kg of cheese	In versatile dairy (>20 000 t of milk / year) 9 kg of milk for 1 kg of cheese
Rate and number of farms supplying milk for cheese C. in the region A	70% means 589	30% means 252
Average milk quota of the dairy	4 000 t of milk (processed into cheese C.)	400 000 t of milk (processed into many end products)
Tons and rate of the cheese C. supply stemming from the variant	5 890 t means 37%	10 080 t means 63%

Social analysis must take into account the diversity of organisations acting at each stage of a life cycle.

b. Choice of the temporal perimeter

The temporal perimeter is the period of time taken into account by the study of the functioning of the value chain. The choice is complicated because numerous parameters are involved. As in all situations involving human actors, changes in the context are exploited by actors to optimize their strategies to such an extent that in so doing, they change the initial situation.

A pragmatic approach is to investigate the use cycle and the investment cycle of the product studied. It is advisable to choose the cycle that is the longer of the two as the temporal perimeter. For example, for a tree crop, the use cycle is annual while the investment cycle (plantation) varies between 10 and 20 years. For the delivery of a service, the investment cycle is non-existent or weak, while the economic production model put in place will function between 3 to 5 years. In the first example, the temporal perimeter should be the duration of the life of the plantation, in the second, it should be the duration of the life of the economic model.

A SLCA study is conducted under the assumption that *everything else remains equal*. Yet it is clear that parameters, sometimes important ones, will evolve during the period covered

by the study. To take into account these phenomena, it is crucial to conduct a sensitivity analysis. This can be done based on elasticity calculations. Elasticity measures the relation of two relative variations between two variables. For example, what will be the variation in work related accident rates if working hours are increased by 1%? Some of the resulting variables will have weak elasticity in relation to certain parameters. In this case, the evolutions of these parameters over time hold little meaning. In contrast, the resulting variables will show strong elasticity against other parameters. This strong elasticity -- an important propensity to change in value when another parameter changes -- must be noted.

c. Choice of perimeter of effects

The perimeter of effects gathers together all of the actors that one esteems will receive the social effects²³ brought to light in the study. Defining the perimeter of effects in a definitive manner assumes that all of the effects and all of the impacts of the change studied on the organisation of the value chain are known. In practice, this condition is never fulfilled because our knowledge is limited.

To define the perimeter of effects, one first inventories the effects and impacts that the mission aims to study. One then examines which organizations are those whose behaviour (affected by the change envisioned) may lead to such effects or impacts and on what type of actor. This enables one to identify the most affected social groups for each effect studied. Table 19 synthesizes this approach in a very simplified case of a three-stage value chain. Here, the effects of the envisioned change are variations in job numbers, while the impacts are variations in confidence levels.

Table 19. Synthesis of the process to identify affected actors

STEPS OF THE LIFE CYCLE Affected organisations	Effect of change upon employment	Affected actors	Impacts
STEP 1: Farms	Farm workers jobs losses	Farm workers	Declining confidence
STEP 2: Food industry	Jobs under threat	Workers of food industry	Declining confidence
STEP 3: Grocery distributors	Sellers jobs gains	Sellers	Confidence building
		Local Society	Evolution of confidence

23. Remember that in SLCA vocabulary, effects and impacts are the consequences of a change (Vanclay, 2002). The term 'impact' designates an experience lived by a person or by a group of people (such as disease, increased confidence, etc.) while 'effect' designates a consequence of a change (the creation of jobs) that can lead to an impact (increased confidence) if it falls on fertile ground in the actors on the receiving end.

Past experience has shown that unexpected effects appear during a mission, when conducting a survey or processing results. These effects often enter into the category of known but “not sought” effects, meaning those that were underestimated or ignored during the literature review preceding the survey. Sometimes previously unknown effects emerge in the value chain. As we will see in the following paragraph, the presentation of results using the Multiple Capital Method reveals these effects because it offers a broader vision of the value chain and its organization.

d. Conclusion on the choice of perimeters

In general, the perimeters of a social LCA study are different from those chosen for an environmental LCA. This is not a problem for the actors (public decision makers, producers, commercial operators, consumers, etc.). In effect, what is important for them is to consider the environmental and social effects of the same alternative.

Fixing the perimeters is the subject of negotiation. Everything depends on who asks the question. This is a critical point because actors have different rationales. In addition, the temporal horizon of decision makers rarely exceeds the term of their mandates. It is therefore imperative to inform, explain, and clarify the whys and wherefores of a social LCA as soon as one starts to prepare the study to avoid any false expectations.

II. Conducting the survey

The objective of the survey is to build Economic Accounts of the social life cycle. We develop them based on the accounts of the companies (and, where applicable, on a reconstituted account to represent consumer households) composing the social life cycle, adding “non-market” elements, meaning values that are not included in conventional accounts.

A. Preparation of the survey

To analyse the variations of a stage in the value chain, we must make a stratified sample.²⁴ The reality on the ground often complicates the task for two reasons which arise frequently in evaluation studies: the absence of information and its confidentiality. We prepare the survey stage in such a way as to recuperate all of the information available. When there are insurmountable obstacles or constraints, it may be a good idea to lower one's objectives! In practice, to manage these constraints while respecting the sampling protocol, one must oversize the sample. This leads one to survey all of the actors in strata with small populations.

For technical and specialized value chains, past experience has shown that results are more interesting when the survey is carried out by a technician and an economist working in tandem. The additional cost of this double mobilization of skills can often be offset by an optimization of the survey protocol.

24. A stratified sample is needed when the various strata do not behave in the same way with regard to the variable studied. In theory, the sampling rates of each stratum are equal to the sampling rate of the total population (see sampling techniques).

B. Utility and definition of an economic account

All monetary calculations, whether accounting, financial, or economic, rely on the notions of uses and resources.

Accounting, financial, and economic approaches:

- An accounting approach is before all else a fiscal approach. It aims to class (national accounting plan, IFRS standards) uses and resources according to their natures in order to establish the calculation of taxes and duties associated with the activity.
- A financial approach focuses exclusively on the financing flows of use and investment cycles and on the return on capital mobilized.
- An economic approach studies all of the value flows and stocks associated with a human activity, whether commercial or not, on the perimeter of the activity. The economic approach includes and goes beyond the accounting and financial approaches.

The life cycle analysis of a good or service is closely linked to the production cycle of the companies that compose the life cycle. The production cycle of a company experiences variations over time which usually are analysed based on a “uses-resources” balance sheet. In a very general manner, the “use” is a production factor held by the company while the “resource” describes the conditions (loan, self-financing, self-production...) employed by the company to get this production factor.

The “uses-resources” accounting approach gives a detailed but partial image of the company's strategy regarding the combination of the means of production. The financial approach only takes into account the resources identified in the accounting nomenclature. In the framework of a social life cycle analysis, the financial approach is reductionist because we must draw up a uses-resources balance sheet for all of the means actually used by the company to produce. This goal implies recognizing all of the non market values included over the entire life cycle. This therefore is an economic approach.

“Life cycle Economic Accounts” are an exhaustive accounting of uses and resources, market and non market, both in terms of flows and stocks, required to produce a good, from the cradle to the grave.

C. Construction

To build life cycle Economic Accounts, one first must build the Economic Accounts of each organization. An in-depth survey is carried out at the level of the value chain organizations. The development of the questionnaires must anticipate data reprocessing. As always in the social sciences, the quality of the results depends directly on the quality of the survey.

One works first with the accounting data available at the companies to avoid weighing down the questionnaires. Three situations may arise.

In the first, the companies agree to participate in the survey: questionnaires are filled in and the balance sheets are transmitted. The construction of Economic Accounts does not pose a problem (see below). In the second situation, the companies agree to respond to the

questionnaires but refuse to share their balance sheets. The construction of the Economic Accounts is possible thanks to the financial evaluation of the crop management technique (see below). The crop management technique is itself reported in the questionnaires.

In the last situation, the companies refuse to participate in the survey. The direct construction of the Economic Accounts is then impossible. On an indicative basis, Economic Accounts can be built based on expert opinion and used with caution.

There are two techniques for building Economic Accounts.

The first is to use the balance sheets, which offers the advantage of being simple and rapid. This work is based on using the accounting data of the company to which one adds the uses and resources that are not listed in the accounts, but which concern economic (government input subsidies...), social (severance costs for society) and environmental (costs of pollution for society) spheres. This technique has two limitations: i) the imputation of accounting data to one out of several activities is tricky and requires allocation assumptions, ii) the aggregation of accounting data does not allow reliable sensitivity tests to study the effects of modifications or adjustments (for example, the effects of a change in a crop management technique).

The second technique is the reconstitution of Economic Accounts based on an assessment of the crop management technique. This requires documentary research. All technical elements are identified and qualified, quantified, and monetarized to their economic unit cost. In certain specific cases, we are obliged to reprocess some data by using economic assessment techniques (ex: correction of subsidised prices, integration of hidden costs, correction of prices to compare two different economic areas).

This second technique offers two major advantages: 1) it is very easy to test the sensitivity thanks to elasticities (for example, one looks at the variation in the number of jobs created in a company linked to the variation of the product's sale price); 2) it facilitates the conduct of a very thorough failure analysis (based on an analysis of the relevance and coherence similar to that presented in table 17). What really is at stake in the value chain appears very clearly. This technique allows one to question actors on their practices and strategies in greater depth, which increases the value of the final results.

If the study conditions (budget, time) allow it, the use of the second technique to construct the Economic Accounts is highly recommended.

D. Spill-over effects of the value chain on the economic and social fabric

All economic activity produces primary income as well as secondary and tertiary income through spill-over effects. Primary income is calculated using the added value and the intermediary consumption generated by actors in the value chain. Two techniques can be used to measure the other incomes.

a. Calculation of primary income

Turnover, which is omnipresent in economic and financial reports, is not a criterion of the measurement of the wealth created by a company. Turnover is only a measurement of

financial inflows in the production process. The measurement of wealth is based on the difference between inflows and outflows.

At the economic level, the relevant criterion is value added: this indicator measures surplus production over intermediary consumption. Added value is thus the wealth created by the company during operations.

b. Calculation of secondary and tertiary incomes through a macroeconomic approach

The macroeconomic approach is based on the input-output tables (IOT) of the national accounting system. Indirect incomes are obtained using matrix calculations. To apply this approach, two conditions must be met in the field.

The first is that the IOTs are freely available. There are countries that do not have, at the level of the national accounting system, a very detailed breakdown by activity branch and sub-branch. The documents available are too simplistic to be used in a relevant manner. At times, countries have statistical services that, in addition to the national IOT, establish regional IOTs. But the regional IOT, despite its great usefulness, at times may not be released to the public on the grounds that, for certain activity sectors, there are too many statistical uncertainties.

The second condition is that the economic size of the value chain is sufficiently large in relation to the size of the national or regional economy. If not, it will be impossible to distinguish what relates to the value chain within the IOT. For example, the “poultry” value chain is identified in the IOT of France, but not the “capon” value chain, the data of which are included in the “poultry” chain.

c. Calculation of secondary and tertiary incomes by the mesoeconomic approach

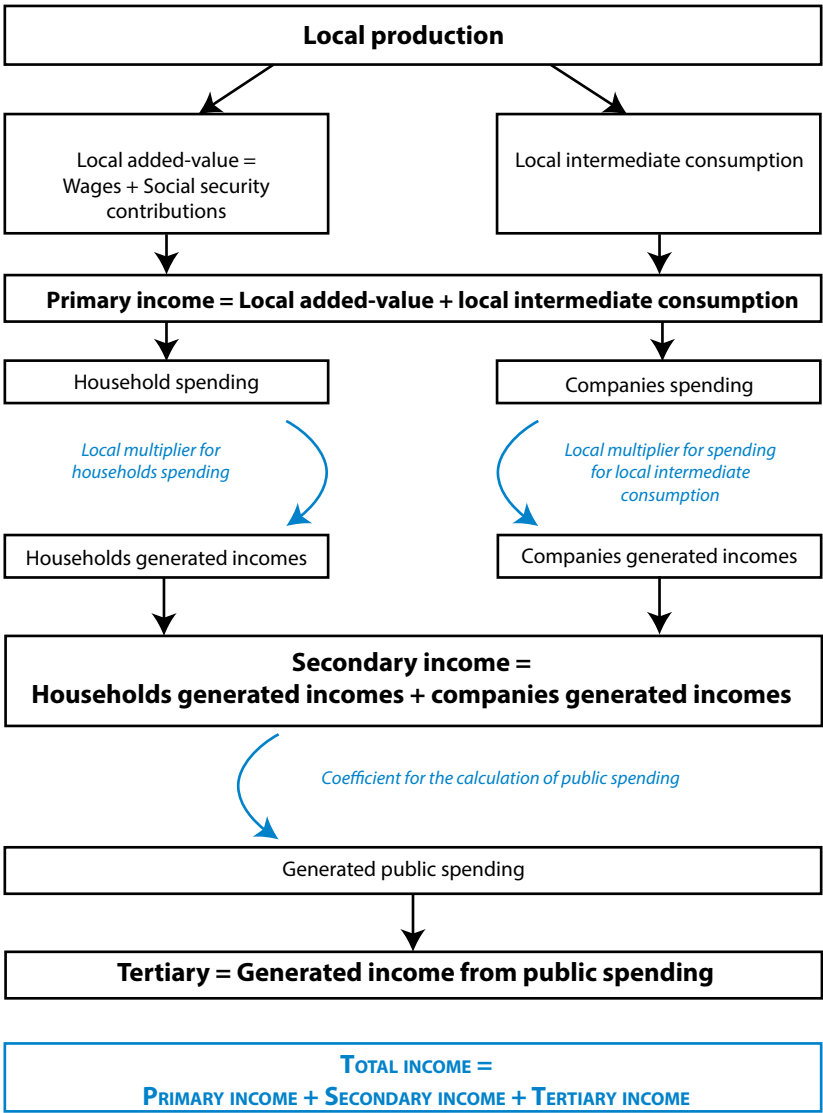
When the study concerns a territory the size of a department or region, one often must use the “supply and demand regional multiplier” method (Garra  , 1994, 2009). This is a method measuring the mesoeconomic effects induced by a project, value chain or investment.

Diagram 16 describes the phenomena that generate income at different levels.

Using the primary income (composed of the direct value added and direct intermediary consumption), the other incomes are calculated with Keynesian regional multipliers. Secondary income is induced by the expenditures of households from direct salaries and by expenditures of companies induced by intermediary consumption, while tertiary income is calculated based on public expenditures induced by the secondary income.

This method may be undertaken on the condition that one has specific information such as household savings, the relative part of local intermediary consumption... This information is collected during the survey from value chain professionals and public services.

Diagram 16. Method of regional multipliers of supply and demand



Source: Centre d'Etude de Projet (CEP)

III. Articulation of the Multiple Capital Model and Economic Accounts

The Multiple Capital Model (MCM) concept presented in Chapter 4 is perfectly suited to building and organising social life cycle Economic Accounts through the associated “uses-resources” balance sheets extended to include economic considerations. They must be reprocessed (section A) with the help of an inventory grid (section B).

A. Reprocessing

We will proceed in two stages. First, aspects of the context, the accounting, and the survey serve to construct the Economic Accounts of each of the organisations in the life cycle. We then do the same for the entire life cycle.

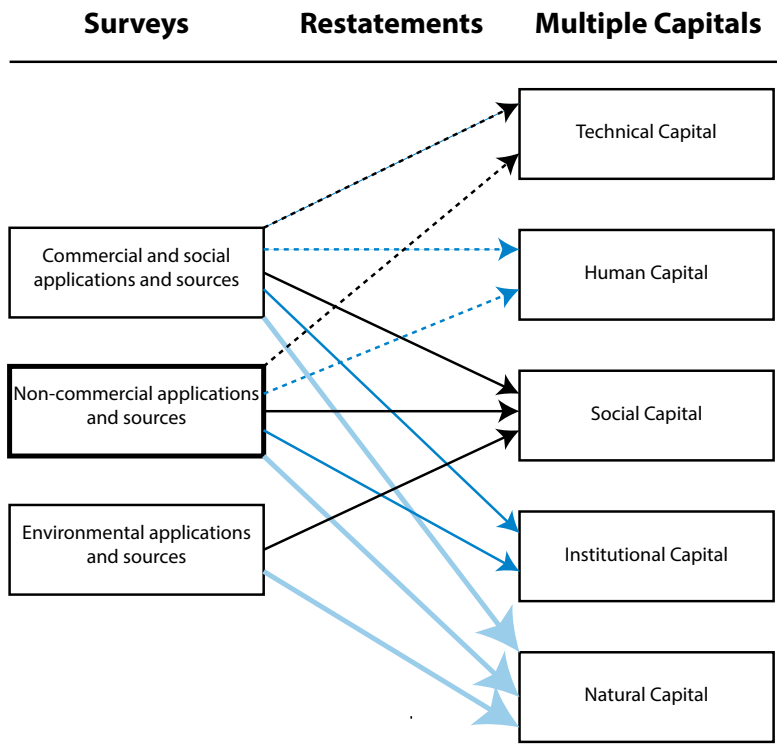
In practice, the practitioner who has done his or her work correctly has in hand not one but three surveys. The first is a survey of uses and market and social uses and resources. The second is a survey of non-market uses and resources, and the third is a survey of environmental uses and resources. The practitioner constitutes the last two through curiosities that s/he observed and remarks made in the field or in consultations with experts. In a second step, results reported by the surveys are reprocessed. This means that we will use MCM to class the results among the five categories of capital.

Reprocessing consists of distributing the contents of the surveys (the synthesis of which forms the Economic Accounts) into Capital Accounts. This process reveals the issues at stake in the operations of a value chain, from the supply of raw materials up to the consumer and the recycling of waste. For example, one remarks that a certain company does not keep records of its consumption of natural assets (a limestone quarry does not count its extraction of limestone). Likewise, it may appear that a company neglects its positive effects such as maintaining the landscape, control of invasive plant species, or soil erosion control. Diagram 17 illustrates the reprocessing procedure.

Treating a company like a production process that transforms inflows into outflows logically leads to considering all growth and development processes like a multiple capital production system. In effect, it is the different quantities of different forms of capital (economic, natural, human, social, and institutional) which are articulated and which characterize the contextual nature of a particular development process.

For the entire life cycle, the processing and data analysis protocols used to move from financial accounting to multiple capital economic accounting are implemented in two stages. First, for each company, there is the inventory and the reprocessing of uses and of market, social, non-market, and environmental resources. In a second step, there is the analysis of the aggregated uses-resources balance sheet at the level of the life cycle for each form of capital.

Diagram 17. Restatement of the data reported by surveys in the capital accounts



The inventory of non-market effects requires one to refer to the elements constituting each class and sub-class of capital (see Chapter 5). For each element selected (for example, “Receive education”), one must define the evaluation criterion and the gradient used. According to the information available, the different evaluation criteria are either a Class of Potential Capacity Effect (receive education without knowing whether it will be used), or a veritable capacity (one sees the person put his or her new knowledge to work).

Finally, it is possible to identify the consumption and creation of capital caused by the envisioned change in the value chain studied. One only will highlight what changes in the alternative situation in relation to the reference situation, and uniquely what is interesting for the interpretation of the study. The differences are assessed or calculated using pathways (see chapter 7). Reading the results (see the example of table 20) allows strategies to be identified that compromise or promote the sustainability of a value chain over the short, medium and long term.

Table 20. Example of map of consumptions and generations of Capital in the project of adding a new organic industry to the current industry, in the country X

Technical Capital		Institutional Capital	
Building	Consumption	Building	Consumption
Construction of new public roads Maintenance of one more school building	Increased use in public infrastructures in the region P. (roads and cargo port)	Creation of new norm about the blue-collar work in the banana industry in the country X	Removing of the old standards about the blue-collar work in the banana industry in the country X
Financial Capital		Natural Capital	
Building	Consumption	Building	Consumption
Cash generation of additional working capital	Liquidation of provisions from the account devoted to fund investments	Set up a new sanctuary to protect biodiversity in the reserve N	Land utilisation, air use, water withdrawal, in the reserve N
Human Capital		Social Capital	
Building	Consumption	Building	Consumption
New hires of 500 workers New social contributions are paid Introduction of new training courses	Dismissal of 30 old employees	Stimulation of the local socio-economic fabric Increased access to local services for the population (hospital)	Increased conflicting sectoral interest for water with local farmers Increased dependency to cultivation of banana

B. Inventory grid of non-market effects

The non-market effects to be inventoried are closely related to the aim of the study. There are as many inventories of non-market effects as there are problem sets. However, all or some of the following questions may be advisable:

- Effects on funding resources?
- Effects on local development (investment and indirect value added)?
- Effects on public resources?
- Effects on the outside equilibrium?
- Effects on unemployment and poverty?
- Effects on ecosystems?
- Effects on natural resources?

- Effects on human health?
- Effects of education on production and productivity?

Tableau 21. Examples of issues to screen the project outcomes

Technical (including financial) Capital	Institutional Capital
<ul style="list-style-type: none"> - Private infrastructures - Public infrastructures - Maintenance of private infrastructures - Maintenance of public infrastructures - Anti-pollution equipments - Waste-management facilities - Financing tools - Financing tools under limited conditions - Subsidies - Other fundings. 	<ul style="list-style-type: none"> - Players information - Consultation of involved third parties. - Creation and promotion of brands and labels - Activity certification according to national or international standards.
Natural Capital	
<ul style="list-style-type: none"> - Underground exploitation - Land exploitation - Air use - Water withdrawals - Pollution. - Biodiversity destruction 	
Human Capital	Social Capital
<ul style="list-style-type: none"> - Employment contract - Collective agreements - Mandatory social contributions - Qualification. - Lifelong training - Working time. - Age composition. - Experience. - Wage. - Sharing of human resources - Employees ownership schemes - Employees social benefits 	<ul style="list-style-type: none"> - Mix of economic activities in rural areas - Unifying approach - Drop in local importations - Territory increased financial independence - Creation of surpluses. - Stimulation of the local socio-economic fabric - Access to local services - Problem transferred from one place to another - Stimulation of voluntary sector - Development of the area. - Conflicting sectoral interests - Patrimony protection - Preventing wastage of resources - Independence and development choices.

The final inventory can take the following form (Table 21). The items proposed are indicative. To proceed to an actual assessment, one must compare the contribution of the alternative situation with the reference situation.

Each assessment criterion must be based on variables that are identified, qualified, quantified and even monetised as much as possible. Once the Capacities relevant to the study are chosen, it is critical to associate each with an evaluation gradient that is relevant, reliable and enforceable against third parties.

In practice, one often runs up against a problem of information access. There are certain effects that cannot be monetised. One then should suggest indices that simultaneously embrace monetary indicators and technical criteria.

Discussion and conclusion

An image from the world of photography will help understand the contribution of MCM in economic and social analysis. The conventional approach is a zoom. It concentrates on the detailed analysis of a relationship between several actors. It focuses on a limited number of assessment criteria (access to inputs and to production factors at the least cost, wealth creation, job creation, work conditions in the broad sense). The multiple capital method is, in contrast, a wide angle that provides a broad overview. It aims to present all of the relationships governing the organization of a value chain. Through numerous and varied assessment criteria, the study maps the chain of value added by taking into account variations in stocks and different capital flows.

The use of MCM throws light on two strategic issues. The first is achieving an understanding of the organization of actors and their development strategies. The complexity of the links between actors highlights interdependent relationships from a new angle. Furthermore, contrary to a conventional approach, the multiple capital method gives a strategic dimension to the production factors which are social capital, natural capital, and institutional capital. A lack of access or a modification of access to these resources can throw into question the development model of the entire value chain.

From the perspective of public interest, this double reading of results enables real development problem sets to be articulated, and therefore to contribute suitable responses to real economic and social needs. At times the conclusions of the two approaches can diverge with regard to the same group of actors. This situation is only paradoxical on the surface. It can be explained by the fact that: i) the fields covered by each analysis are different, ii) the relative weight of results differs according to the two levels of appreciation (the value chain, the reference capital), and iii) the assessment criteria are not the same.

Even when they are contradictory, the results of the two approaches are complementary. They translate the complexity of the links between the production factors associated with a specific economic and social organization.

The practice of SLCA as we have implemented it requires the joint use of proven project assessment methods and a classification based on multiple capital. Paradoxically, the partners involved adhere very easily to the presentation of results with the help of the MCM.

The MCM fills a void between the reality that the study commissioners manage on a daily basis and conventional studies deemed to be both technically complex and “simplifying”.

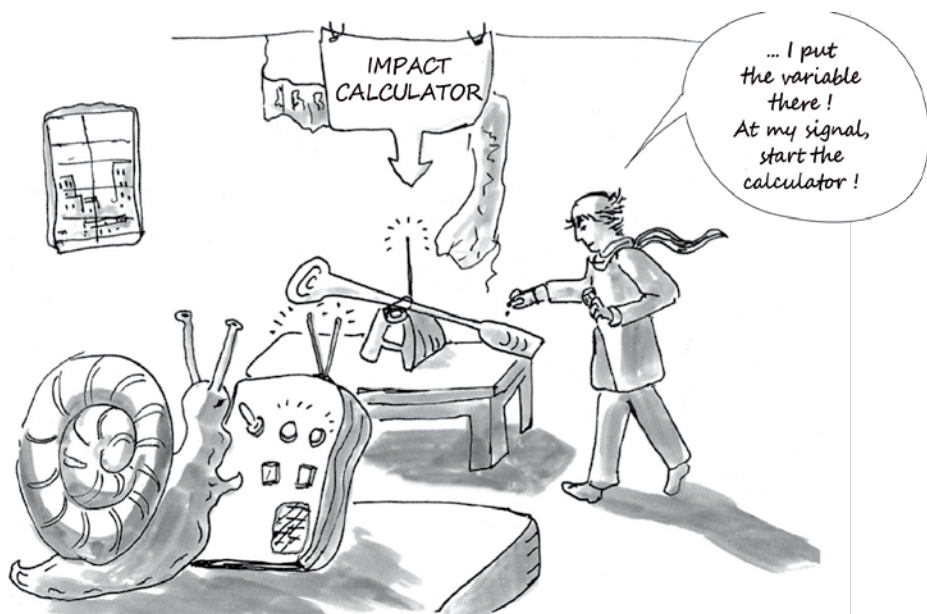
At the end of the study, making a decision nevertheless is not simple. However, by sketching out a broader and richer overview of the forces present, MCM offers decision makers more action levers. The method allows the challenges of their spatial, temporal and effects perimeters to be specified better. Study partners are very receptive to the presentation of results integrating natural, social and institutional capital. This approach offers them a global perspective on the conditions of sustainability. It provides them arguments they can use to respond to multiple lobbies.

SLCA can be applied to both short and long value chains that are or are not industrialized. As in every assessment, one must ensure the fit between the question asked, the perimeters covered by the study and the levels of access to information. It makes no sense to implement a SLCA study for a regional value chain by using national level information. The correct definition of the problem set is a task that determines the effective conduct of the study.

For the moment, the pathways that we have used are type 1. However, we will soon also be able to take into account type 2 and type 3 pathways. Chapter 7 is dedicated to the presentation of these three types of pathways.

References

- Garrabé M. (1994). *Ingénierie de l'évaluation économique*, Ellipses, Paris.
- Garrabé M. (2009). *La valeur d'activité totale d'une opération de développement local – Les multiplicateurs territoriaux : théorie et application*, CIHEAM.
- Lagarde V., Macombe C. (2012). « Designing the social life cycle of products from the systematic competitive model », *International Journal of Life Cycle Assessment*, 18(.): 172-184, DOI : 10.1007/s11367-012-0448-1.
- Malassis L. (1983). « Filières et systèmes agroalimentaires », *Economies et Sociétés - Cahiers de l'ISMEA, série Développement agroalimentaire*, AG, n°17, Grenoble.
- Vanclay F. (2002). « Conceptualising social impacts », *Environmental Impact Assessment Review*, 22: 183-211.



Chapter 7

Catherine Macombe

How can one predict social effects and impacts?

We have been discussing social effects and impacts from the very beginning of this book. In this chapter, we will finally explain how we propose to assess and calculate them. It is precisely the act of assessing and calculating anticipated social effects and impacts that distinguishes social LCA (SLCA) from other social assessment methods. This chapter aims to discuss the different ways of proceeding.

We seek to assess in advance the social consequences of changes in a life cycle. We call these consequences either social effects or social impacts. According to Vanclay (2002), social impacts always are phenomena experienced by individuals or groups of people. They include, for example, variations in health, feelings of confidence, the strength of a social tie felt by a community. However, social consequences cannot always be estimated

in terms of impact, in other words, in terms of the experience lived by individuals or groups of people. Variations in the number of jobs, suppression of trade unions freedoms, reduction in work-related accidents, etc, are social effects. They testify to changes in the social sphere, they are interesting to know and predict, but we do not know how to link them directly to a specific social impact. The procedures that we will describe in this chapter therefore serve to predict either social effects or social impacts that may occur in response to changes in the social life cycle.

Section I explains why one cannot treat impact assessment in the same way as in environmental LCA (ELCA). The three families of pathways (the relations that allow one to predict effects/impacts) that we know will be presented in section II.

I. Can one proceed in the same way as ELCA?

To predict the social effects/impacts caused by changes in a life cycle, one cannot proceed in the same way as one would in an ELCA study.

A. In ELCA, one measures actual flows

In the beginning, ELCA was a question of energy (Grisel and Osset, 2004). Engineers started by measuring the quantity of oil consumed by the production of different products (for example, in making different packaging). They later logically extended this to measure all of the flows of substances that entered and exited a “basic process”, meaning an ensemble of related or interactive activities transforming inputs into outputs (ISP standard 14044, 2006 & 3.11). The flows in question actually exist. Furthermore, *it is possible to identify ALL of the incoming and outgoing flows of material* (including water and energy) involved in the production stage of a certain product. The same is true for the use and recycling stages. The inventory of flows of material is complete. When a new case presents itself, one consequently can apply values measured previously on identical procedures.

We thus know, starting as early as the environmental inventory phase, the consequence related to the functioning of the system. In effect, for each substance X, the difference between the inflows and outflows of X gives the quantity of X consumed by the process. **This consumption is a consequence of the functioning of a life cycle.**

Let us assume that the burning of X releases gas Y in known proportions. One can add up all of the emissions of Y during the entire life cycle to obtain the total value of emissions of Y caused by the functioning of the life cycle. The ensemble of quantities of substances and energy consumed and generated by the life cycle therefore represents the first manifest consequences of its functioning.

From this solid, comprehensive base, LCA researchers then advanced further. Thanks to the work of scientists and experts, they succeeded in establishing cause and effect relations between the magnitude of emission Y (resulting from burning X), and, for example, the growing hole in the ozone layer. This relation, accompanied by all of its terms of use (for example, knowledge of the temporality of phenomena) is known in LCA language as a “pathway”.

These initial results persuaded engineers to define other pathways, including ones for more local effects such as the eutrophication²⁵ of water ways.

B. In social LCA, one cannot make an inventory of flows

It is therefore impossible for SLCA to proceed in the same way! First, “basic process” must be replaced with “organization” as the study subject (see Chapter 3). But this is not the heart of the problem. The difference arises from the fact that it is impossible to make a complete inventory of immaterial phenomena which create or can create social effects when entering or leaving the organization. In the social sphere, there is no equivalent to the substances (carbon gas, nitrogen, etc.) that ELCA works with. We do not have an inventory that could be used as the first approach to the social consequences of the functioning of a life cycle. We do not know the equivalent of substance Y (resulting from the consumption of social substance X!), the emissions of which would be additive over the entire life cycle! Given this situation, how should one proceed?

Randomly identifying characteristics of the reference situation would not help much. One might hope that certain characteristics would turn out to be useful to calculate social effects, but that would involve a lot of effort with little return. This is because while most characteristics of the situation (for example, the number of changing rooms per worker) seem to relate *a priori* to human well-being, we do not know in what measure, nor if it is a general phenomenon.

C. Proceeding in reverse

However, we know that the functioning of life cycles provokes changes other than the consumption or emission of material. These changes bring about social effects. This has been observed for a long time. Scientific and expert knowledge on this subject has been accumulating for some time; one example regards changes in the state of poverty of populations caused by changes in value chains.

Our suggestion is to identify “in reverse” these social effects using the scientific literature. Social effects are provoked by variables which we will call “Z”. The Z variables simultaneously feature two characteristics: they are dependent on an economic activity (the functioning of a life cycle generates economic activity) and they provoke social consequences (effects or impacts) esteemed important in the literature. It is the Z variables, and the criteria that serve to calculate their value, that constitute the inventory of SLCA.

Thanks to the literature, we know that the Z variables provoke effects/impacts. One can thus reasonably estimate that these effects/impacts are likely to emerge once one recognizes Z in a new case.

In SLCA, the inventory thus is customized using the identification of the Z variables noted in the literature. The goal of the inventory is to precisely identify the information required

25. Eutrophication is a phenomenon through which an input of nitrogen into an aquatic land environment (lake) holding large quantities of phosphorus will provoke an explosion in the growth of aquatic vegetation that can lead to the suffocation of the lake and the disappearance of other species (fish, etc.).

(and only this information) to calculate the values taken by the Z variable(s) in the case under study.

The Z variables which assess “work related stress” (imbalance between effort and reward):

- are dependent on an economic activity because, by nature, they describe the stress of workers; and
- are known to provoke cardiovascular diseases.

The Z variables, “job creation” and “job elimination”:

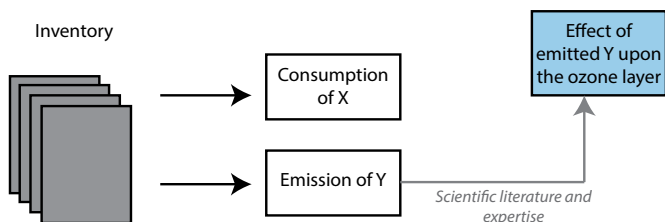
- are dependent on an economic activity; and
- cause important social impacts, even if one does not know how to calculate them (change in health status, etc.).

The procedure (from effects towards causes) is thus the reverse of what we have just described for ELCA (which moves from causes towards effects) as illustrated in diagram 18.

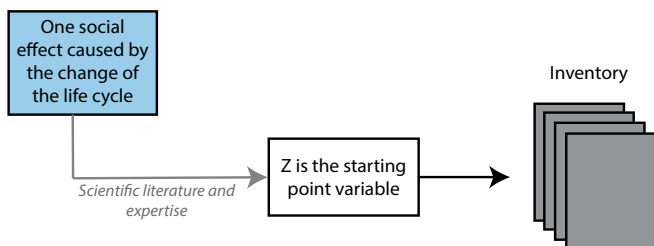
When the relation has been established, the pathway is still not yet complete. One has to specify the conditions that must be respected in the field for its use to be allowed.

Diagram 18. Classical and reverse process to predict the effects/impacts

Standard process for looking for environmental effects in environmental LCA



Reverse process for looking for social effects in social LCA



In sum: In ELCA, inventory flows correspond to consumption and emissions that actually are measured (at least once). For a same substance X emitted at different life cycle stages, the addition of different emissions of X is meaningful: it is the total emission of substance X by the life cycle.

In SLCA, the inventory contains variables (for example, the local value added generated by a life cycle stage) that are relevant because one can link them to effects or impacts. In general, the addition of various values of the same variable over the entire life cycle has no point. The addition, (for example, of different local value added values) does not allow one to calculate an effect/impact because the conditions of the calculation are different depending on the stage and organization.

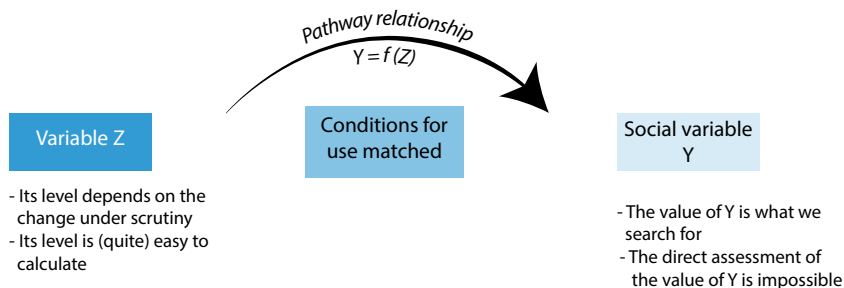
II. Different types of pathways

A. What is a social LCA pathway?

A pathway is a relation or a set of relations – between a variable for which the value is (fairly) easy to obtain and a social effect/impact resulting from this value – accompanied by its/their terms of use. If these conditions are not respected, it is likely that the relation is not applicable. One then foregoes using it.

These relations interest us because they link the Z variables, the value of which is a direct consequence of the activity of a life cycle, with a social effect/impact. These consequences can occur outside the organization that caused them and frequently emerge after a certain length of time. To capture these consequences, it does not suffice to look only within the organization. Diagram 19 describes this process.

Diagram 19. Example of the assessment or calculation process for one social impact in social LCA



B. Seeking pathways

“Authors such as Esping-Andersen (2000) have criticized social indicator research as being merely descriptive since most authors merely collect data without an underlying theoretical conception, which ideally should guide the selection of criteria and indicators. This problem is predominant since social indicators cannot be derived from an overarching societal theory. A widely accepted theory for the measurement of social impact does not exist.” (Carrera and Mack, 2010, page 1031)

Pathways research, like that of social indicators, cannot be left up to chance. The ideal would be to have a consensual theory on what well-being does. It would show us very precisely the impacts that count, and would rank them in hierarchical order. This theory also would give us indices to calculate each impact based on changes in the life cycle. As such a theory does not exist, we must choose one among those that do. In Chapter 4, we presented an economic theory that facilitates the presentation of results. This theory does not yet explain how to calculate effects, and does not rank them. However, it does enable one to verify whether one has forgotten a type of capital (by neglecting to calculate effects that might affect its value), which is already an important step forward.

While waiting for THE overarching and consensual conceptual framework, we move forward in the manner of the researchers who developed ELCA. We use partial theories, meaning theories that concern only one effect/impact at a time, to establish general pathways (type (2) and (3) below).

ELCA researchers were concerned very early on by social impacts. Using multiple hypotheses, they developed models to predict the impact of environmental damage (pollution, radiation, climate change...) on overall human health (without distinguishing the populations affected). These are the “Human Health” impacts of different ELCA calculation tools.

We also have chosen to work first on variations in health because changes in this domain are unanimously recognized as being very important. It is featured in numerous proposals (Jolliet et al, 2004; Norris, 2006; Weidema, 2006; Hutchins and Sutherland, 2008).

We then thought of two types of target populations whose health could be affected by the functioning of life cycles: first the workers engaged in the life cycle, then the general population of the country where a stage of the life cycle takes place. We will return to the example of the workers in paragraph II.C.c.

We have sought to identify the general determinants of the health of a population. Most epidemiologists believe that the determinants of health are socio-economic. More precisely, Wilkinson and Pickett (2010) show that in a poor country, the variable dominating changes in health is per capita annual income. Once a country becomes wealthier, the population’s health is on average worse when wealth is distributed unequally.

The functioning of life cycles generates annual incomes (salaries distributed, purchases from suppliers...) that can have a colossal influence on a given country. These incomes will join the total income of the country, and thus influence the level of average health. This is why we have established a pathway linking the local value added created by a life cycle based on a large value chain (under well specified conditions, including being located in

a poor country) with changes in potential life expectancy of the population in question (Feschet et al., 2012). However, income inequalities also count. This is why a future pathway will link income generation, the increase or decrease of income inequality, and the changes that result in terms of the health of populations.

These two relations can be generalized to numerous circumstances. But this is not always the case. In fact, this depends on the type of pathway. We have identified three forms of pathways.

C. The different families of pathways

In the research conducted to date, we have used three kinds of pathways. It is possible that we will need to develop another family in the future, but for the moment, we have only built these three types of pathways.

The first family includes simple and intuitive relations. It is based on a calculation of the difference in situations before and after a change (for example, the number of jobs created) or between two scenarios (the number of more or less jobs if one chooses scenario A instead of B). In this family, the task involved is almost always predicting social effects rather than impacts.

The second pathways family is that which we mentioned in the preceding paragraph. This pathways family is based on a formalized mathematical relation (largely generalizable) drawn from scientific literature and its terms of use. It allows social impacts to be anticipated.

Lastly, in the third family, the pathway is like a matrix in which we unite all of the known results (qualitative and quantitative) on the relations of interest without being able to model a unique relation. The following three paragraphs present and illustrate these three families.

a. A type 1 pathway: Calculate jobs created/destroyed

The anticipation of social effects discussed in Chapter 6 was done using this type of pathways.

Let us take the example of the calculation of a change in terms of jobs. A study commissioner may be particularly interested in having this effect calculated, or this may serve as intermediary data in the calculation of another pathway.

Of course, we do not know how to go as far as the assessment of the impact felt by people due to the creation or loss of jobs. We can only presume that these impacts will be more or less important depending on the conditions (Jeorgensen et al., 2010).

The following table (22) illustrates an actual case. The calculation of jobs created and lost depends on several technical functions between the level of an activity (here, pig farming) and the number of jobs needed within the value chain or in the companies competing with this value chain. The calculation involves the creation of a farm factory holding 500 sows. It leads to the creation of jobs throughout the value chain, but it destroys jobs in competing, mid-size farms, and in the value chain of these competing mid-size farms.

Table 22. Example of calculation of the number of created/lost jobs by setting one plant-farm

Jobs gains		Jobs losses	
One big farm	2	7 average farms (3 workers in each farm)	21
Farm supplying male and female breeding-stocks to the above farm	0.2	Male and female breeders are raised in the above farms	0
Feed supplier	0.2	Feed supplier	0.2
Industrial slaughter plant	2	Communal slaughter house	4
Total	4.4	Total	25.2

In fact, one can anticipate numerous social effects using a type 1 pathway. The future value of the effect is mainly obtained in two ways. The most commonly used is the discovery of technical functions, based either on the observation of the current situation (in this value chain, x amount of slaughterhouse workers are needed to process y amount of pigs), or as much as possible on likely socio-technical changes (if the value chain is restructured, with the increase in productivity, such a number slaughterhouse workers will no longer be needed to process such a number pigs). The second approach – which is, furthermore, complementary to the first – is to consult experts in the value chain. The inconvenience of these procedures is that it produces functions that generally will not be applicable or transposable to other contexts.

This way of calculating social effects is the most intuitive. To calculate social impacts, one must proceed in a different manner. This is the case of the type 2 and 3 pathways families.

One will note that the criteria, “number of jobs created”, also is an inventory data recommended in life cycle CSR (for example, in the factsheets based on the Guidelines, one finds “number of jobs created”, Benoît and Mazjin, 2009 to 2012). However, there is an important difference in meaning between the two calculations.

In life cycle CSR, it involves the number of jobs created compared to a situation where the life cycle did not exist.

In social LCA, it involves the number of jobs created following a change, so one compares an alternative situation with the reference situation (example in table 22).

b. A type 2 pathway: the wealth created by a life cycle influences the health of a poor population

Nearly 40 years ago, Preston (1975) demonstrated that if one considers a given date, the average life expectancy of the inhabitants of a country is a function of the average per capita income of these inhabitants. Life expectancy is an excellent criterion to assess the health of a population, particularly when one does not have precise data, which is at times the case in developing countries. The average per capita income is calculated by dividing the official monetary wealth created each year (estimated by the Gross Domestic Product) by the number of inhabitants. The curve obtained through representing life expectancy by income level and by country takes more or less the same shape year after year. Diagram 20 shows the form of this curve for 2009.

The functioning of a life cycle and changes within it create additional incomes, or destroy incomes. Considered over several years, this accumulated variation of distributed income provokes changes in the life expectancy of populations. To establish this pathway (between variation in economic activity and variation in potential life expectancy), and thus to allow its generalization to the greatest number of cases possible, we made some additional calculations. We recalculated the relation for all countries and all years together (over 60 years), and in variation (relation between differences). We obtained a valid relation for countries where average per capita income is under \$10,000. Thanks to the literature, we determined the situations in which the relation was valid (for example, there is a lag time between the moment when wealth is created and the moment when life expectancy improves thanks to this extra money). When it was possible, we made the calculations needed to verify if these ideas were correct.

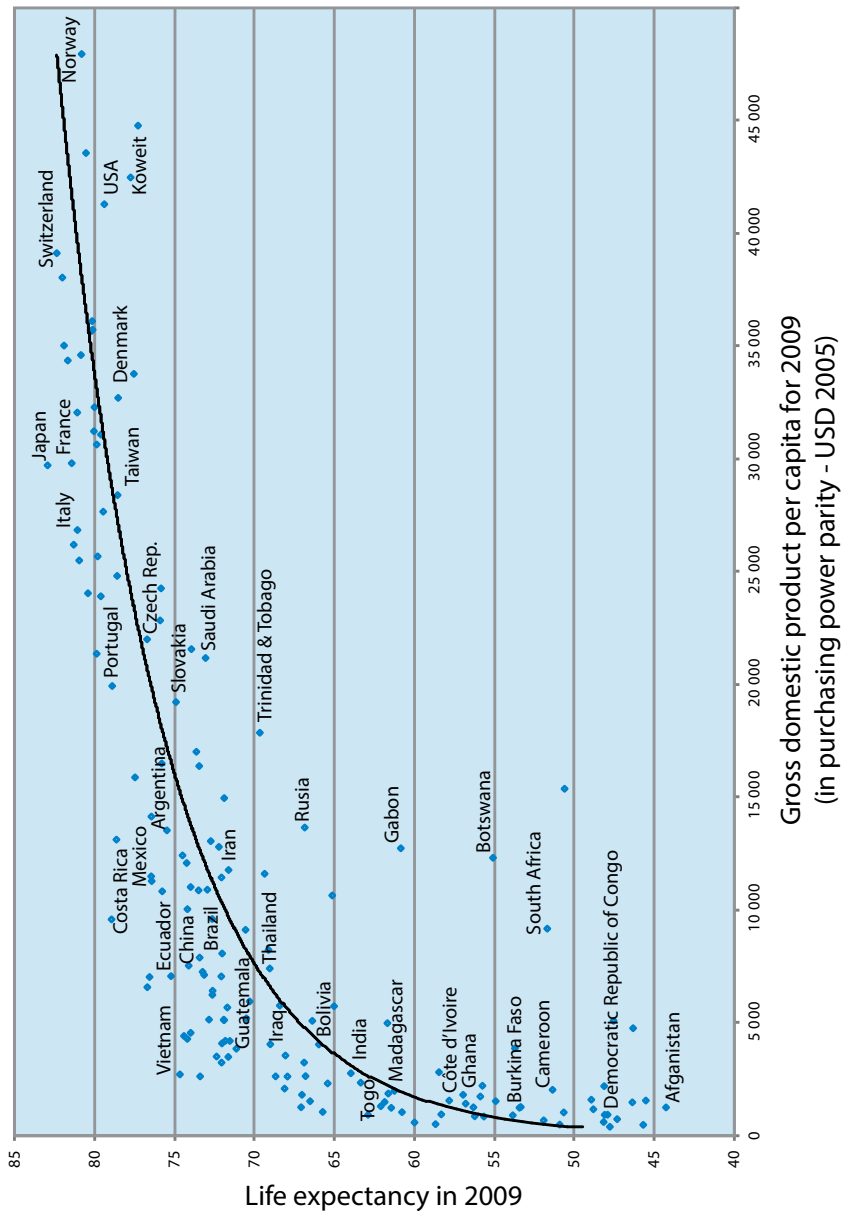
How may one apply this pathway to the life cycle? Let us assume that one very large company, or a very large number of small companies, working on the same product (farms, artisanal workshops), is or are operating in a poor country. Each year, this/these firm(s) produce wealth known in economics as **local value added** (it involves monetary flows that directly benefit the country). One does not count the value of dividends paid abroad, or purchases made from foreign suppliers. This local value added includes the salaries paid to local workers, as well as taxes paid to the government of the host country. All local economic agents benefit to a greater or lesser extent through the ensemble of these channels.

Let us assume that the wealth thus produced represents over 10 years $x\%$ of the Gross Domestic Product of the country. We suggest attributing the same proportion ($x\%$) of progress in life expectancy over these 10 years to the wealth creating activity. Naturally, the calculation is made holding all else constant. A large part of the income must be effectively distributed over the population and the pathway must only concern countries where extra wealth represents a real improvement in the living standards of the poorest of the poor.

As previously mentioned, we currently are working on other general relations of this type. We are studying, for example, the link between income generation, the more or less egalitarian distribution of this income, and infant mortality 15 years later (Bocoum et al, 2013).

Diagram 20. The Preston curve for 2009

Data from Gapminder. Source: Feschet et al., 2012.



c. A type 3 pathway: the matrix of risks linked to job-related stress

The people working in one of the organizations composing the life cycle are sometimes exposed to phenomena that harm their health. They are exposed to noise, dust, pollutants, radiation, etc. But there are other elements of discomfort that are more difficult to grasp and which have not yet been taken into account in LCA. Working at night, having an insecure contract, not being trained correctly for a new job, lack of recognition, all seriously harm health. These are what are called “psycho-social risks”. They are elements contributing to what has been called “work-related stress” based on the models of two well-known authors, Karacek (1990) and Siegrist (1996). The effects are insidious, often chronic and difficult to identify precisely. Work-related stress leads to absenteeism, accidents at work and at home, and, sooner or later, a deterioration of health that is temporary or definitive. It also is often manifested by musculoskeletal disorders and affects a growing number of European workers (European Foundation for the improvement of living and working conditions, 2007).

Before the multiplicity of variables generating stress and the multiplicity of forms of its expression (absence, accidents, health problems, immediate/differed, mortality), it is impossible to establish a single pathway between stress variable(s) and health. One also must take into account the frequent cumulation of stress conditions.

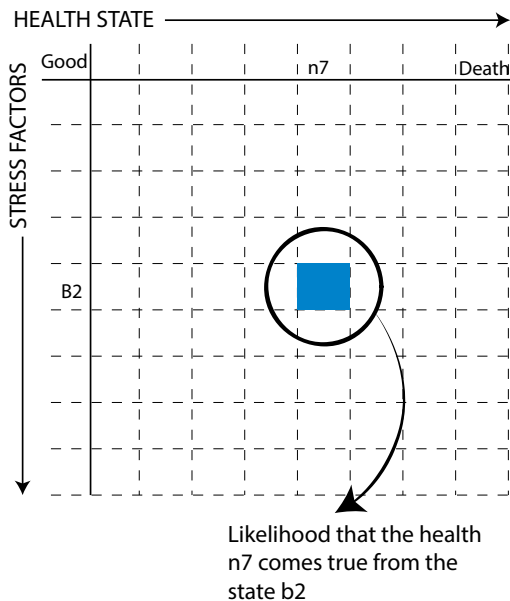
We have therefore chosen to establish a matrix to take into account these relations. The different forms of ailments are on the line going across the matrix and the different stress variables on the column going down. At the intersection, each box holds the findings of scientific research that tested the effect of the stress variable of the line on the health variable of the column. We indicate in the box the qualitative and quantitative results (in general expressed in odd-ratio²⁶) and terms of use. All of the health variables are ranked from least to most serious, which is the most delicate part of the work, and requires formulating hypotheses on the “value” of diseases. The stress factors likewise are ranked from the most benign (at the top) to the most serious (at the bottom). Finally, we obtain a matrix where the least serious problems are listed on the top left and the most serious (frequent and rapid death) on the bottom right.

This matrix allows one to find the probability of a certain health problem occurring given a certain stress. The pathway between work-related stress and health thus is presented as a matrix²⁷ (Diagram 21).

26. Odds-ratios express the probability of occurrence of a certain ailment for a group subject to a risk factor compared to a control group not subject to the risk factor.

27. In fact, several superimposed matrixes are involved due to time-delayed effects. We present the diagram in the form of a single matrix for greater simplicity.

Diagram 21. Example of matrix pathway



The matrix itself only holds the original research results of scientific studies, for example, a study of the effects of risk factor B3 conducted on blue collar Chinese workers in 1980. If one wishes to anticipate the effects of B3 on blue collar German workers in 2013, we do not a priori know if the original relation is really applicable to this new case. We therefore propose a transfer method (Gasnier et al, 2013). It allows one to know if one can transfer the original results to new cases, and to what extent.

The use of the matrix stimulates the discovery of the organisation scenarios which are the least harmful as possible for workers by completely avoiding the most serious stress factors.

Here is how one company could use this matrix. Imagine that this company is considering two possible organisation scenarios, A and B. In the two scenarios, we will count the “groups at risk”, meaning the probable number of workers that would be exposed to one stress factor or another. Table 23 counts the workers probably exposed in the two scenarios.

Table 23. Number of workers exposed to each stress category for both scenarios

Work-related stress factor	Scenario A	Scenario B
B2	380	350
B3	0	1 200
B10	701	0

Thanks to the matrix and the transfer method, it is possible to calculate for each stress factor the probability of the occurrence of a harmful effect on health, and to state how many people in a risk group will be concerned on average. As the health states are ranked in the matrix, the company can weigh the losses of health caused by scenario A and the losses of health caused by scenario B. The choice of one or the other will be made knowing the human cost of work of each of the two scenarios, the calculation depending on the hypotheses chosen. It likewise is possible to go as far as calculating the economic costs caused by these ailments from the perspective of the company and of the society.

Conclusion

To carry out a SLCA study in a given situation, it is necessary to combine the pathways which are available and which are relevant to the case in question. Each pathway produces results regarding different effects/impacts that will be expressed in different units.

Even if one only considers health-pathways, the units will be different from one pathway to another (% infant mortality avoided, days of life expectancy gained in the population, cardiovascular accidents caused by work, etc.). In effect, each pathway has its own scientific logic, and calculates results in relation to a specific health problem. In ELCA, one also uses different units to take into account diverse threats to a good ecological state. Likewise, in SLCA, the diverse units used account for diverse threats to a good health state.

If a large company distributes the local value added on one hand, and has its workers labour under stress conditions on the other, it will have two distinct effects on health. The first is the Preston effect, which improves the average life expectancy of the population, the second is the negative effect on the workers' health. In other words, over the long term the company improves the average health of the entire population while sacrificing its workers. Isn't this phenomenon rather well known and quite wide spread? It is by assembling several pathways that one can begin to grasp the complexity and wealth of a situation.

Today, numerous pathways allow one to predict effects caused by changes in a life cycle on the environment. They have been built over a period of more than 50 years. The ELCA pathways were built one by one based on tested scientific research as well as through consensus between the actors who developed the LCA methods, and often thanks to

expert advice when scientific research was lacking or was not conclusive. LCA researchers sought to build pathways that led to environmental impacts deemed socially important... and that they were able to calculate. Pathways that were important but about which few scientific results were available were developed much later than those which were better documented!

In the same way, SLCA pathways will be developed gradually, one by one, based on social science research as well as on expertise and through a consensus between SLCA researchers. This is an endless process because we will always envision new impacts as society finds new challenges to worry about, and/or when it becomes possible to calculate new ones. However, at a certain point in time, those interested will decide that a sufficient number of methods to calculate social effects/impacts have been developed and tested to provide useful predictions in most standard cases. This will not be a sign that the method is complete, nor that it has envisioned all social problems. It will be a sign that the knowledge available enables one to predict most standard potential social consequences. In so doing, one will be able to rank the different scenarios envisioned in an order of social relevance that conforms closer to reality than a random ranking!

References

- Benoît C. et Mazjin (2009-2012). *Guidelines for social life cycle assessment of products*, factsheet, UNEP/SETAC Life Cycle Initiative, Paris.
- Bocoum I., Macombe C., Feschet P. (2013). « Income inequality and infant mortality: An attempt to identify a new pathway to assess the social impact in LCA », Extended abstract, ID 581 website, SETAC, May 13-16, Glasgow (UK).
- Carrera DG., Mack A. (2010). « Sustainability assessment of energy technologies via social indicators: Results of a survey among European energy experts », *Energy Policy*, 38(2), 1030-1039.
- Esping-Andersen (2000). *Social indicators and welfare monitoring*. Social policy and development programme, paper n°2, United Nations research Institute for Social Development, Geneva.
- European Foundation for the improvement of Living and Working Conditions (2007). *Work-related stress*, electronic format, <<http://www.eurofound.europa.eu/ewco/studies/tn0702028s/tn0702028s.htm>>, août 2013.
- Feschet P., Macombe C., Garrabé M., Loeillet D., Rolo Saez A., Benhmad F. (2012). « Social impact assessment in LCA using the Preston Pathway– The case of banana industry in Cameroon », *The International Journal of Life Cycle Assessment*, 18(2): 490-503, DOI: 10.1007/s11367-012-0490-z.
- Gasnier C., Macombe C., Grimbuhler S. (2013). « Towards the pathway “ stress at work ” », Extended abstract, ID 582 website, SETAC, May 13-16, Glasgow (UK).
- Grisel L., Osset P. (2004). *L'analyse du cycle de vie d'un produit ou d'un service*, AFNOR éditions, Paris.
- Hutchins MJ., Sutherland JW. (2008). « An exploration of measures of social sustainability and their application to supply chain decisions », *Journal of Cleaner Production*, 16(15): 1688-1698, DOI: 10.1016/j.jclepro.2008.06.001.
- ISO (2006). *ISO 14044: environmental management—life cycle assessment—requirements and guidelines*, ISO 14044:2006(E), International Standards Organization.
- Jeorgensen A. Finkbeiner M., Jeorgensen M., Hauschild M. (2010). « Defining the baseline in social life cycle assessment », *The International Journal of Life Cycle Assessment*, 15(4): 376-384, DOI: 10.1007/s11367-010-0176-3.
- Jolliet O. Mueller-Wenk R., Bare J., Brent A., Goedkoop M., Heijungs R., Itsubo N., Pena C., Pennington D., Potting J., Rebitzer G., Stewart M., Udo de Haes H.A., Weidema B. (2004). « The LCIA midpoint-damage framework of the UNEP/SETAC life cycle initiative », *The International Journal of Life Cycle Assessment*, 9(6): 394-404, DOI: 10.1007/bf02979083.
- Karasek R., Theorell T. (1990). *Healthy work: stress, productivity, and the reconstruction of the working life*, Basic Books.
- Norris G (2006). « Social Impacts in Product Life Cycles - Towards Life Cycle Attribute Assessment », *The International Journal of Life Cycle Assessment*, 11(0): 97-104, DOI: 10.1065/Ica2006.04.017.
- Preston SH. (1975). « The changing relation between mortality and level of economic development », *Population studies*, 29: 231-248.
- Siegrist J. (1996). « Adverse health effects of high effort-Low reward conditions at work », *Journal of occupational health psychology*, 1: 27-43.
- Vanclay F. (2002). « Conceptualising social impacts », *Environmental Impact Assessment Review*, 22(.): 183-211.

General conclusion

This chapter recapitulates the main points addressed in the first seven chapters of the book, and suggests avenues of future research. We will not forget to discuss along the way what we have omitted from the book. We will add a short paragraph on the comparison between social LCA pathways and environmental LCA (ELCA) pathways. The topic of pathways is effectively important because as long as one has not used a pathway (whatever the type), one remains incapable of assessing the social consequences of an activity. We end this conclusion with a message for our readers.

Contents of the book

When a value chain doubles its production, when it disappears from a region or supplies numerous jobs, when it distributes new income or distributes income differently, these developments provoke social changes that can be anticipated. This book is an attempt to share our preliminary ideas on how to do so.

- The method proposed is an **alternative to, and a complement of, life cycle CSR**, because it looks at the important social effects/impacts provoked by changes in life cycles, and not at the social performance of companies. The method proposed here does not have the same objectives as life cycle CSR.

- The method is meant for those public and private policy makers who are convinced that in the future, one must adopt the vision of a “social planner” just as one adopts the vision of an environmental planner in ELCA. **Social LCA embraces an omniscient and empathetic point of view.** It knows everything that happens, and takes the point of view of the entire society, or, in other words, of every actor in turn.
- The social life cycle is a convenient representation of reality. But it is not the environmental life cycle. The **social life cycle** of a product or service is composed of special objects (organizations, flows). It is regulated by rules that are different from those that serve to define the perimeter in ELCA.
- The method ultimately will be endowed with a **theoretical framework**. We are still only in the early stages. We have presented here a theory drawn from economics that greatly facilitates the presentation of results because it is a grid that can be used to grasp possible effects/impacts. Other grids are used in other research works, and yet others may be suggested.
- The method already is being implemented in the field through **painstaking investigations aiming to determine the reference state and to anticipate the effects of an envisioned change**. The foundation of the investigation is what is commonly known as a “project assessment” with the understanding that the “project” in this case is one or more changes in a value chain.
- The method requires one to be capable of **estimating the future state that will follow the change(s)**. The social consequences of change will thereby be deduced from the differences between the present and future states. We know three ways to estimate the future state: type 1, 2 and 3 pathways.

Summary of results per chapter and future research avenues

Chapter 1

To date, most methods referred to as “social LCA” do not anticipate the social consequences of changes in the functioning of value chains. These methods aim instead to capture the social performance of companies. However, there are a few methods that calculate social effects by assessing the difference between future states and a reference state. The works of Tiziana Susca (2012) anticipate future effects on the health of New Yorkers using the hypothesis that if the albedo of New York roofs is increased, the ambient temperature will decrease. The research works underway aiming to refine and complete the “Human Health” pathway within ELCA methods are based on the differences between the future state (feared or desired) and a reference state. The pathways leading to the calculation of “Human Health” category impacts explain health problems caused by the environment (pollution, radiation, etc.). Taking into account other types of causes (for example, work-related stress) broadens the possibility to anticipate damage to health. For the moment, the “Human Health” impact is calculated in a global manner. By identifying the target populations that are victims of health problems, precious information is obtained on their potential health (which is undoubtedly a social effect).

Chapter 2

We are betting that more social LCA studies will be commissioned for reasons similar to those that promoted the spread of ELCA. As long as the social method presents the same, (quasi) omniscient viewpoint of a planner that characterizes the LCA spirit, we think it will be increasingly used. The entire LCA community will benefit from a better understanding of how decision makers use the results of studies provided to them. This is a huge research field, one very useful and, for the moment, little explored. Despite its importance, we carefully avoid the subject in this book. In this chapter, we propose four uses of social LCA, drawing inspiration from the four uses of ELCA listed in the ISP standards. We discuss three important qualities that the method must have to serve as a decision support tool: modesty, feasibility, and relevance.

However, the most valuable part of this chapter probably is the last section where the numerous limits of the method are listed. Certain limits will be overcome in the future: a lack of data, for example. But we will never be able to overcome certain other limits. The discovery of classes of “universal impacts” are among these. This choice is contingent on a theory of “what matters in the social world”. Even if it is built on a general social consensus of what matters, it is sure to be fleeting. The corollary is that we always risk missing very important impacts in this case no matter what social theory we use. This observation should not stop us from proposing theories of the social world to justify the choice of effects/impacts to assess.

Chapter 3

To conduct a social LCA study of a change in the value chain of product X, one must be able to identify what part of the real world will change due to the change in X's value chain. Everything cannot be included! One thus must represent only the part of the real world that is of interest. This representation is the social life cycle of product X. It highlights the organizations “sensitive” to the product, meaning those whose social behaviour is likely to change significantly following a change in X's value chain. Immediately, one notes that the competitor of the value chain studied (which also produces product X) is among the sensitive organisations. In contrast, the supermarket that distributes X could not care less what happens to X. It will change nothing with regard to its behaviour. One therefore must admit that the social life cycle of product X includes organizations different from those which compose its value chain!

There appears to be three types of research needed in the social life cycle field. There are currently an insufficient number of models to determine in practice which organizations must figure in the social life cycle depending on the circumstances (competition, political stakes, etc.). There are differences in nature between the impacts created by site construction/deconditioning stages and the impacts caused by routine functioning. Specific research appears to be required on this subject. Lastly, new case studies would further reflection about the three perimeters: spatial, temporal, and the actors affected.

Chapter 4

Chapter 4 is based on the idea that the notion of “sustainable development” is at the heart of LCA. The Multiple Capital Model (MCM) is an economic theory that proposes to explain the phenomenon of sustainable development as the result of a combination of different

types of capital, on the condition that the value of each capital does not cross a critical threshold over time. MCM theory can be enriched with the notion of “Capacities”. Capacities concern all types of capital (not only human capital) by analogy with the “Capabilities” of Sen’s model. Its contribution to social LCA includes: i) clarification of the nature of the inventory descriptors sought because these are all indices of the state of a capacity; ii) a grid that can be used to rank and present results to study commissioners. Of course, this theory does not indicate what matters most in the social world. This is not its objective. MCM shows, however, that everything able to change the value of a class of capital – the field is thus very vast -- merits our attention!

The field of future theoretical study thus remains open, with three avenues of research that are not mutually exclusive. Efforts may focus on the theoretical determination of the nature of universal impacts (those that would be important to consider in every case), if these exist. The proposition of Claudia Reitingier et al (2011) moves in this direction. Future research also could use theories aiming to grasp social phenomena other than sustainable development (for example, globalization...). The question raised thus becomes: how may one build social LCA so that it reflects social effects in this globalization model? A third way of approaching the question is to assume a position of “complex methodological individualism”, meaning to take into account collective phenomena that follow their own laws of self-organization, and extend the Capacities concept from an individual to a collective dimension.

Chapter 5

Chapter 5 is a methodological breakdown of the conceptual framework presented in Chapter 4. It presents a particular approach to social LCA, here referred to as ‘capacities social LCA’. It shows how one may combine a value chain analysis with an approach specific to the multiple capital model. This approach consists of measuring the impact of a change in the life cycle of a product on the transformation of individual endowments into additional functioning capacities. These Capacities are likely to increase or decrease. They are variations affecting the different stocks of capital. This chapter identifies the different classes of potential Capacities effects and presents different methods to estimate these effects.

The approach has not been completely finalized, and numerous propositions are still under debate (survey protocol, outside sources of information, etc.). More specifically, the question of the measure remains open. After having identified variations in Capacities, it is desirable to quantify these changes more precisely. Current estimation methods allow information to be ranked but provide insufficient detail on the actual level of effects. The question thus is: “how may one measure?”, all the while knowing that Sen’s capability concept has its own questions in this regard (Reboud et al. 2008). The interpretation of variations in Capacities must, furthermore be undertaken carefully: the value chain registering the strongest variations is not necessarily the one most advancing the level of well-being of its actors. The starting thresholds must be considered and a strong positive variation starting from a low level of capacity may fail to lead to a higher level of well-being compared to a weak variation starting from a high level. The measure of “acceleration” is thus an important element to consider in the estimation of variations in Capacity. Case studies are underway to test the relevance/feasibility of certain propositions.

Chapter 6

Chapter 6 covers the different practical steps of a social LCA value chain study on a territory. One will notice that it involves a project assessment, but with the original feature of the project here being an important change in an existing value chain.

In reality, the investigations required always surpass the limits of the territory itself out of respect for the omniscient LCA spirit. LCA is effectively interested in all parts of the social life cycle, including those that take place outside the territory of the commissioner of the study. However, the studies mentioned here are comparative, so the “upstream” parts of the value chain, which are said to be unchanged, are not included. This chapter explains the application of the multiple capital model (introduced in Chapter 4) to the reclassing of accounting and economic data obtained during the surveys. To date, the examples presented have only used type 1 pathways. However, when the terms of use of a pathway are amenable, certain future states will be anticipated with type 2 and 3 pathways. For example, it is possible to collect, through a survey on the territory, the data needed to compare situations of different work-related stress provoked by two development options of the value chain. This will render it possible to assess the social impacts on the health of the workers involved in a differentiated manner according to the alternatives.

However, the practical difficulties encountered during studies of “regional” value chains are not the same as those found at the scale of a State or a small company. We have not examined cases like this in our book. This is why the recommendations given in this chapter are not necessarily transferable to other scales.

This chapter is an invitation to carry out more case studies by rigorously specifying and carefully noting all of the hypotheses that the practitioner is obliged to pose as s/he proceeds.

Chapter 7

Impacts are assessed through the difference between a future state and a reference state. The assessment of the future state is undertaken in two different ways depending on the circumstances.

- When the general relations of the social effects are known (changes in poverty, infant mortality, diseases generated by work-related stress, etc.) and the case fulfils the terms of use of the relation, we try to use type 2 or 3 pathways. These are mathematical relations that allow one to calculate the future state of a variable of interest (one translating a social effect) using the variables of the present state.
- When the study commissioners wish to anticipate social effects for which we have no mathematical relations (for example, changes in confidence levels, solidarity, etc.) we conduct ad hoc studies in the field to estimate these changes through diverse means: consulting experts, calculations using technical functions, opinion surveys, etc. We call these ad hoc methods type 1 pathways.

Type 2 and 3 pathways can be generalized to numerous situations, on the condition that their terms of use are respected. On the other hand, they only cover a small number of social effects. Type 1 pathways, however, cover all social effects (with more or less robustness depending on the effect), but they are created for a specific case. Their method of calculation generally cannot be transferred to another case.

Research on future pathways may pursue two directions. It may first focus on developing an overarching conceptual framework that will designate certain impacts as being the most important. Or it may organize itself around the health impacts (because these are unanimously recognized as important) of different categories of affected actors. In both cases, the relations that we can calculate easily will be developed first. However, another five to ten years of research on type 2 and 3 pathways probably will be needed before they are sufficiently numerous for a social effects study to be satisfactorily conducted using only them. In the meantime, we calculate multiple effects by using type 1 pathways. Chapter 6 explained how to use type 1 pathways to investigate diverse and specific effects in a manner that cannot be easily generalized but which responds perfectly to the needs of local study commissioners. Type 2 and 3 pathways, in contrast, can be generalized to numerous cases.

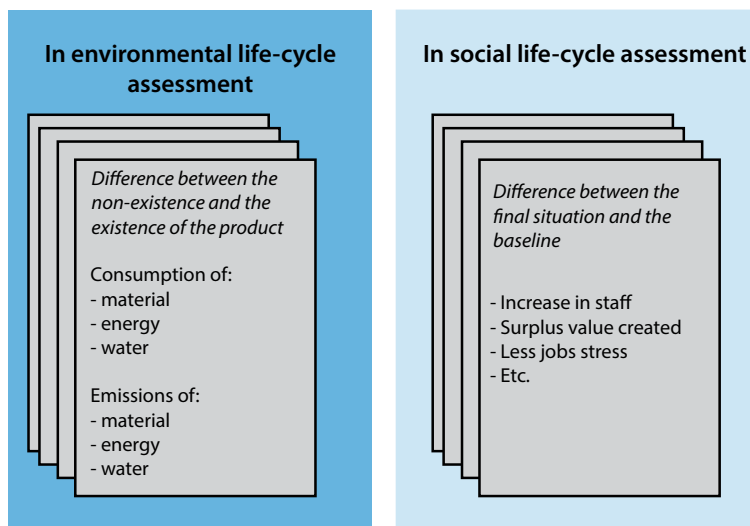
Our aim is to join type 2 and 3 pathways with those of type 1 whenever the former are able to add relevant forecasts.

ELCA pathways and social LCA pathways

Let us consider a project to create a product A value chain. Assume that we build the environmental life cycle and the social life cycle of product A. The consumption and emission of

Diagram 22. Bringing together environmental and social LCA inventories

Inventory of the life-cycle of the product A



materials, energy and water that constitute the ELCA inventory already are an assessment of the raw consequences of the existence of the life cycle.

In effect, a “consumption” and an “emission” are both a difference between two states of the material. An inventory of the reference situation would consist of a table filled with zeros.

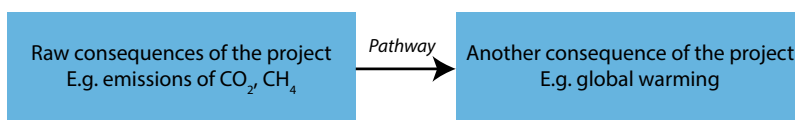
When one conducts a social LCAA study, a situation filled with zeros does not exist because there are always social effects independent of the existence or non existence of a product. One therefore identifies the characteristics of a reference situation (for example, the number of people working in a certain place) and one anticipates the future characteristics (the number of people who will work in a certain place if the project is realized). It is the difference between the two (the value of the future characteristic “less” the value of the reference characteristic) that is the raw consequence of the project. The diagram (22) brings together environmental and social LCA inventories.

We know that in ELCA, researchers, consultants, and study commissioners decided that sometimes one had to go further in the assessment of consequences. They sought relations that existed between inventory elements (such as CO₂ emission) and other consequences of concern linked to this CO₂ emission such as climate change. Consequently, in ELCA, pathways convert variables expressing a raw consequence into variables expressing other consequences. They do not use the descriptor of the starting situation (such as the number of machines emitting CO₂ because this data is already included in the resulting emission of CO₂) as the input variable in the calculation.

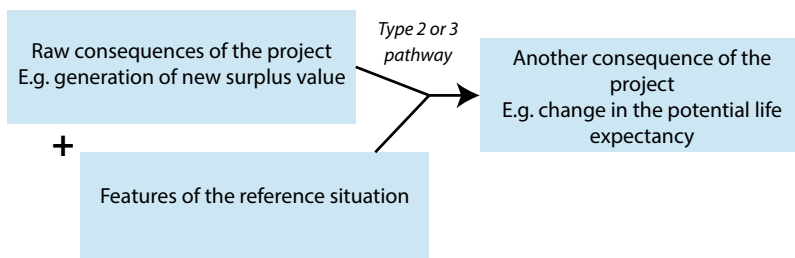
From this perspective, social LCA pathways are not the strict equivalents of ELCA pathways.

Diagram 23. Natures of variables involved in environmental and social pathways

IN ENVIRONMENTAL LIFE-CYCLE ASSESSMENT



IN SOCIAL LIFE-CYCLE ASSESSMENT



Type 2 and 3 pathways use two natures of starting variables. To calculate the future state (for example, the future life expectancy), they combine i) one or several raw consequences of an activity (for example, the value added generated) and ii) one or several descriptors of the reference social situation (for example, the current average life expectancy in the country).

Type 1 pathways generally use descriptors of the reference social situation (such as the number of workers present at a certain place) as the input variable. They apply to this baseline situation a technical function, or expert opinion, to calculate the future state. The diagram (23) illustrates these differences.

Consequently, type 2 and 3 pathways come close to what one calls a pathway in ELCA, but they are not built in exactly the same way. If type 2 and 3 pathways need to include characteristics of the reference situation as input variables, it is because of the relativity of the social sphere (zeros are never everywhere). When one wants to “spatialize” ELCA, meaning take into account the prior state of the natural environment where the impacts occur, one finds oneself in the same situation. In other words, one is obliged to introduce descriptors of the reference state.

Message to our readers

In conclusion, it is clear that this book in no way enables one to conduct all of the social LCA studies needed. For example, we have not discussed how to address the assessment of the social effects on consumers caused by the use stage of a product. We also provide relatively few details on certain essential steps of the method because several detailed publications already are available and more will follow.

We have written this book to present an overview of the ensemble of “pieces” that must be assembled together to conduct a social LCA study. We can easily understand the impatience of the reader – particularly if s/he already needs to conduct such a study! We provide the reader here the conceptual elements to articulate the different problems to resolve, but we do not pretend to provide solutions. The solutions shown here are those that we have chosen in a more or less justified manner. Many other options are possible. The book thus complements numerous peer-reviewed publications which have appeared on SLCA.

This book suggests future scientific research to build an assessment method of social effects caused by changes in life cycles. It thus also addresses itself to those who would like to consider the question of social LCA from a research angle. The method under development will always be imperfect and incomplete. But we must ask this question: is it socially preferable for it to exist, or for it not to exist? In a few years, if we continue our efforts, when companies and governments really wish to assess by anticipation the main social consequences of their choices regarding large value chains, they will have at their disposal (as in ELCA today) some critical pathways. They will look in the face the direct effects of their choices on future life expectancy in poor countries, on the health of workers, on the health or the level of education of consumers, etc. Of course, something always will be missing, and the assessments will remain rough. However, is it better to be able to rely on a limited but transparent method, or to not have one at all? This is why we invite you to contribute to this effort.

We thank you sincerely for your interest and attention.

References

- Reitinger C., Dumke M., Barosevcic M., Hillerbrand R. (2011). « A conceptual framework for impact assessment within SLCA », *The International Journal of Life Cycle Assessment*, 16(4):380-388, DOI: 10.1007/s11367-011-0265-y.
- Susca T. (2012). « Social dimension of a multi-scale life cycle assessment: The urban heat island mitigation », session Social LCA, SETAC 18th LCA Case Study Symposium, 4th NorLCA Symposium, *Sustainability Assessment in the 21st century -Tools, Trends & Applications*, November 26-28, Copenhagen (Denmark).
- Reboud V., Bakshi P., Bouamrane M., Droy I., Dubois J.L., Fertel C., Hoffmann A.M., Kane L., Le Clairche C., Levrel H., di Tommaso M.L., Trani J.F. (2008). « Amartya Sen : un économiste du développement ? », Notes et Documents, n°30, Agence Française de Développement, Paris.

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