21ST INTERNATIONAL CONFERENCE ON ENGINEERING DESIGN, ICED17
21-25 AUGUST 2017, THE UNIVERSITY OF BRITISH COLUMBIA, VANCOUVER, CANADA

CODESIGN OF SUSTAINABLE PERFORMANCE OBJECTIVES IN A FOOD VALUE CHAIN

Petit, Gaëlle (1); Yannou-Le Bris, Gwenola (1,2); Trystram, Gilles (1)
1: AgroParisTech, France; 2: CentraleSupélec, Université Paris-Saclay, France

Abstract

Food value chains actors market products to the end-consumer but most of the time their goals and are strategies not aligned, in particular on sustainability. Today in a context of global warming, resources depletion, and social struggles, it has a special importance for a value chain to prove its commitments and reevaluate its brands image towards the end-consumer and citizen. This case is about the French pork value chain, spanning feed production to food consumption. The study shows that assessing the sustainability performance is a first step in order to then enhance the value chain sustainability and the importance of actor negotiation in finding trade-offs among solutions proposed. From an average value chain, the authors designed and envisioned several improvement scenarios at various steps of the value chain that can be assessed thanks to various sustainability-specific tools. The set of retained sustainability indicators was tested as a support with the actors of the value chain and the results can be the starting point of a reflection to go towards a joint arbitration and a will to share the potential added value brought by the new scenarios.

Keywords: Sustainability, Participatory design, Case study

Contact:
Gaëlle Petit
AgroParisTech
GENIAL (Ingénierie, procédés, aliments)
France
gaelle.petit@agroparistech.fr

Please cite this paper as:
Surnames, Initials: *Title of paper*. In: Proceedings of the 21st International Conference on Engineering Design (ICED17), Vol. 5: Design for X, Design to X, Vancouver, Canada, 21.-25.08.2017.

1 INTRODUCTION

Integrating sustainable perspective in the design process of products/services derived from living systems is a more and more important matter. (Melanie Fritz and Gerhard Schiefer, 2009). Food sector is at the center of stakes easily perceived: availability of food resources for all populations and communities (Techane Bosona and Girma Gebresenbet, 2013), respect for animal welfare (Beth A.Ventura *et al.*, 2015) but also respect for eating habits (Xavier Irz *et al.*, 2013). The complexity of the situations under consideration is intensified by the global trade internationalization and the prices volatility which reinforce the instability for organizations of producers and agricultural resources buyers (Jacques H.Trienekens *et al.*, 2012). In this context for several years the literature review shows an increasing number of publications on the emergence of food value chains (FAO and David Neven, 2014). Value chains are to be differentiated from the concepts of supply chain (Laurent Trognon, 2009). The term "supply chain" is commonly used to designate relations of products and services flows exchanges between companies and commercial actors. The value chain concept implies the willingness of the supply chain actors to set up durable relationships and to develop various forms and intensities of collaboration. This paradigm of value chains makes sense when it comes to increasing the sustainability of end products to be offered to the market (Peter Gibbon and Stefano Ponte, 2008). Indeed, many studies have shown that the final sustainability of a food product is largely defined by the upstream production stages (J. Humphrey; O. Memedovic, 2006). However, the economic pressures exerted by international competition have reduced the economic capacity of upstream food producers to build and improve the sustainability of food production. In a context of intense competition inherent to food markets in developed countries, the idea of increasing collaboration between actors from upstream and downstream in order to offer a more sustainable food offer is highly praised (Tzu-An Chiang and Amy J. C. Trappey, 2007).

The question arises of establishing the nature and intensity of sustainability performance that the actors will seek to achieve together. If the assessment of the environmental performance of a product is already by itself multi-criteria (Damien Craheix *et al.*, 2012; Caroline Sablayrolles *et al.*, 2014) assessing its sustainable performance increases operation complexity. Indeed the number of criteria that have be taken into account to establish the sustainable performance (including environmental, economic and social criteria) of a food offer (since to environmental indicators are added economic and social indicators) (Claudia R. Binder *et al.*, 2010) is not only augmented. It induces different perimeters and temporalities considered for the systems analyzed. Yet if the actors of a value chain want to build together a more sustainable value chain, they must also evaluate their level of performance and define together how they will improve it. In the research works presented here the question of actors' points of view convergence for the assessment and design of this sustainable value chain is raised. This work refers to a class of issues that constitute collective action: decision, rationalization, representation, legitimacy, cooperation, prescription (Albert David *et al.*, 2012). Given each actors expectations and constraints, and thus the variability in the emphasis placed on the various sustainability criteria, is it possible to create solutions from designing the value chain that satisfy all the actors?

2 METHOD AND PRESENTATION OF MODELS USED

The selected value chain for this experimentation is a chain of pork production. The animals are bred, slaughtered and the meat is distributed in France. The perimeter considered here extends from breeding to consumers sales.

2.1 Assessed models

Through an analysis of the scientific literature and expert interviews, the major sustainability issues associated to the value chain are identified: the sustainability hotpoints. These hotpoints are potential impacts (environmental, social and economic) for the stakeholders (representatives of the environment defense, experts, society). The analysis of the activities carried out during the product life cycle leads to assume strong causal links between the sustainability performances of the sector and:

- The composition of the animal feed ration;
- The preparation method of the animal feed ration;
- The managing method of material losses;

- The place of meat cutting.

In the case of feed preparation, differentiating factors considered are the type of preparation from the feed and the dominant raw material. Indeed, there is a great variability in the way the food is prepared, from the farmer who produces all the raw material on the spot to the farmer who buys the whole of his food after an Animal nutrition cooperative. All intermediary cases are possible. Also extreme situations are represented in this work: a breeder who produces all the feed (except the mineral supplement), a breeder who buys all the feed and a breeder which represents a mix between the two, that is, it buys part of the food and produces another part of it. On the other hand, these breeders and cooperatives do not all use the same cereal or the same dominant protein. The choice depends on the nutritional balance of the ration, the cost of the raw materials and their availabilities. The major trends are represented here: maize, soybean or rapeseed dominance according to the methods of preparation.
On the other hand, the shared use of a methaniser between the actors of the value chain induces reuse of wastewater from livestock production, slaughter waste at the slaughterhouse and at the level of the manufacturing plant and waste of various kinds at the store level (food oils, bread and biscuits, meat and meat products, dairy products). This implies a regional implementation of the value chain that is being studied here. Indeed as transport distances are proportional to environmental impacts and costs these transports must be minimized. The electricity produced by this methanizer is re-injected into the livestock farm as well as into the slaughterhouse, enabling the model to operate in a closed loop for part of the electricity. Finally, the place of second cutting of the meat refers to two alternatives: one, existing, takes place in the factory of cutting after slaughter and transport of the lanyards of pig. The punched pieces (roast, sausages, ribs, etc.) are then transported packed to the distribution shop. The second, theoretical, implies that the pork loins are directly transported to the store and cut on the spot in a traditional butcher shop. The actors of the value chain (producer, distributor) validated the interest to assess impacts on sustainability of these alternative solutions. To conduct these assessments several combinations of scenarios have been tested.
The reference model describes a scenario "Buying a complete feed from an animal nutrition cooperative, soy predominant" (<u>scenario D</u>). Ten other scenarios were constructed (outlined below) and evaluated (see next section).

Table 1. The eleven scenarios of animal feeds assessed.

A.	Full on-farm processed feed, rapeseed dominant
B.	Full on-farm processed fee , maize dominant
C.	Full purchased feed, rapeseed dominant
D.	<u>Full purchased feed, soy dominant</u>
E.	Mixed (part on-farm processed and part purchased), soy dominant
F.	Mixed, maize dominant
G.	Addition of linseed to the animal feed
H.	Methanizer shared between actors of the value chain
I.	Second meat cutting directly at the distribution shop
J.	Mixed feed, linseed addition, methanizer shared
K.	Mixed feed, linseed addition, methanizer shared, cutting at the distribution shop

2.2 Assessment of sustainable performance for each model

In order to evaluate the sustainable performance of each scenario, three types of indicators are used: environmental, social and economic. Environmental indicators are calculated using LCA software. The values of the other indicators are derived from the bibliography (especially for raw material costs, transaction between actors or feed preparation facilities operation). The values of the social criteria are also derived from the professional publications or social studies identified in the sector. As a result, the selected indicators do not cover all the social and economic hotpoints recommended to be handled, but those for which data exist, are accurate and traceable. The sensitivity to the scenarios tested was the last criteria retained for selecting the socio-economic data used for the scenario evaluation. As a very large majority of the indicators are impacts, the objective for the actors in a value chain is to minimize their numerical value. Consequently each impact value must therefore be analyzed with “the lower the better" point of view. The set of selected indicators for the experiment is summarized in Table 2.

Table 2. Indicators and associated references.

Indicator	Reference	Unity
Soc1. Carcass pH	Real data from value chain	#
Soc2. Transport duration	Real data from value chain	h
Soc3. Foodmiles / localness (local cultures)	Estimation from bilbiography	%
Soc4. Breeder's welfare (survey)	Estimation from interviews	Score 1 to 5
Soc5. Employees' welfare (survey)	Estimation from interviews	Score 1 to 5
Soc6. Biodiversity (number component /formula)	Estimation from bilbiography	#
Soc7. Sensory evaluation score	Real data from value chain	Score 1 to 10
Soc8. Omega 6 / Omega 3 ratio	Estimation from bilbiography	%
Soc. 9. OGM ratio	Real data from value chain	%
Soc10. Water losses after cooking (Technological quality)	Estimation from bilbiography	%
Eco1. Additional income paid to breeder	Real data from value chain	€
Eco2. Production valorization (losses)	Estimation from bibliography Real data from value chain	%
Eco3. Muscles rate (economical quality)	Real data from value chain	%
Eco4. Waste (losses)	Estimation from bibliography Real data from value chain	%
Eco5. Number of hires	Estimation from interviews	#
Eco6. Additional work hours (-)	Estimation from bilbiography	h
Eco7. Variation of labor cost	Estimation from bilbiography	€
Eco8. Short-term **i**nvestment	Estimation from bilbiography	€/t
Eco9. Long-term **i**nvestment	Estimation from bilbiography	€/t
Eco10. Variation of manufacturing cost per product	Real data from value chain Estimation from bilbiography	€
Env.1. Climate change	Estimation from bilbiography	kg CO2 eq
Env2. Terrestrial acidification		kg SO2 eq
Env. 3 Freshwater eutrophication		kg P eq
Env4. Human toxicity		kg 1,4-DB eq
Env5. Freshwater ecotoxicity		kg 1,4-DB eq
Env6. Marine ecotoxicity		kg 1,4-DB eq
Env7. Agricultural land occupation		m2a
Env8. Urban land occupation		m2a
Env9. Water depletion		m3
Env10. Fossil depletion		kg oil eq

2.3 Indicators weighting by the actors of the value chain

The indicator grid was submitted to some actors in the value chain to define the relative importance they give to each of these indicators. These actors are here considered as "super" experts. Two actors were contributing but their good knowledge of the value chain made it possible to ask them to take the place of more specific actors. On one hand an agricultural cooperative expert answered for farming phase (actor 1) (including breeding, slaughterhouse and transformation). On the other hand the responsible Sustainable Development of the distribution cooperative reported on the opinions of supply (actor 2) and sales activities (actor 3a and 3b). The 3a and 3b distinction comes from the fact that the interlocutor saw two different visions representative of store managers, he then detailed them two. The manager 3a represents the average manager, the most widespread in this type of organization. The manager 3b is more sensitive to the overall sustainability indicators and not only to his economic performance. Initially, each interlocutor was asked to assess the relative importance of the three pillars of sustainable development among themselves. Five scale levels are analyzed: from very high importance (weighting value 1) to very small importance (weighting value 5). Subsequently, the same interlocutors were invited to express their views on the relative importance of the indicators within each pillar. The same scaling factors were applied. These two successive weights were applied to the matrix of the sustainable performance values obtained for the 11 scenarios described in section 2.1. However, to allow the application of these weights the raw performance values of the scenarios have been standardized beforehand. The standardization step has previously asked to carry out a ranking of the scenarios performances between them by indicator (while maintaining the hierarchical order which gives the best solution the smallest numerical value). A synthetic representation of the data processing is given in Figure 1.

3 RESULTS

Table 3 shows the results by indicator for each scenario. The scenarios are classified as shown in Section 2 from A to K and the indicators are ranked from 1 to 10 per pillar: social, economic, environmental. Colours have been added to the table for greater readability. Green tones correspond to the best-performing scenarios by indicators, so these are the lowest values. Red, on the other hand, corresponds to the worst-performing scenarios and the highest values. There are 11 maximum positions for each scenario; some colours (the darkest green or the darkest red) correspond to two positions (respectively the lowest score and the strongest score).

Table 3. Numerical result of each scenario by indicator.

	A	B	C	D	E	F	G	H	I	J	K
Soc1	-5,4	-5,4	-5,4	-5,4	-5,4	-5,4	-5,6	-5,4	-5,4	-5,6	-5,6
Soc2	8	8	8	8	8	8	2,8	8	8	2,8	2,8
Soc3	15,9	35,0	93,5	91,0	48,5	84,9	91,0	91,0	91,0	15,9	15,9
Soc4	-2	-2	-2	-2	-2	-2	-5	-2	-2	-5	-5
Soc5	-2	-2	-2	-2	-2	-2	-5	-2	-2	-5	-5
Soc6	-9,7	-6,3	-6,0	-5,3	-11,3	-7,0	-6,3	-5,3	-5,3	-9,7	-9,7
Soc7	-6,02	-6,02	-6,02	-6,02	-6,02	-6,02	-6,34	-6,02	-6,02	-6,34	-6,34
Soc8	10,7	10,7	10,7	10,7	10,7	10,7	3,8	10,7	10,7	3,8	3,8
Soc9	7,5	7,5	7,5	7,5	7,5	7,5	0,9	7,5	7,5	0,9	0,9
Soc10	15,45	15,45	15,45	15,45	15,45	15,45	13,2	15,45	15,45	13,2	13,2
Eco1	0	0	0	0	0	0	-10	0	0	-10	-10
Eco2	1	5	5,9	5,9	1	5	4,55	5,9	5,9	1	1
Eco3	-60,9	-60,9	-60,9	-60,9	-60,9	-60,9	-61,9	-60,9	-60,9	-61,9	-61,9
Eco4	1	5	5,9	5,9	1	5	4,55	5,9	5,9	1	1
Eco5	0	0	0	0	0	0	-13	0	0	-13	-13
Eco6	0,17	0,25	0	0	0,335	0,335	0	0,5	0	0,5	0,5
Eco7	3	4,5	0	0	6,25	6,25	0	0	0	3	3
Eco8	24	24	0	0	18	18	100	20	0	144	144
Eco9	8	8	0	0	6	6	0	0	0	14	14
Eco10	30	39	0	0	31,3	38,5	0	43,5	0	73,5	73,5
Env1	1 815 474	1 802 227	1 803 321	1 819 355	1 809 714	1 812 392	1 868 506	128 418	1 856 315	128 763	125 533
Env2	8 882	8 727	9 047	9 114	9 204	9 432	10 551	5 023	9 626	6 045	6 031
Env3	81	79	50	59	62	93	118	53	59	114	114
Env4	2 433 286	2 421 922	2 240 300	2 270 810	2 157 413	2 199 149	2 288 051	220 041	2 267 413	104 266	83 417
Env5	3 021	3 106	2 592	2 462	2 707	3 157	2 571	762	2 499	1 066	1 044
Env6	916 151	904 334	776 651	734 365	707 373	712 825	760 476	101 246	744 318	72 952	55 471
Env7	501 602	415 184	236 829	325 076	318 773	274 965	427 068	325 076	314 857	422 840	422 692
Env8	614	660	368	192	210	210	216	192	139	203	118
Env9	29 715	29 002	12 639	9 973	14 345	26 875	9 843	3 170	9 560	7 449	7 432
Env10	549 687	549 122	550 504	552 019	547 919	552 210	567 459	18 905	565 505	16 379	15 292

Table 4 shows the weights given by the actors in the value chain in response. They were initially asked for their opinion on the relative importance of the three pillars between them: environmental, economic and social. In the second stage, the actors spoke about the relative importance of indicators within each of the three pillars. The importance of the pillars is given in the vertical boxes for each of the actors: agricultural cooperative, logistician, store 1 and store 2. The weight of the indicators is given in the horizontal boxes for each of these actors. In total, five distinct importance groups appeared and are represented by a colour code from factor 1 to factor 5.

Table 4. Weighting given by the actors of the value chain

	Actor 1		Actor 2		Actor 3a		Actor 3b	
Soc1	4	2	3	5	3	2	2	2
Soc2		2		5		2		2
Soc3		5		2		3		3
Soc4		2		3		3		3
Soc5		2		3		3		3
Soc5		5		3		3		3
Soc6		4		5		2		2
Soc6		4		5		2		2
Soc7		4		5		2		2
Soc8		4		5		2		2
Soc9		1		5		2		2
Soc10		3		3		5		5
Eco1	1	1	2	5	2	2	2	2
Eco2		3		3		5		5
Eco3		4		2		2		2
Eco4		3		2		2		2
Eco5		3		2		2		2
Eco6		4		3		2		2
Eco7		4		3		5		5
Eco8		2		5		2		2
Eco9		2		2		4		4
Eco10		5		4		4		4
Env1	4	5	5	4	5	2	2	2
Env2		2		4		4		4
Env3		5		2		2		2
Env4		5		2		2		2
Env5		4		4		2		2
Env6		4		4		2		2
Env7		4		4		4		4
Env8		4		4		4		4
Env9		2		5		2		2
Env10		2		5		2		2

Finally, Table 5 gives the final single scores for each of the scenarios studied and for each of the weights proposed respectively by the players in the value chain. Only the three best cases (green, lower values) and the three worst cases (red, higher values) are identified for each of the given weights. In dark green for example, scenario H is the most efficient for actor 1 whereas scenario G is the more efficient for actor 2 and for unweighted calculation, all indicators with equal weight. In dark red, scenario B is the worst-case scenario all actors excepted for actor 1. Scenario F is the second worst-case scenario for all actors excepted for actor 1.

Table 5. Aggregated indicators value considering all different data acquisition and processing stages

	A	B	C	D	E	F	G	H	I	J	K
Actor 1	35,01	34,87	31,68	31,76	28,60	34,47	32,88	23,99	31,76	20,12	16,85
Actor 2	40,32	39,64	33,08	34,66	32,54	38,07	34,68	27,13	33,90	24,31	20,68
Actor 3a	30,64	30,26	26,78	28,43	24,45	30,31	29,15	19,63	28,73	17,32	14,29
Actor 3b	16,16	16,80	14,73	15,38	13,88	16,76	14,41	12,58	15,50	10,51	9,30
Unweighted	3,11	3,28	2,78	2,84	2,74	3,21	2,61	2,56	2,82	2,13	1,92

4 DISCUSSION

The subject of this research is centred on the possibility for the actors of a value chain to define in common criteria to assess the sustainability of their activities. The first result of this experimentation is the difference of weighting given by each actor at the sustainable pillars and criteria (Table 4). For all of them economic criterion is the more important but for agricultural cooperative the difference of weighting between economic criterion and other criteria is stronger. The important economic troubles shared by the agricultural sector explain this particular position.

The results of the table 5 highlight the three best (gradient of green) and the three worst cases (gradient of red) for each actor interviewed. These results show first of all that there is no strong contradiction between the actors. In other words there is no scenario into which the best triplet for one actor is the worst triplet for another actor. Indeed, the scenarios A, B and F (full on-farm production of the feed / with rapeseed or maize dominant and mixed feed with maize dominant) are the worst triplet for all the actors. Scenarios H, J and K (methanizer shared / mixed feed, linseed addition, methanizer shared / mixed feed, linseed addition, methanizer shared, cutting at the distribution shop) are the best triplet with the same ranking for all actors. There is absolutely no contradiction in theoretical improvement solutions, while there are minor contradictions (within the worst triplet) in existing theoretical solutions. It is important to recall here that these rankings were performed without actually presenting the results to the actors. These last provided only the hierarchy of their weighting of indicators and accepted the types of solutions that needed to be assessed.

There actually are cases where some scenarios are unanimous but this apparent consensus conceals a form of complexity that will be detailed in further work. Indeed the three scenario with methanizer shared seem systematically more efficient than all the others but their economic performance remains poor due to the investment required. However given the weighting that was applied according to the actors without having access to the different scenarios performance results, these poor results are not sufficient to disadvantage these scenarios. And yet the individual economic values for initial indicators at the beginning of the data processing are very bad and they could have been expected to severely disadvantage the three considered scenarios. As a result, it is doubtful whether the actors of the value chain would have been interested in these scenarios. In others words, these three scenarios are surely the solutions that best fit the values the actors want to pursue, not necessarily those they can afford. In any case it is clear that this must be verified in additional work. To go further choosing one of these solutions, given its bad economic situation, the results comparison matrix becomes a common reflection frame to question about who "pays" the related investments and truly start to codesign a more sustainable value chain. If the discussed solutions, i.e. sharing a methanizer, clearly improves the global sustainable performance score of the value chain and according to the declared preferences of the actors of this chain, it is a starting point to establish which kind of economic solidarity is to develop between them.

A final remark can be made about grouping solutions by category of actor. Indeed, the results of the second store manager are very close from the unweighted ranking. This is explained by the fact that the choice of this actor leads to the equal consideration of the three pillars (environmental, economic and social) of the selected indicators. These two classifications give an indication of the scenarios chosen when none of the three pillars (and in particular the economic pillar, often widely promoted by the actors) is favored. These solutions, while representing a different equilibrium from that which is considered as the most expected, provide a good basis for reflection on what may be a more sustainable value chain.

The highlighted elements make it possible to answer the question asked. There are, in fact, areas of common satisfaction between the actors and certain scenarios can be selected as performing by several actors or all the actors. On the other hand, to arbitrate more in detail between scenarios that do not constitute extremes or to arbitrate among extremes triplets, discussions and negotiations between actors will be necessary. If the upstream and the downstream of a value chain do not communicate or do not cooperate, the risk that some actors will implement improvement solutions that do not satisfy other players in the value chain is not negligible.

This study showed that some scenarios tend to impose themselves by their "spontaneous" performances. It is always interesting to highlight it because these choices can be the subject of a consensus quickly. For other cases, the actor's joint decision seems to be more important. Thus the actors of the same value chain, that is to say actors predisposed to work together on the sustainability of their practices and the products they put on the market and for which they are responsible in the eyes of the consumer, have a real interest in sharing tools, common representations of their global system in order to better understand the arbitrations that can be joined. This is the case for advancement in the increments to be discussed for continuous improvement. These are therefore iterative actions, both from design and management of the sustainability of organizations practices and products. Even if the weights granted by the actors are different, the ranking order of the different scenarios is not so different. Finally, stakeholders could reach agreement and conciliate on the best and worst scenarios to be implemented as part of an enhanced desired sustainability of the value chain. The remarks made above concerning the economic performance of the best solutions (sharing a methanizer) show the importance of the negotiation between actors to allow local arbitrations. The poor results of selected economic indicators penalize certain actors in particular those of the upstream (i.e. breeder). It is possible to propose trade-offs for the four solutions including the sharing of a methanizer. Nevertheless, the field of experimentation chosen here is special since the players in this value chain already know each other and seek to build together more sustainable approaches. We can therefore assume that they already share common values and that this explains the coherent rankings. It has been shown that a compromise can be constructed, and this result differs from what is usually read in the literature. It is much more frequently a focal actor that gives the lines of conduct to be followed by everyone.

Many new questions are coming out from this study. Indeed it would be interesting to measure how and how much results change if treatment stages are modified. Further works on sensitivity study is expected for example looking at the impact of changing some aggregation data elements or discuss whether one of the actors over or under evaluates his weighing.

5 CONCLUSION

This study has shown that measuring the performance of different solutions, classifying them according to a weighting of pre-established sorting criteria allows decision-makers in a value chain, therefore predisposed to work together, to find a consensus on sustainability alternatives for products and practices. It is important to specify here that the various actors interviewed expressed their respective weighting for the various sorting criteria before the respective performances of the different scenarios were presented to them. According to Simon (James Gardner March and Herbert Alexander Simon, 1965), economic rationality and optimal choice imply that all information (choice possibilities) is available, that the decision-maker can measure the performance linked to each of the possibilities and that he can classify the performance in function of a predetermined order of preference. Within organizations, social actors cannot find an optimal solution because of their cognitive and temporal limitations. The human being can focus his attention on only a limited number of problems and solutions at the same time. To decide an action, he proceeds sequentially and iteratively by comparing the possible solutions to what it considers to be minimum criteria of satisfaction. In general, the decision-makers will stop their choice to the first satisfactory and sufficient solution that emerges. A future study could therefore be the measure of the different choices of the actors when they are aware of the different scenarios performances compared to their blind choice, in other words the sorting criteria weighting before they even know the consequences of their choice.

REFERENCES

Binder, C.R., Feola, G., Steinberger, J.K.. (2010), “Considering the normative, systemic and procedural dimensions in indicator-based sustainability assessments in agriculture”, *Environmental Impact Assessment Review* 30, 71-81.

Bosona, T., Gebresenbet G. (2013), “Food traceability as an integral part of logistics management in food and agricultural supply chain”, *Food Control* 33, 32-48.

Chiang, T-A., Trappey, A.J.C. (2007), “Development of value chain collaborative model for product lifecycle management and its LCD industry adoption”, *International Journal of Production Economics* 109, 90-104.

Craheix, D., Angevin, F., Bergez, J-E., Bockstaller, C., Colomb, B., Guichard, L., Omon, B. (2012), “Multicriteria assessment of the sustainability of cropping systems: A case study of farmer involvement using the MASC model”, *10. European IFSA Symposium : Producing and reproducing farming systems. New modes of organisation for sustainable food systems of tomorrow*, Aarhus.

David, A., Hatchuel, A., Laufer, R.(Eds.), 2012. *Les nouvelles fondations des sciences de gestion : éléments d'épistémologie de la recherche en management*. Presses des Mines.

FAO and Neven, N. (2014), “Developing sustainable food value chains - Guiding principles”.

Fritz, M., Schiefer, G. (2009), “Tracking, tracing, and business process interests in food commodities: A multi-level decision complexity”, *International Journal of Production Economics* 117, 317-329.

Gibbon, P., Ponte, S. (2008), “Global value chains: from governance to governmentality?”, *Economy and Society* 37, 365-392.

Humphrey, J., Memedovic, O. (2006), “Global value chains in agrifood sector”, United Nations [UN] Industrial Development Organization

Irz, X., Leroy, P., Requillart, V., Soler L-G., Allais, O. (2013), “Identifying sustainable diets compatible with consumer preferences” *134. EAAE Seminar : Labels on sustainability : an issue for consumers, producers, policy makers, and NGOs*, Paris, p. 22 p.

March, J.G., Simon, H.A. (1965), “Les organisations. Problèmes psycho-sociologiques”, *Revue Française de Sociologie* 6, 111.
Sablayrolles, C., Busset, G., Belaud, J-P., Montréjaud-Vignoles, M. (2014), “Multicriteria analysis for life cycle sustainability assessment of virgin olive oil production : a case study”, *LCA Food 2014*, San Francisco.
Trienekens, J.H., Wognum, N., Beulens, A.J M., Van Der Vorst, J. (2012), “Transparency in complex dynamic food supply chains”, *Advanced Engineering Informatics* 26, 55-65.
Trognon, L. (2009), “Filière, supply chain et stratégies : de la différenciation à la distinction”, *Economies et Sociétés, Développement, croissance et progrès* 43, 1879 - 1896.
Ventura, B.A., Von Keyserlingk, M.A.G., Weary, D.M. (2015), “Animal Welfare Concerns and Values of Stakeholders Within the Dairy Industry”, *Journal of Agricultural and Environmental Ethics* 28, 109-126.

ACKNOWLEDGMENTS

This work was supported by the AgroParisTech Chair Sustainable Demand Supply Chain.