Chapter 9
An Inductive and Multidimensional Approach to Sustainable Innovation: Evidence from Multiple Case Studies

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Abstract Governments, businesses, researchers and civil society actors need to assess multiple critical issues (e.g. barriers, drivers, opportunities and threats) and put in place diverse management initiatives in order to effectively foster sustainable innovation (SI) processes and achieve multi-systemic transformations. As part of a large European Union-funded mobilisation and mutual learning (MML) effort to advance knowledge and develop a framework for the assessment and management of SI (CASI-F), a broad sample of critical issues have been identified through the mapping and analysis of over 500 sustainability-related initiatives, including product, service, social, organisational, governance, system and marketing innovations. An inductive analysis of these issues served to identify a set of 50 critical factors, which helped to develop a SI management framework structured around ten key aspects and four dimensions. Given the multidimensional and open nature of SI, the issues were also mapped, in parallel, from technological, economic, environmental, political, social, ethical and spatial perspectives. The study thus resulted in a number of practical considerations and lessons for SI management.

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9.1 Introduction

Sustainable innovation (SI) differs from other areas of innovation in that SI adopts a much wider system view and its activities typically address issues the solution to which demands observing the problem from multiple points of view. For this reason, SI also requires looking for insights from multiple stakeholders.

To understand and provide advice on how to manage sustainable innovation, SI analysts need to make assessments and propose actions from technological, social, economic, ethical, political, environmental and spatial (TEEPSES) perspectives (Popper et al. 2016).

In addition, the analysis of SI demands structured approaches that look for the profound motivations of the innovation process, whilst taking into consideration critical issues that influence the success and sustainability of innovations, which the innovators are likely to be confronted with during the lifetime of their innovations. In CASI, mapping practices, outcomes and players of multiple SI processes proved useful to identify these key aspects. The study described in this chapter demonstrates how a methodological strategy that combines and applies an inductive and multidimensional analysis to SI critical issues serves to generate practical recommendations for SI assessment and management. After this introduction, Sect. 9.2 offers an overview of the background for the analysis presented in the chapter. Then the inductive method to analyse critical issues and resulting SI management dimensions are discussed in detail in Sect. 9.3. This is followed by a description of the multidimensional method for the analysis of critical issues in Sect. 9.4. Finally, some 60 SI management recommendations and lessons are shared in Sect. 9.5, followed by some conclusions and final remarks in Sect. 9.6.

9.2 Background

The objectives of the 'state of the art of sustainable innovation' work package in the CASI project (Popper et al. 2016) were (1) to position sustainable innovation within the framework of the Horizon 2020 Societal Challenge on 'Climate Action, Environment, Resource Efficiency and Raw Materials' of the European Commission and (2) to set the foundations for the assessment and management of sustainable innovation. In order to better position the concept of SI, the CASI project developed a comprehensive methodology to review areas of research related to Climate Action, Environment, Resource Efficiency and Raw Materials, as well as to evaluate selected case studies of sustainable innovation initiatives mapped in CASIPEDIA.[1] Incorporated work and perspectives from environmental scholars (Carrillo-Hermosilla et al.

[1] A database of SI initiatives mapped during the CASI project. Experts and supporters of sustainability agendas can access the CASIPEDIA platform to learn from different initiatives. CASIPEDIA also facilitates the analysis of practices, outcomes and players of different types of SI.

2009, 2010; Charter and Clark 2007; Porter and van der Linde 1995; Fussler and James 1996; Rennings 2000; Andersen 2002; Geels 2002, 2005; OECD 2005, 2009; Kemp and Arundel 1998; Kemp and Pearson 2008; Oltra and Saint Jean 2009), European Commission environmental research programmes (FP5, FP6, FP7 and Horizon 2020) and multiple stakeholders mobilised in CASI (innovators, citizens, etc.) served as the basis for the project and was used to propose a working definition of sustainable innovation as '*any incremental or radical change in the social, service, product, governance, organisational, system and marketing landscape that leads to positive environmental, economic and social transformations without compromising the needs, welfare and wellbeing of current and future generations*' (Popper et al. 2016, see also Sects. 1.1–1.3).

To put the basis for assessing and managing sustainable innovation, we undertook a systematic set of mapping activities that included an inductive analysis of more than 500 cases and a multidimensional analysis of SI critical issues, in order to extract lessons for SI managers and to guide the conception, design and development of the methodological framework known as CASI-F (see Sect. 1.4; Popper et al. 2017). The nomination and mapping of the SI initiatives against practices, outcomes and players-related criteria generated a resourceful database[2] of critical issues related to SI initiatives from Europe and the world. (Most of these, at the time of writing, remain publicly available in an online platform called Ideas Bank).[3] Critical issues refer to technological, economic, environmental, political, social, ethical and spatial (TEEPSES) issues that have the potential to shape the present and/or future of a given sustainable innovation. These critical issues can be barriers, drivers, opportunities or threats. Over 1500 critical issues were identified with the support of key stakeholders—most importantly innovators, but also sponsors, supporters, beneficiaries and users who were given access to the online mapping and knowledge co-creation platform (CASIPEDIA) and invited to contribute to the evaluation of the SI cases.

9.3 Inductive Method to Analyse Critical Issues

Inductive methods are frequently utilised in research to devise ground theories that help explain complex societal problems. As pointed out in 'Inductive Reasoning and Bounded Rationality' (Arthur 1994), '*as humans we are only moderately good at deductive logic, and we make only moderate use of it. But we are superb at seeing or recognising or matching patterns—behaviours that confer obvious evolutionary benefits. In problems of complication then, we look for patterns; and we simplify the problem by using these to construct temporary internal models or hypotheses or schemata to work with*'. In this vein, we decided to take an inductive approach to the

[2]CASIPEDIA URL: http://www.futuresdiamond.com/casi2020/casipedia/

[3]Ideas Bank URL: http://www.futuresdiamond.com/casi2020/ideas-bank/

simplification of the problem of making sense of such a large number of critical issues, in order to arrive at a more manageable set of what we called 'critical factors'. The process included the following steps:

- SI practices were analysed to identify those factors that have the potential to increase or decrease the chances of success of the innovation processes. The outcome of this exercise was a preliminary list of critical factors.
- A content analysis software was then used to support and facilitate a preliminary clustering of the previously identified critical factors. This task also included word counting and critical analysis of terms.
- Finally, three focus groups of experts were held at the University of Manchester to discuss and agree on definitive clustering criteria. As a result, two levels of clustering were defined. The description and the name of the critical factors were also defined through these discussions.

9.3.1 Critical Factors, Key Aspects and Dimensions of Sustainable Innovation

The above-mentioned analytical process led to the identification of a set of 50 *critical factors* (Table 9.1) that were clustered into four management *dimensions of sustainable innovation* (SI context, people, resources and impact) and ten related *key aspects* (see also Fig. 1.9). The 'context' dimension includes key aspects of SI, such as momentum, foresight, resources and actors' mobilisation; the 'people' dimension covers the aptitude and attitude aspects of stakeholders; the 'process' dimension refers to SI catalysing and fostering aspects; and the 'impact' dimension includes the SI capacity of transformation and sustainability.

From a multi-stakeholder mobilisation and mutual learning (MML) perspective, what is worth highlighting from the process of analysing critical factors is that, on the one hand, several stakeholders associated with the mapped SI initiatives have learned how to identify and prioritise those critical issues affecting the sustainability of their innovation process. On the other hand, the meta-analysis of all these critical issues helped us recognise important patterns or 'critical factors' that we used to learn about managerial needs and shape the construction of a framework of SI management 'dimensions' and relevant 'key aspects'.

The following subsections provide short descriptions for each of the four SI management dimensions, together with examples showing how the 50 critical factors relate to the ten identified key aspects.

Table 9.1 Framing critical factors, key aspects and dimensions of sustainable innovation

Dimension	Key aspect	Critical factor
1. Context	1. Momentum	Political setting
		Exemplars
		Problems
	2. Foresight	Horizon scanning
		Strategic targets
		Trends
	3. Resources	Geographical setting
		Funding sources
		Infrastructure
		Data sources
		Scalability
	4. Mobilisation	Public participation
		Community support
		Institutional support
		Champions and facilitators
		Public–private partnerships
		Research and education engagement
2. People	5. Aptitude	Leadership
		Charisma
		Creativity
		Knowledge
	6. Attitude	Enthusiasm
		Empathy
		Involvement
		Commitment
3. Process	7. Catalysts	Comprehensibility
		Crowdsourcing
		Learning by doing
		Supportive services
		Absorptive capacity
		Ex ante impact evaluation
		Piloting and experimenting
	8. Fosterers	Incentives
		Coordination
		Networking and synergy
		Knowledge management
		Intellectual property management
		Ex post evaluation and monitoring
		Communication and dissemination
4. Impact	9. Transformations	Stakeholder and community development
		Knowledge-based products and services
		Values and lifestyle changes

(continued)

Table 9.1 (continued)

Dimension	Key aspect	Critical factor
		Multi-challenge approaches
		Capacities and skills
		Entrepreneurship
	10. Sustainability	Societal sustainability
		Economic sustainability
		Environmental sustainability
		Government system sustainability
		Infrastructure system sustainability

Source: Popper et al. (2016)

9.3.2 SI Management Dimension 1: Context

The success of SI depends heavily on the contextual circumstances surrounding the innovation process. To begin with, the 'momentum' key aspect should be understood as an eventual space for innovation where entrepreneurs' objectives, the political context (e.g. procurement and regulating aspects), other ecological and social initiatives and the perception of a common sustainability 'challenge' give rise to a positive environment for devising creative SI solutions. Secondly, the 'foresight' key aspect of SI brings the potential to anticipate, define strategies and to be prepared to foresee future innovation difficulties and opportunities. Thirdly, the key aspect of 'resources' combines varied factors, like people's skills, companies' capabilities, funding options, location advantages and market matching opportunities. Finally, the 'mobilisation' key aspect refers to the capacity for promoting public participation, getting communities' endorsement, achieving adequate support from institutions, getting promoters and social facilitators' commitment, establishing public–private partnerships and engaging with research and education actors.

9.3.3 SI Management Dimension 2: People

People's behaviour influences very significantly the effectiveness of SI processes. Such an influence can be observed both at individual and collective levels (e.g. business leaders, professionals, scientific communities or lobbying groups' initiatives). Policy goals would be unachieved if policies and programmes are not capable of engaging nor offering attractive incentives to the right people. 'The entrepreneur' or 'the innovation leader' roles deserve special attention in a knowledge-based society, as it demands a focus on multiple and complex necessities. In this context, it is essential that entrepreneurship or leadership skills are well distributed, balanced, shared and based on a spirit of teamwork. In contrast to other general types of innovation, the SI ecosystem normally shows positive conditions to

these skills, whilst admitting that the figure of the 'heroic' and 'solitary' innovator still remains.

9.3.4 SI Management Dimension 3: Process

Innovation is often recognised as a complex, participatory and multidimensional process. The analysis of SI initiatives mapped in CASIPEDIA confirmed the importance of paying careful attention to different points of view and multiple actors involved in SI projects. Assessing SI processes has to draw on the interpretation of many factors as well as on their eventual synergies. As we have too much options for clustering, and looking for simplicity, the critical factors were classified into two categories: 'catalysts' aspect, i.e. factors that support the activation and launching of the innovation, and 'fosterers' aspect, which involves those factors that facilitate the continuation and strengthening of SI measures.

9.3.5 SI Management Dimension 4: Impact

The impact of SI processes can be studied from two distinct angles. We could use a transformational (system transformation orientation) approach, the objectives of which, if achieved, would eventually give rise to a positive contribution to address broader sustainability challenges, e.g. lifestyle modifications, sustainable economic growth, community sense reinforcement, commitment with entrepreneurship, etc. Alternatively, impacts can also be the consequence of targeted actions that address SI challenges more precisely and specifically. With this assumption, the influence and impact of successful SI processes can be evaluated from social, economic and environmental perspectives. CASI-F confirmed that SI initiatives often bring about transformational impact, and, at the same time, SI challenges-oriented strategies.

9.4 Multidimensional Method for the Analysis of Critical Issues

This multidimensional analysis ran in parallel to the above-described inductive approach. The main objective was to analyse the critical issues (mapped in CASIPEDIA) from multiple perspectives, including technological, economic, environmental, political, social, ethical and spatial, all of which helped to elaborate a set of practical considerations for SI management. The critical issues identified included over 1500 barriers, opportunities, threats and drivers of innovation, and 644 factors

Table 9.2 Critical issues rated from multiple perspectives

Critical issues	Tec (%)	Eco (%)	Env (%)	Pol (%)	Soc (%)	Eth (%)	Spa (%)
Factors of success (644)	14	21	20	11	22	6	7
Barriers (382)	13	34	4	19	24	1	4
Drivers (406)	9	24	19	17	25	3	3
Opportunities (422)	10	24	25	9	26	1	5
Threats (290)	14	37	6	16	21	2	3

Note: Analysis of technological (Tec), economic (Eco), environmental (Env), political (Pol), social (Soc), ethical (Eth) and spatial (Spa) critical issues and factors of success from 202 cases in CASIPEDIA, see http://www.futuresdiamond.com/casi2020/casipedia/cases/

of success from 202 SI initiatives. A breakdown of these critical issues mapped against multiple perspectives is included in Table 9.2.

Each SI case mapped in CASIPEDIA included a list of SI *factors of success*, i.e. inputs, resources and other elements with potential to positively affect the SI process. Amongst 644 factors of success the most important were of social (22%), economic (21%) and environmental (20%) nature. The most important social factors refer to contexts where the awareness about sustainability challenges is relatively high, and the innovation is recognised as a solution that will eventually produce a highly positive impact on the environment. Most important economic aspects of success include the possibility for a SI to increase energy efficiency of industrial processes to promote energy savings, as well as the capacity of innovation to generate new job opportunities.

The *barriers* to SI are sometimes more difficult to identify, since public reports and companies web pages tend to showcase the success stories of their business, projects or initiatives. In the CASI project, although cases of 'failures' were outside of the project's scope, analysed initiatives show that (a) innovators find difficulties along and beyond the SI process; (b) sometimes SI processes have very short life, although long enough to learn about 'what sort of things could go wrong'; and (c) other SI cases that seem to have had a long life have actually failed to adequately develop themselves, thus remaining endlessly in the 'innovation' basket. 382 barriers were mapped in CASIPEDIA, most of which were economic (34%) including resource scarcity and high initial investment, followed by social barriers (24%) related to coordination of multiple actors and interest, the scepticism of users and governments due to lack of understanding, as well as overall resistance to change. Political barriers (19%) that were considered important by the CASI mappers included ineffective regulation, hard bureaucracy, institutional inertia and strong resistance to change.

The analysis of SI *drivers* looks at the context and SI motivations, in every phase of the SI process, i.e. from idea conceptualisation to design, development and dissemination. The most significant drivers amongst 406 mapped were social (25%) and economic drivers (24%). Social drivers referred to issues of welfare, social inclusion and human health, whilst economic drivers drew to the attention

economic benefits, cost reduction, self-employment and local development and employment matters.

Assessing SI *opportunities* is related to financial gains, cultural enrichment and technology advances. Amongst 422 opportunities mapped, rather equal importance was given to social (26%), environmental (25%) and economic (24%) ones. Social opportunities were found in the knowledge transfer mechanisms, public participation, enthusiasm and motivation, partners' awareness, as well as networks' support. Environmental opportunities were in large part related to waste up-cycling alternatives, whilst economic ones focused on market needs and gaps and financial stability and support.

SI *threats* are negative factors and risks (expected future risks or existing factors in the present), which could have impact on the positive outcome of the SI initiative. Alongside the innovation process threats could be experienced in the form of financial issues, social discontent, unexpected collateral effects, climate change or inadequate or unavailable infrastructures, to name only a few. Economic problems (37%) are by far the most significant and include lack of capacity to meet demand, constraints related to economies of scale, decisions to abandon research and innovation activity and the lack of adequate business model to face competition. As for social types of threats (21%), the clearest threats include an excessive dependency of volunteering recruitment and absence of appropriate social impact evaluation. The most prominent political threats (16%) are related to changes in government priorities and the collision of vested interests.

The analysis of critical issues shows that ethical considerations are surprisingly absent in SI. One possible explanation could be that ethical aspects are somehow intertwined with social ones; thus, they could be camouflaged under that category. Nonetheless, even though ethical concerns are unlikely to outweigh economic factors, it is important to consider ethics of sustainable innovations as SI frequently aspires to tackle complex societal challenges and environmental issues.

Following the previous analysis, a number of questions were discussed for each type of perspective:

1. How can innovators benefit from factors of success?
2. How can innovators deal with the identified SI barriers?
3. How can innovators grasp SI opportunities related to the innovation process?
4. How can innovation threats be waived by the innovator?
5. How can strengths and weaknesses be treated?
6. How can innovators understand the effect of drivers and use them to address the SI objectives?

These, combined with the above outlined approach, led to the identification of a total of 60 considerations or recommendations for SI management, which are presented in the next section.

9.5 SI Management Recommendations and Lessons

In this section, the considerations have been formulated as recommended actions that SI innovators need to put in place in order to tackle problems that are often encountered in their operations. Furthermore, a cross-cutting analysis of recommended actions against the dimensions identified through the inductive approach, i.e. context, people, process and impact, has also served to extract useful lessons for SI management (Popper et al. 2016):

From a Technological Perspective, SI Managers Should Consider the Implementation of the Following Actions

1. Analyse dependence on other technologies
2. Develop an IPR strategy
3. Elaborate technology development plans
4. Identify and assume protection and imitation costs
5. Make plans for digital and social media communication
6. Guarantee an easy use of innovation
7. Create maintenance and contingency plans
8. Reinforce technical capabilities and capacities for technological anticipation
9. Ensure an adequate level of novelty in both radical and incremental innovations
10. Develop supporting infrastructures
11. Comply with tech standards and get the right level of complexity

Further Lessons for SI Management from a Technological Perspective

(a) It is crucial that innovators elaborate long-term innovation plans. These plans can include technology roadmaps, to visualise the present and future relations and dependences with other technologies. Roadmaps would also facilitate technological maturing plans and support the definition of corporative IP plans. By including relevant staff and strategic stakeholders in the roadmap creation process, innovators would, in addition, have the opportunity to better understand and capture societal and technological trends and perspectives.

(b) Participation is important to enhance staff's skills and foster technical creativity. It also contributes to boost motivation of personnel. Involving consumers in the SI innovation process also helps to identify technological pitfalls, find eventual obstacles on the usability of technical solutions and devise more insightful product development (or product substitution) plans.

(c) IPR strategies should be updated on a regular basis. Planning technologies protection actually requires forward-thinking processes that put into question the whole innovation project and assesses the importance of disclosing innovative ideas. These plans may be as well used as a tool for communicating some

(strategically selected) features of the innovation to potential funders and end users.

(d) Technology planning also helps to guarantee the sustainability of the ongoing innovation processes. By estimating consumers' necessities or anticipating the availability of strategic equipment and infrastructures, the technology innovation process can be more precise and address more efficiently social and environmental objectives.

From an Economic Perspective, SI Managers Should Consider the Implementation of the Following Actions

12. Elaborate market expansion plans
13. Create realistic business strategies
14. Design capacity enlargement and production adjustment plans
15. Differentiate between mass production and differentiation strategies
16. Define economic benefits targets, where applicable
17. Define cost reduction objectives, where applicable
18. Elaborate a strategy for local development
19. Assess the possibilities and implications of self-employment
20. Make a clear estimate of initial investments
21. Evaluate the availability of resources needed for the future
22. Ensure the stability of funds during the SI process
23. Increase/maintain adequate efforts in R&I

Further Lessons for SI Management from an Economic Perspective

(a) SI projects have often unrealistic missions and objectives. SI objectives should consider, in this sense, the analysis of local or regional opportunities. SI should be compatible with local and regional plans. It would allow to get an accurate idea of local needs and thus facilitate economic growth and regional stability.

(b) Business plans are very frequently inspired by very strong and unrealistic innovators' optimism. As a consequence, innovation plans are often risky and unapproachable. Staff hiring, for example, may become a heavy burden if the personnel recruitment plan is very ambitious and unaffordable. Since motivation and voluntarism are very common aspects amongst SI innovators, it is also important, in this respect, that the SI manager will find the right balance between such a voluntarism and the necessary specialisation and professionalism.

(c) SI typically demands a constant flow of funding. Innovation processes can thus be better reshaped and the production capacities be resized on time. Conserving and reinforcing research capabilities would contribute to build a positive corporative image in front of external actors and potential investors and show our profound understanding and conception of innovation.

(d) The capacity of SI to achieve a positive impact, either socially and/or environmentally, largely depends on the innovator's abilities and specialised knowledge background. To achieve economic impact, it is necessary that innovators are

accompanied and supported by managers that provide skills to positively change or update business objectives, monitor and analyse costs and benefits and strategically modify production plans.

From an Environmental Perspective, SI Managers Should Consider the Implementation of the Following Actions

24. Understand the potential and implications of climate change adaptation and mitigation strategies
25. Identify those environmental elements where SI could make a better impact
26. Develop environmental ex ante impact measuring tools
27. Evaluate the potential of SI to solve energy problems
28. Define and communicate how the innovation is contributing to promoting sustainable lifestyles
29. Evaluate potential ecological collateral effects

Further Lessons for SI Management from an Environmental Perspective

(a) Sustainability challenges usually have social, economic or ethical implications. They are present, directly or indirectly, in every Horizon 2020 societal challenge. SI solutions need to be conceived and developed with processes that recognise those aspects that positively affect the environment as well as eventual and pernicious collateral effects. The potential of SI to address environmental concerns must therefore acknowledge unintended damages and how these damages may be avoided.

(b) Sustainable innovators usually present abilities and enough motivation to raise awareness on the benefits of sustainable lifestyle. However, our work with CASIPEDIA has showed that innovator's attitude is not sufficient. Innovator's aptitude and knowledge capital of firms/organisations are also crucial to create impactful environmental solutions.

(c) SI processes must be modified in accordance with the evolution of the environmental issue at hand. Monitoring and modifying SI management decisions on time can eliminate eventual differences between innovator's initial plans and actual environmental objectives as well as reduce negative (social or economic) consequences.

(d) The impact of environmental innovation is only observable and measurable in the long run. This makes SI critically dependent on civil actors' awareness and their solid commitment to environmental protection. Convincing people to have an environmentally impactful lifestyle is, however, an arduous educational endeavour that usually goes beyond innovators' main priorities.

From a Political Perspective, SI Managers Should Consider the Implementation of the Following Actions

30. Understand bureaucratic processes
31. Acknowledge/influence government's political position
32. Analyse policy agenda opportunities
33. Learn applicable regulation
34. Be regularly informed of current and potential regulation changes
35. Achieve sustainable political support
36. Get timely access to experts and policy advisors
37. Estimate and assess lobbies' and competitors' reactions

Further Lessons for SI Management from a Political Perspective

(a) Policies, regulation changes and institutional R&I agenda may offer interesting opportunities that need to be fully understood and leveraged by innovators. In this sense, approaching scientific lobbies and experts' networks could be a strategic decision for innovators. This may be complemented by reviewing foresight studies (or participating in foresight projects) that utilises future scenarios to create sound and practical advice for management (Velasco 2017) and by analysing other sorts of SI-related reports.

(b) Networking depends on the SI managers' capacity to be part of policy agenda setting workshops and participate in different stakeholders' groups. It is desirable that managers are able to interpret the messages behind policy discourses.

(c) SI processes need to be resilient to political changes. A strategic network of collaborators and informers is useful to develop such a resilience. Similarly to owning instruments of technological intelligence, innovators must also be aware of new government initiatives and decisions in order to adapt their innovation action to the evolvement of policies and regulations.

(d) SI strongly depends on the definition of R&I policies and sustainability priorities. The complexity of SI problems calls for the convergence of varied actors' interests, which share a common policy agenda. Taking distance from the official agenda could consequently put innovator's efforts (i.e. his/her dedicated resources) beyond those areas that could attract much more political interest. Interesting SI solutions could be eventually considered of little interest by policymakers and potential sponsors. Business plans related to those cases would need to look into more favourable markets and political settings.

From a Social Perspective, SI Managers Should Consider the Implementation of the Following Actions

38. Elaborate a SI communication plan
39. Establish realistic poverty-related targets, where applicable
40. Establish achievable social minorities-focused objectives, where applicable
41. Establish realistic health targets, where applicable
42. Establish realistic welfare and security targets, where applicable
43. Interact with social actors with impact-oriented plans
44. Devise instruments to measure the social impact of the innovation
45. Design/implement motivation techniques for personnel
46. Balance the use of volunteering and professional resources
47. Keep alive the interest of beneficiaries in the SI
48. Coordinate the action of the actors involved
49. Develop knowledge transfer mechanisms and platforms
50. Update and share objectives with partners
51. Establish linkages/relationships with civil society organisations

Further Lessons for SI Management from a Social Perspective

(a) SI demands the innovator's interaction with relevant and influential social actors. To enable such an interaction, effective communication plans shall be used to present and explain the SI objectives. Coherence and convergence is needed between these objectives and the social, economic and environmental impacts that the SI will eventually achieve. SI would benefit, in this respect, from actions that raise the interest and empathy of SI actors and users. By (ex ante) evaluating and communicating expected impacts to these agents, the innovator will increase public acceptance and people's commitment towards the project.

(b) As a consequence of the interaction needed between sustainable innovators and civil society, sustainable innovation is very often considered merely a social innovation process. To avoid that, SI mission has to be explained and discussed with the main actors engaged or participating in each phase of the innovation process. The values of personnel, for example, need to be understood by SI managers to find out if they are compatible with the main ethical drivers and social motivation of SI.

(c) SI processes require to take decisions that have social impact. These decisions may help to accelerate and consolidate the innovation project. An interesting step would be the active participation of innovators in expert platforms and knowledge networks.

(d) Sustainable innovators shall also analyse the unexpected social consequences of their SI actions. For example, it is important to put in place mechanisms and barriers to avoid SI solutions bringing about any social exclusion experiences, e.g. some innovations could be unavailable or unaffordable to some social minorities, the elderly or very particular vulnerable groups.

From an Ethical Perspective, SI Managers Should Consider the Implementation of the Following Actions

52. Make ex ante evaluation of the SI ethical consequences
53. Avoid SI bringing about the exclusion of specific user groups
54. Develop a communication plan based on unambiguous organisational sustainability objectives
55. Identify and integrate all affected community members
56. Communicate how the innovation is aligned with social values

Further Lessons for SI Management from an Ethical Perspective

(a) SI sometimes leads to ethical debates, especially when proposed solutions are radical or disruptive. This is explained by the strong relations that sustainability projects have with social innovation and the effects that an ethically responsible lifestyle has on both types of innovation. Discrepancies between individuals' conceptions of sustainability, not to mention the diverse factors affecting SI processes, can make it difficult to harmonise every actors' interests and preferences. To manage these differences, innovators have to fully understand the discrepancies, and inform and involve as much as possible every legitimately affected stakeholder in the innovation project.

(b) The analysis of the ethical consequences of SI is often subject to many types of interpretations and potential biases. Consequently, innovators need to analyse their proposed solutions, and the opinions generated around them, with a very critical perspective. In fact, sustainability 'activists' may publish and disseminate opinions that basically vary with their affinity to the project and their empathy towards the sponsors or managers of innovation. Our study confirmed that opinions of this sort could become more relevant factors for SI than other human capabilities, such as creativeness or personal leadership.

(c) To raise the interest of users and investors in our sustainable innovation, we need to eliminate or at least minimise any ethical controversies and doubts. Reinforcing consumers' reliance on solution should be an important SI manager's ambition during the full innovation process. An effective communication strategy, focused on clarity and transparency, can help develop practical and emotional linkages between stakeholders and the innovation we work on. Such a strategy must delimitate unambiguously the differences between the pursued not-for-profit sustainability objectives and other financial targets of the organisation.

(d) Paying attention to the ethical aspects of SI will, to some extent, contribute to fulfil the objectives of transformation more effectively. Ethics-driven decisions can, in addition, support the continuity and sustainability of managers' action. Disputes around ethical and social aspects can certainly undermine the sustainability benefits of the innovators' action and the reliability of the full project. The elaboration of impact evaluations is useful in this respect to assess and inform in advance about positive social or environmental expectations.

From a Spatial/Geographical Perspective, SI Managers Should Consider the Implementation of the Following Actions

57. Establish realistic demographic objectives, where applicable
58. Align innovation with rural/local traditions
59. Contemplate heritage preservation in the innovation conception
60. Distinguish between local SI experimentation results and their application to other environments

Further Lessons for SI Management from a Spatial/Geographical Perspective

(a) On many occasions, SI objectives directly address the protection or development of rural/local culture and the preservation of local traditions. It is particularly useful that regional authorities and affected communities will endorse and support the SI action in these cases. Alternatively, rural communities-oriented actions can be conceived and developed in order to join and indirectly complement other SI targets.

(b) The innovators' interest in conserving local traditions and their motivation to preserve rural environment are important aspects to consider in the analysis of SI factors. A particularly favourable factor for SI, when SI relates to rural and geographical aspects, is the innovator's capacity to understand the historical and cultural background. In this context, aligning the innovation with the values and concerns of the people, e.g. by devising solutions to manage or preserve the local heritage, is an important innovator's objective that, if achieved, would improve the recognition of rural community.

(c) Sustainable innovators should evaluate the capacity of their solutions to tackle sustainability problems in local and regional areas. This could be made by analysing actors' opinions and behaviours in front of the provided solution and by assessing the extent to which the SI has improved people's living conditions and preserved rural culture. Targeting efficiently this sort of demographic and cultural issues is actually a favourable component of a well-balanced and productive innovation management.

(d) Another key aspect to be considered by SI managers is the capacity to differentiate experimental tasks from the application of their solutions in the real world or in very specific environments. Many innovations, for example, prove to work successfully only in particular conditions, e.g. remote locations, islands, very particular groups of users or consumers, etc. Innovators have to recognise and acknowledge this contextual dependency and admit that, in general, SI solutions cannot be easily 'replicated' in any geographical or demographic circumstances.

9.6 Conclusions and Final Remarks

The CASI project devised an innovative approach to provide meaningful and practical insights for a range of sustainability stakeholders. In particular, the inductive analysis of how the SI critical issues actually match with the innovator's experience, and the 'translation' of results into a coherent frame linked to context, people, process and impact dimensions, demonstrated to be a powerful instrument for SI assessment and management.

In addition to the potential of multidimensional approaches, the results have shown that data from multiple and diverse sources can be analysed and cross-compared, even though findings could sometimes contradict established paradigms. The lessons derived from this analysis, which have been scrutinised from multiple perspectives, have useful implications and suggestions for SI policy formulation:

- *Policymakers should take measures to facilitate fluid dialogues between SI players, in particular to improve and ease the interaction between SI innovators.* These dialogues would accelerate knowledge and technology transfer between governments, industry, academia and civil society actors. In this respect, CASI is a good example of sharing best practices of sustainable innovation, which can help innovators better understand common critical issues of their innovation processes. In fact, these issues will certainly influence, to a larger or lesser extent, their SI management activities and future plans.
- *To fully understand the contextual circumstances of SI, instruments of strategic intelligence should be used to support policymakers.* Utilising future scenarios as a methodology for foresight would consolidate the levels of actors' participation in sustainability governance and provide collective and long-term advice. The representation of citizens, innovators and other actors in SI policies has been suggested in a policy report—CASI Sustainable Innovation Policy Advice (Popper and Velasco 2017).
- *Agenda setting processes on sustainability need to be enriched with the experience of SI entrepreneurs and innovators.* Policymakers should encourage the participation of SI managers in the policy formulation process so that they can inform about their actual aspirations and concerns. Acknowledging potential discrepancies with innovators' objectives would guide the policy action towards more accurate and democratic definition of innovation priorities.
- *When formulating innovation policies and programmes for sustainability, policymakers should reflect on the wide range of values that are intimately associated with and eventually affect the SI processes.* The importance of raising people's awareness on sustainability challenges and the communication efforts needed to highlight the impact associated with these problems makes SI a field of work very much linked to pure psychological or social processes. In this sense, it is necessary that the objectives of sustainability-oriented policies are compatible not only with the SI actors' objectives, but also with their understanding of environmental problems and their social or cultural preferences.

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