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Article

Linking Transitions to Sustainability: A Study of the Societal Effects of Transition Management

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Abstract: Sustainability transitions as processes of fundamental change in societal systems are open-ended, nonlinear and uncertain. Respective research and governance approaches, e.g., transition management, propose a reflexive way of governing, aiming for a number of societal effects to help facilitating a transition. Effects include empowerment, social learning and social capital development. Jointly mentioned effects shall allow for reflexivity and innovation in developing socially robust and contextualized solutions to sustainability challenges that work in practice. But, understanding the mentioned societal effects and their interplay in more depth is necessary to design and assess transition management processes. While such understanding and related assessment framework is under development in the transition management literature, transdisciplinary sustainability research can provide a rich body of tools and experiences. Building on a review of the literature, this article develops an evaluation framework focusing on social learning, empowerment and social capital as important and hitherto under-conceptualised aspects of the sustainability transition literature. This framework is used to empirically investigate the effects of two specific transition management processes at the local scale. In doing so, the article provides a conceptual and empirical understanding of how social learning, empowerment and social capital contribute to a transition towards sustainability. The three effects are shown to be interrelated, mutually supportive and bridging different scale levels from individuals to groups, niches and beyond. Results highlight possibilities to facilitate and assess societal effects, addressing sustainability as their inherent quality.

Keywords: assessment; case study; empowerment; social capital; societal effects; social learning; sustainability transition; transition management; sustainability transformation

1. Introduction

More than 20 years after the international community agreed upon sustainable development as a major principle to strive for [1,2], the environmental, social and economic challenges addressed by it have not lost their relevance (cf. [3,4]). Recent international attempts to strive for sustainable development, including the SDG [5], are calling for transformational change. Related societal challenges, such as climate change, biodiversity loss or poverty, are characterized as being complex, highly interrelated and subject to uncertainties, and unfold their impacts over long time horizons.

Challenges can be regarded as ‘ill-defined’ problems, which are defined, perceived and valued differently and persist over time [6,7].

The emerging field of transition research proposes that solving mentioned problems requires a fundamental change in the structures, cultures and practices of a societal system for the system to become (more) sustainable [8,9]. While these transitions do not automatically lead to sustainability, an adequate facilitation may nevertheless work in favour of it [10,11]. Rather than assuming that societal change processes can actually be ‘managed’, transition governance frameworks including transition management, hold that sustainability transitions cannot be governed in a regular way. Due to their open-endedness, non-linearity and uncertainty, they require an iterative, reflective and explorative way of governing [12,13]. In this transition management shows similarities to other reflexive governance approaches, such as adaptive co-management (e.g., [14,15]). Transition management is further outlined in specific process methodologies, for example for policymakers in cities [16] or for transdisciplinary/action researchers [17]. When being implemented in close collaboration between scientists and stakeholders and aiming to solve real-world problems, transition management shows commonalities with other approaches of transdisciplinary (sustainability) research [12–14,18,19]. It is the latter, the transdisciplinary and operational application of transition management, that we focus on in this paper.

Learning and empowerment are core societal effects that transition management aims for [12,13]. The approach postulates the systematic development and empowerment of actors, developing alternatives in societal niches as a key instrument to facilitate sustainability transitions [20–22]. In its essence, it “focuses on [. . .] organizing an interactive and selective participatory stakeholder searching process aimed at learning and experimenting” [6] (p. 140). This asks for processes that on the one hand allow for empowerment and learning and on the other hand assure a contribution to sustainability (transitions). This relationship is not self-evident and has been under conceptualized [23–26].

To guide the contribution of transition management to sustainability, appropriate assessment frameworks are needed. There is an inherent tension when assessing the outputs and outcomes of transition management—the tension between the open-endedness and complexity of transitions and the attempt to govern it in direction of sustainability. This tension gives rise to evaluation proposals focusing on adaptive, process-oriented criteria capturing mechanisms of solving the mentioned wicked problems. These criteria are empowerment [27], learning [28–30] and a better understanding of complexity or the development of a shared narrative [31]. All contrast to positivist, impact-oriented evaluation approaches. A shared and comprehensive transition management evaluation framework is nevertheless still under development [32].

Recent contributions developing evaluation frameworks for transition management and related approaches face limitations in assessing the societal effects of transition management processes in relation to sustainability. Contributions from the field of transition management studies are directed towards the evaluation of transition programmes, thus applying a policy-oriented perspective [33,34]. The same holds true for alternative approaches, e.g., those directed towards the evaluation of policy effectiveness and legitimacy (e.g., [35,36]). This policy orientation hinders the application of frameworks to the project and process level of transition management. Reflexive evaluation approaches (cf. reflexive monitoring, [37,38]), to the contrary, are directed at supporting the ongoing learning process of those involved in experiments, projects or programmes. As they focus on reflexivity, these evaluation approaches are coherent with the open-endedness and complexity of transitions. Nevertheless they fall short of explicitly assessing the sustainability quality, and therefore the normative aim, of the transition.

Assessments of strategic niche management, a neighbouring approach to transition management, also highlight the relevance of learning, networking and expectations [39]. As with transition management, a broadly used assessment frame is still under development. Furthermore, current studies either focus attention on setting up and managing niches (e.g., via policies) [40,41] instead of applying strategic niche management as a transdisciplinary approach [39], or do not explicitly include

sustainability in the evaluation framework (e.g., [42]). In sum, there is a lack of understanding as to how the core societal effects of transition management are related to sustainability as well as the lack of a framework from the field of transition studies to assess this.

Thus, we turn to the field of transdisciplinary sustainability research for suitable approaches that help to assess the societal effects of research projects in relation to sustainability (e.g., [43–46]). We made this choice for two reasons: first, it allows for a focus on the actual practice of applying transition management. Thereby we start from an understanding that transition management can be put into practice in form of a transdisciplinary research approach. Second, transdisciplinary sustainability research offers expertise on the structured and broad assessment of societal effects, and on their relationship to sustainability. It aims to develop actionable knowledge to solve real-world sustainability challenges. A key avenue to achieving this is collaboration with stakeholders from outside academia, aiming to allow for mutual learning and creating socially robust solutions that can be transferred to scientific and societal practice [19].

To further address the mentioned gap, we focus our article on the following core research question: What are relevant criteria to assess the contribution of transdisciplinary transition management processes towards sustainability, focusing on core societal effects and the local level? To answer this question, we state four interrelated objectives. First, to conceptualize a framework to assess societal effects of transdisciplinary transition management, including their relationship with sustainability. Second, to operationalize this framework for empirical application at the local level. Third, to test and apply it empirically to local transdisciplinary transition management processes. Fourth, to critically reflect on the suitability of the framework, taking into consideration conceptual and empirical insights.

According to the four objectives, this article is structured into four main sections as follows. In the first section (Chapter 2) we develop a conceptual framework to assess the societal effects of transition management, building on a review of the relevant literature. In the second section (Chapter 3), we operationalize this framework for empirical application and present two case studies of local transition management as well as data collection and interpretation methods. In the third section (Chapter 4), we present the results of an empirical analysis of both cases, applying the framework. In the fourth section (Chapter 5) we recapitulate, compare and reflect the results of both conceptual and empirical works, including an assessment of the core societal effects of transition management in relation to sustainability. We close the paper by outlining our conclusions regarding the core research question (Chapter 6).

2. Assessing the Societal Effects of Transition Management Processes

Transdisciplinary approaches differentiate between the societal and scientific effects of transdisciplinary research: scientific effects are e.g., new scientific insights, theory development or similar, while societal effects include a wide range of effects of the research on society [46]. The latter are of primary interest for us here as they contribute directly to the core aim of transition management, a sustainability transition as societal change. The following subchapters present a review of the literature in two steps. First a broad conceptual frame of the different societal effects of transdisciplinary sustainability research including transition management is presented. In so doing we build on the transition management and transdisciplinary sustainability research literature. Effects of primary importance to the assessment of transition management processes are identified. Second, identified effects and their relationship to sustainability are discussed in depth, taking into account additional literature relating effects and sustainability. Results are summarized in the form of an overview table.

2.1. Societal Effects of Transition Management and Transdisciplinary Sustainability Research

For assessment purposes, the various societal effects of a transdisciplinary program, project or experiment can be differentiated with regard to how immediately the effects occur [43,45,46]. Different terminologies exist to differentiate between effects. We adopt a differentiation into outputs (What was

generated?), outcomes (What was accomplished?) and impacts, which mediate between outputs and outcomes [43,45,46].

Outputs are immediate, directly traceable achievements of a program, project or experiment. Impacts are the changes induced when participants are involved in creating the outputs. Generated outputs and impacts can lead to further societal effects (outcomes), such as changes of action and decision-making of larger collectives and related structural changes of institutions or infrastructures. Thereby, impacts are assumed to mediate between outputs and outcomes, e.g., enhanced capacities (impacts) developed by participants when producing a product or service (outputs) can lead to changed decision-making or collective action (outcomes). Outcomes in turn are related to the further societal and ecological achievements of the transdisciplinary processes. While impacts and outputs tend to be tangible, outcomes happen outside the spatial and temporal boundaries of most projects, programs and experiments [37].

In this article we focus on outputs and impacts for two reasons. First, being tangible, they are relatively easy assessed. Second, they are indicative of outcomes being accomplished [35,37]. Thus, and although the relationship of outputs and impacts to outcomes is not straightforward, we assume they can be used as qualitative indicators to assess transition trajectories [30], for example regarding their orientation towards sustainability.

According to Wiek et al. [45,46], the impacts and outputs of transdisciplinary sustainability research projects can be differentiated into three basic categories:

- (1) Outputs in the form of usable products such as (innovative) goods, services and action plans or publications as well as production-related experiences of participants.
- (2) Impacts in the form of
 - a. Enhanced capacities such as knowledge gains and problem-solving capacities and
 - b. Network effects, such as new relationships, trust or accountability.

In the following, we discuss how these three categories come back in the transition management processes.

- (1) The first category refers to the creation of usable products as a concrete and tangible output of solution-oriented sustainability research, which in design, production and delivery themselves should be oriented towards sustainability principles [45]. At the very least, in transition management processes, vision documents and related pathways are produced [32]. The processes can also lead to other artefacts, such as websites (see e.g., www.lebensklima.at, the website of one of the case studies) or new products (e.g., a floating building, cf., [47]) and services (e.g., a public lecture series on participation and sustainability, cf., [48]). The intensity (quality and frequency) of being involved in creating products and having experiences can be seen as an indicator for the creation of impacts such as enhanced capacities and network effects [46]. Experiences may include methodological experiences and organizational experiences, such as experiencing new ways of working, planning and organizing as well as social experiences, such as interactions with others [44].
- (2a) The second category refers to enhanced capacity, which includes the acquisition of knowledge by individuals and collectives as well as of skills (know-how) for applying the new knowledge. Capacity is built through participatory research features, “as they organize and encourage information exchange, mutual, and joint learning” [45]. Rather than on ‘enhanced capacity’, transition management focuses on (social) learning and empowerment of participants in the transition arena setting [13,49].

Transition management aims for “transformative change in societal systems through a process of searching, learning, and experimenting” [32] (p. 1006). Learning is considered as core to

overcoming lock-in situations, allowing for innovations and systems change [29]. Loorbach highlights the value of learning-by-doing as a core process within transition management, allowing for an experimental and explorative attitude to social innovation and change [22,25]. Social learning, as a reflexive learning process that involves and goes beyond individual participants, is considered a precondition of change within the transition management literature. It is based on bringing together different actors' perspectives and a variety of options in participatory settings. Joint learning of participants can contribute to the development of alternative and visionary solutions to complex challenges. This results in new types of discourse as well as changing perspectives [32].

Besides social learning, the empowerment of civil society in locally addressing sustainability forms a second core effect of TM processes. As stated by Loorbach [13] (p. 284), "The ultimate goal of transition management should be to influence and empower civil society in such a way that people themselves shape sustainability in their own environments, and in doing so contribute to the desired transitions to sustainability". This refers to the finding and realizing of (new) ways to solve social challenges in a local and sustainable way—and turn the visions of the future (sustainable) communities developed as part of the TM process into reality. Avelino highlights the empowerment of change agents and frontrunners in niches to challenge, transform or replace (unsustainable) regimes as a core strategy of transition management [49].

- (2b) The second category includes as well network effects. These refer to the creation or expansion of stakeholder networks and relationships (e.g., new contacts) as well as other qualities of human interrelations such as trust, identity, and accountability [45]. Via participation, transdisciplinary research does help to develop networks and structured interrelations. Similarly, transition management aims at the forming of new coalitions and networks [32] and more broadly new social relationships (such as new actors) to address societal challenges and contributing to sustainability transitions [48]. Transition management is centred around participatory spaces, e.g., transition arenas, which bring together a diversity of change agents or frontrunners for joint envisioning and collective action (e.g., [16]). The development of trust, shared goals and mutual expectations benefits the functioning of the transition arena process. The developed vision and respective images of change then need to be translated to wider networks, organizations and institutions [22]. Altogether, networks and relationships of trust and reciprocity are main determinants of social capital, whose increase is a third core societal effect of transition management processes—and an important precondition of collective action to address societal challenges [50].

Figure 1 summarizes the different societal effects of transdisciplinary sustainability research as well as their temporal interplay. Core impacts of transition management, namely social learning, empowerment and social capital development, are located within this broad conceptual frame. This explains how these core impacts are created with participants (by creating outputs) and how impacts contribute to a societal transformation towards sustainability (as predecessors of outcomes).

Impacts are put central stage in the transition management literature as core processes of transitions and change. Their process character corresponds to the reflexive character of transition management [32] and the underlying nature of sustainability transitions as complex, open-ended processes. Transition management methodologies propose the facilitation of an open ended process and do not outline how 'sustainability' is to be introduced. Rather, defining sustainability is left to the transition arena group. The participating frontrunners essentially shape the understanding and valuation of sustainability in the transition management process [10] (p. 10). Therefore, they play a crucial role in directing the process towards sustainability—and not only them, but also the process managers who are actually selecting these frontrunners and framing the process (a practice that has been critiqued by Shove and Walker [25]). Rauschmayer et al. [24] draw attention to the need to design a proper process that makes sustainability meaningful to the frontrunners and to later critically evaluate the process outputs, impacts and outcomes.

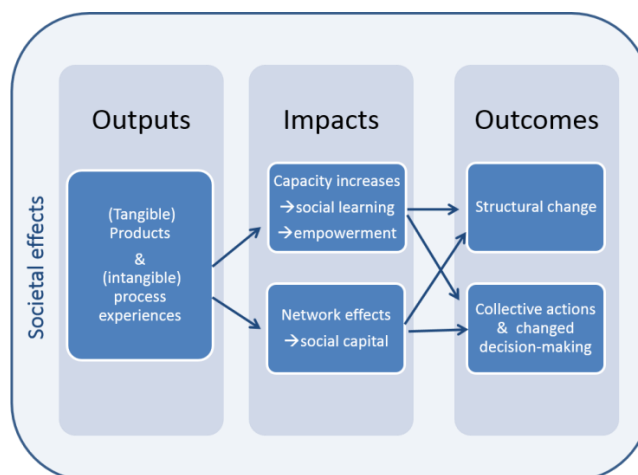


Figure 1. Effects of transdisciplinary transition management processes. This figure shows the interplay of outputs, impacts and outcomes, jointly referred to as societal effects. Outputs are directly created by transdisciplinary processes. Impacts are the changes induced with participants being involved in creating the outputs. Outcomes arise with a temporal and/or spatial distance from these processes and can include societal as well as environmental aspects. Impacts mediate between outputs and outcomes. Both impacts and outputs are tangible and indicative of outcomes.

In the following we deepen our understanding of the impacts and their relationship to sustainability. Due to their mediating function, it is crucial to understand their relationship to sustainability for assessing the overall orientation of the transition towards sustainability. While the output level is not explicated in conceptual terms here, it will be considered again when it comes to discussing and assessing concrete empirical examples in later sections.

2.2. Relating Social Learning, Empowerment and Social Capital to Sustainability

To expand our understanding of social learning, empowerment and social capital in relation to sustainability, we reviewed additional literature from the field of sustainability science (e.g., [51,52]). To identify relevant literature, Scopus has been searched using the following search strings: “social learning AND sustainability”, “empowerment AND sustainability”, “social capital AND sustainability”. Due to the quantity of all sources displayed ($N = 1895$, 6.3.2017), only a number ($N = 65$) of seminal, highly cited works as well as systematic literature reviews and recent empirical studies have been selected. This selection aims for a broad overview of the three impacts. It claims neither comprehensiveness nor representativeness. Relying on the literature, each impact is discussed with regard to three questions: (1) what constitutes it? (2) who is the subject of it? and (3) how does it contribute to sustainability transitions?—including critical reflections.

2.2.1. Social Learning

A core role in many sustainability-related disciplines is granted to social learning, e.g., in adaptive co-management of social and ecological systems in general [14,53] or with more specific foci such as water [54], agriculture [55], resource governance [15], ecological economics [56], transformation and participation studies [57–60] or with regard to broader political responses to global change [61]. Although social learning enjoys great interest from sustainability-related scholars, and albeit recent attempts to clarify the concept [53], the understanding of what social learning is and what it contributes to is unclear [56,62].

(Add 1) What is learned is understood in different ways [14], but at its core it involves a lasting change in the interpretive frames (belief systems, cognitive frameworks, etc.) guiding the actions of a person [63]. A frequently made distinction separates first- and second-order, lower- and higher-order

or single- and double-loop learning [14,46,53]. In the following we use first- and second-order learning. First-order learning is understood as the simplest mode of learning, basically involving the acquisition of new cognitive knowledge. First-order learning allows for doing things in a better way. The kind of social learning most relevant in the context of transitions can be defined as second-order learning [57]. This indicates learning processes aiming at changes in values, worldviews and assumptions underlying the actual behaviour: learning to do new things or “old” things in a fundamentally new way.

(Add 2) Individuals are the subject of learning, but as indicated by the term social, their learning is happening in a form of social exchange, e.g., within a group. Furthermore, as Reed et al. [53] point out, learning cannot be considered social if the learning content only stays with one person. Social learning therefore relates to the transmission of individual learning to wider social groups at smaller or larger scales.

(Add 3) How may social learning contribute to sustainability transitions? Reed et al. contend that “social learning may lead to pro-environmental or sustainable behaviour but this is not guaranteed” [53] (p. 3). Siebenhüner et al. [56] put forward that (social) learning contributes an orientation towards transformation and to creating paths and routines for individuals and collectives that contribute to sustainability. We elaborate on this relationship in three steps:

First, several authors have emphasised second-order learning as a way to adapt to a continuously changing and increasingly complex environment through collaborative action and dialogue [54,55,64–68]. In transition management, social learning allows to deal with complexity and uncertainty, based on individual and collective experimentation and reflection. Considering collective actions e.g., of sustainable grassroots organisations, social learning contribute to a more successful achievement of group aims [68]. Thus, we assume that second-order learning is one aspect of voluntary behavioural change as well as the development of innovative and successful solutions to persistent local problems. Schäpke and Rauschmayer [69] hold that (social) learning can be understood as one major source of empowerment (e.g., via new skills).

Second, social learning is connected to changes in values, assumptions and worldviews and relates to the awareness and valuation of sustainability topics in the arena process. Overall, the social learning process should increase the transition mindedness of the people involved [70]. Social learning, in this regard, can contribute to sustainability by raising awareness of sustainability-related problems as well as by increasing the feeling of responsibility and capacity of people to react to these sustainability problems (cf., [69]). It can also function as a process of spreading sustainable practices from alternative niches to the broader societal mainstream (the regime) [24].

Third, social learning processes may go beyond individual interests and/or values and allow for “shared understanding and joint action” [67] (p. 1713) and may strengthen intrinsic values [71]. In addition, Crompton [72] shows that people with high intrinsic value tend to have more and better social relationships (cf. section on social capital).

Critical remarks point towards social learning (pre-)conditions: To come across in participatory setting, social learning is dependent on a trustful atmosphere and intensive, open exchange between participants, combined with a willingness to reflect on one’s own position. When focussing on mutual understanding and shared goals, and thereby emphasizing consensus, this may potentially limit the space for radically new and more sustainable solutions.

2.2.2. Empowerment

Empowerment is a multidimensional and multi-scalar concept and transition studies [49,73] as well as sustainable resource management and development studies (e.g., [74–79]) outline various aspects of it, based on different disciplinary traditions, such as psychology, management studies, social as well as political studies, and critical theory. Issues of power and politics in transition management have generated growing interest among scholars [25,73,80].

(Add 1) Empowerment is discussed in various disciplines (see [41] for an overview). Psychological research understands empowerment as a perceived increase of intrinsic motivation and control of

the situation [49]. Here empowerment may be accompanied by increased feelings of self-esteem and pride [75]. An intrinsic motivation (to do something) is dependent on positive task assessments, such as the perceptions of choice, impact, meaningfulness and competence on what a person does [49] (p. 377), [81]. Such intrinsic empowerment increases the capabilities of a person to lead a valuable life [74]. Management studies interpret empowerment as a process of sharing decisional power (against hierarchies), delegating decisional power [82] and providing people (individuals and groups) with the power to make decisions [83]. In this regard, empowerment is linked with leadership and innovation. In broader political terms, empowerment is linked to participation in decision-making and the development of leadership, which may be granted to or gained by certain groups [76,77]. In economic terms, it is related to gaining control of resources [75,76,79]. In social terms, empowerment is related to better education, the development of social capital or improved local organizations [75,78].

(Add 2) Depending on the context of the analysis and the scale level, various actors are proposed for empowerment, such as individuals as well as groups and communities. Frequently the question of whom to empower is linked to observation of the (unequal) distribution of power, resources and opportunities—with empowerment being a process of redistribution or at least gains of resources and opportunities by formerly less well-off individuals or groups.

(Add 3) Empowerment can contribute to a transition to sustainability in various ways and on different scales. At an individual psychological level, empowerment processes do offer the possibility to increase the motivation and capacity of individuals to act sustainably. Here, Schöpke and Rauschmayer [69] highlight the role of values and awareness when it comes to how people ‘use’ a respective empowerment: engaging for sustainability or not. Engagement is likely if a felt empowerment is linked to an increase in awareness of and felt responsibility for sustainable behaviour—or simply, if sustainability-oriented actors feel empowered. A similar relationship between empowerment and sustainability transitions can be assumed at the organisational and political level, e.g., understood as gains in decision-making capacities. These are likely to be used for sustainability, if (newly or already) sustainability-oriented actors are given more decision-making power on sustainability-related issues.

More broadly speaking, a transition to sustainability as a fundamental change necessarily entails a shift in existing power constellations. In this regard, Avelino [73] distinguishes between different types of power as a capacity of actors, such as transformative power (the capacity to invent and develop new structures and institutions, e.g., legal structures, infrastructure or norms) or innovative power (the capacity to invent and create new resources, such as natural resources or technologies). Gains of innovative and transformative power may lead to a change towards more sustainability, if empowered actors change structures and institutions to become more sustainable. In this line of thought, frontrunners or change agents, as empowered individuals, are the first to realize possibilities for solving sustainability challenges, e.g., by establishing consumption and lifestyle alternatives. Solutions developed by change agents at the micro or niche level transfer to wider social groups by processes of upscaling and broadening [40,84]. Frontrunners function as the drivers behind innovation, trendsetting, mainstreaming and institutionalization processes of sustainable alternatives [23,24,85,86].

Still, critical theory holds that the power of an individual or group depends on its position within the system—and empowerment could therefore only happen in connection to changes in the system. It also holds that the very attempt to empower somebody creates a dependency relationship that is reinforcing the dualism between the powerful and the powerless—and therefore is ultimately dis-empowering [49]. This calls for critical reflection on the development of dependencies in contrast to system changes as part of the research process.

2.2.3. Social Capital

Social capital is a broad concept that is used in several sustainability-related disciplines, such as adaptive collaborative governance [87], resource governance [88,89], collective action [90], community development [91] studies on socio-ecological systems [92] and sustainability management [93].

(Add 1) Social capital is a broad concept that describes relationships, relationships of trust, reciprocity, and exchange, the evolution of common rules, and the role of networks and of social ties [87,90,94,95]. Thus, a distinction can be made between structural aspects of social capital, such as networks and groups, and content-related aspects, such as values, norms or trust [87,96]. Important dimensions of social capital, according to [97], are bonding vs. bridging social capital. “Bonding” social capital describes the links within a homogeneous group (e.g., people with common interests, worldviews, and social background). “Bridging” social capital refers to ties between people belonging to different societal groups. This distinction depends on the perspective taken and both processes can happen simultaneously [96].

(Add 2) Social capital development basically can occur with every individual and group. Depending on the subject of social capital analysis, e.g., an individual or a certain group, the different types of social capital development (bridging and bonding) can be observed—what constitutes bridging for one person may constitute bonding for another, as groups of people known to one person vary from those of another. The kind of social capital development process observed is therefore related to the object of analysis.

(Add 3) Social capital can have positive and negative effects on persons or groups. In positive terms, social capital facilitates collective action [88,90] and increases the probability of mutually beneficial, cooperative behaviours [98]. In this way, social capital functions as a productive resource allowing us to achieve (additional and joint) benefits [89,99]. This explains how individuals and groups use their relationships with other actors in societies for their own and the collective good [100]. In negative ways, social capital e.g., by excessive bonding may result in exclusion and island groups [101], which may hamper innovation [102] and obscure power and class relationships [91,103]. A strong community is characterized by solid bonding but should still remain flexible, not leading to exclusion of others [104].

Social capital is frequently linked to sustainability, especially to its social aspects [101,105,106]. Social capital thereby contributes to the wellbeing of communities, their sustainability and ability to function. Social capital and ‘social cohesion’, as concepts, are associated with social networks, norms of reciprocity and features of social organization [99], and the integration of resulting social behaviour [101]. More precisely, social capital influences social innovations and their potential impacts. Social capital is regarded as a “sustainable investment in the common good and the capacity of societies to innovate” [97] (p. 10). In terms of an environmental focus of sustainability, Chang et al. [107] (p. 232) point out the critical role of social capital in sustaining and developing community initiatives and environmental protection efforts, while Garcia-Amando et al. [88] highlight the positive relationship between social capital and collective action for sustainably governing common resources.

As an intermediate conclusion we propose a conceptualization of a framework to assess societal effects of transdisciplinary transition management (Table 1). This includes three impacts, aspects composing them, qualitative indicators of their potential contribution to sustainability as well as potentially adverse effects. Impacts are suitable for assessment, as they are both tangible and indicative for (later) outcomes of transition management. All three impacts may contribute to the orientation towards sustainability, e.g., in its ecological or social dimension.

Impacts show conceptual overlaps as well as interlinkages in a number of aspects (Table 1, arrows). Overlaps and interlinkages originate from how aspects are described in the literature. They are particularly frequent when it comes to how aspects are assumed to contribute to sustainability. They may indicate different relationships between aspects, e.g., potential synergies, mediating effects and positive feedback loops. As the concrete relationships are unknown, we do not erase them from the framework, but make the potential overlaps and interlinkages explicit. These observations, based on a literature review, will be further explored in empirical case studies, starting with the operationalization of the concepts in the next step.

Table 1. Summary of review and conceptual overview of impacts. The first three columns show how the effects are conceptualized in the literature and how they are assumed to contribute to sustainability. The numbers indicate aspects that are used in the framework. Numbers correspond to Figure 2. Aspects used in the fourth column are used as critical reflexive questions. References correspond to the literature reviewed (Sections 2.1 and 2.2.1–2.2.3). Arrows indicate potential interlinkages and synergies between the aspects of different societal effects, e.g., →sl 7 = is linked to aspect 7 of social capital. Abbreviations: sl = social learning, em = empowerment, sc = social capital.

Impact	Description (Subject and Object of Impact)	Potential Contributions to Sustainability (Result of Impact)	Adverse Effects (Critique)
Social learning	<p>Social learning comprises processes of individual and collective experimentation, reflection and innovation [22,32], which lead to lasting changes in the interpretive frames (such as belief systems, cognitive frameworks, etc.) guiding the actions of a person [63]. In detail, it can include:</p> <ol style="list-style-type: none"> (1) (a) First- (new knowledge, skills) and (b) second-order learning (changes in values and assumptions) [43,46,53] cf. [14,15]. (2) Transmission of individual learnings to wider social groups at small or larger scales [15,53]. 	<ol style="list-style-type: none"> (3) Raising awareness on sustainability-related problems [56,58,69,70]; (→em 6) (4) Increasing the feeling of responsibility and capacity of people to react to these sustainability problems [54–56,58,69], e.g., by overcoming unsustainable lock-in situations [31]; (→em 6,7) (5) Allowing for the development of joint visions in direction of sustainability [32,34]; (6) Allowing for the development of collective action in direction of sustainability [29,67,68] (→sc 7); (7) Spreading of (sustainability) insights from individuals and groups to wider groups is possible [15,22,24] (→em 9, sc 4). 	<p>A focus on consensus building, shared goals and trust/respect to foster social learning may limit the space for radical change (towards sustainability) [108]</p>
Empowerment	<p>Empowerment refers to:</p> <ol style="list-style-type: none"> (1) Increases in intrinsic motivations via choice, impact, meaningfulness and competence [49,74,81], (2) Increases in decision-making capacities [82,83], (3) Gains in control over resources and possibilities [73,75,76,79], (4) (Beneficial) changes in the overall position of individuals and groups within the system [76], (5) Development of new resources [73,75,78]. 	<ol style="list-style-type: none"> (6) When process of (psychological) empowerment are linked to increases in awareness and motivation on/for sustainability (→sl 3,4) [69]; (7) If psychological empowerment raises capacity to react to sustainability problems (→sl 4) [13,69], (8) Giving sustainability interests more decision-making power; (9) Contributing to changing structures, if new structures are more sustainable, e.g., sustainable niches become mainstream (transformative power) [40,49,73,109], e.g., when frontrunners trend set sustainable alternatives [23,24,85,86]. (→sl 3,4,7, sc 7). (10) Contributing to the development of new, more sustainable resources (innovative power) [73] (→sc 6). 	<p>Empowerment paradox: the attempt to empower somebody establishes a dependency relationship and therefore may ultimately be disempowering [49]</p>

Table 1. Cont.

Impact	Description (Subject and Object of Impact)	Potential Contributions to Sustainability (Result of Impact)	Adverse Effects (Critique)
Social capital	<p>Social capital structurally refers to relationships between individuals, groups and networks [87,96]. Two dimensions can be distinguished [97]:</p> <p>(1) Bonding amongst people in a group</p> <p>(2) Bridging to people outside a group.</p> <p>Relationships have a quantitative (e.g., number of contacts) and a qualitative side (trust, common rules and values as well as norms of reciprocity) [45,87,90,94,95].</p>	(3) Building and maintaining strong ties within a group (e.g., via trust, shared rules and values) is contributing to a strong local community, which can be considered one of the social aspects of sustainability [89,98–101,105,106]	Strong increase of social capital within a group may create exclusion tendencies towards “outsiders” [101], hamper innovation [102] and obscure power relationships [91,103].
		(4) Group remaining flexible and inclusive; openness towards other groups or across groups, networking (bridging) [22] (→sl 7, em 9);	
		(5) Supporting to develop and sustain community initiatives [107] (sl6, em 10);	
		(6) Increasing the capacity of the community for (sustainability) innovations (→em 10) [97];	
		(7) Positively relating to collective action for sustainability (→sl 6, em 9) [48,51,88,90,92,100]	

3. Materials and Methods

In this section we operationalize the three impacts for application in the context of transdisciplinary transition management. We first describe the case studies the framework gets applied to. Secondly, the impacts are operationalized for direct and indirect measurement and the methods of data collection and interpretation are outlined.

3.1. Case Description

In our cases we focus mainly on the application of a core governance instrument of transition management, the transition arena. This is a protected space for social learning, where participants meet outside of their usual habits and roles and engage in a deliberative process and transformative action regarding a specific persistent problem [22]. The deliberative process of the transition arena includes a common problem framing, envisioning a sustainable future as well as participatory back-casting to define concrete steps for realizing future visions. Setting up experiments so as to carry out these steps is part of the process. Once finished, the transition arena group presents their transition narrative to a broader public and reconnects it with political, social and economic realities [22]; the group is its ambassador.

We focus on two specific transition management processes that we were involved in: one in the village of Finkenstein in Austria and one in the urban neighbourhood of Carnisse in Rotterdam, The Netherlands (for details see Box 1). These processes were initiated as part of the EU FP7 funded research project “InContext” (2010–2013), which (amongst others) developed and applied a transition management approach for local communities, the community arena [17]. This was done by adapting the transition arena approach outlined above to the local level.

Box 1. The case study communities (taken from, [110], modified).

Finkenstein am Faaker See is located in Austria, on the border between Slovenia and Italy. It is one of the largest communities in Carinthia (one of the nine Austrian Länder). About 8500 people live in Finkenstein, spread over about 28 villages, and settlements divided into a Slovenian-speaking minority and a German-speaking majority. The main economic sectors are tourism and (small) industry and agriculture. Societal challenges at the local scale include limited political participation, low social cohesion and over-individualization as well as un- or overused natural heritage. The focus of the community arena process was on quality of life. The process was co-financed by the municipality of Finkenstein and a supporting group to the community arena, including local politicians, was established. The vision is put into practice through action-oriented projects or deliberative processes in a number of working groups, e.g., on economics, sustainability and social issues. These working groups realized various activities, such as workshop series on gardening or participation, welcoming brochures for new arrivals and local journalism.

Carnisse is an urban neighbourhood in the city of Rotterdam, situated on the western coast of The Netherlands. Some 10,000 (out of Rotterdam’s 600,000) inhabitants live in Carnisse. It is known as a deprived neighbourhood, scoring low on a number of municipal indexes and marked by a high turnaround of inhabitants, who together represent about 170 nationalities. Severe budget cuts in the municipality are threatening the continuation of social work as well as community facilities. Societal challenges at the local scale include economic hardship, over-individualization, poor building stock, and a lack of social cohesion and public spaces. The focus of the community arena process was on the quality of life in the neighbourhood and it was co-financed by the Dutch government. The local city administration was informed of the arena process, but it did not officially support the process. The vision is put into practice by a group that aims to re-open one of the community facilities, a community centre and a related community garden under self-management. In addition, members of the community arena are also organising a number of deliberative meetings with different stakeholder groups.

Using an action research approach, researchers systematically facilitated a collective search to explore opportunities for joint action in Finkenstein and Carnisse [48]. The process was participatory and reflexive in nature, aiming to allow for intensive learning amongst the participants. Participatory processes lasted 16–17 months and included 13 (Carnisse) and 16 (Finkenstein) participatory meetings (see Supplementary Material Description S4 for details). Researchers took diverse roles including as knowledge brokers, reflexive scientists and process facilitators (see [22] for a comprehensive analysis

of researchers' roles). All authors have been involved in the case studies, albeit to different degrees (see the author contributions declared below). Reflexive elements included a focus on the values, needs, thoughts and feelings of the participants, as they were supposed to be essential drivers for behavioural change and collective actions.

The InContext project consortium agreed that a predefined sustainability goal with targets for the case studies would be counterproductive to the idea of an open process of experimentation and learning. The case studies were conceived of as a learning journey to render the concept meaningful in the local context [48]. Rather than focusing on the concept of sustainability, the community arena process aimed to play into local dynamics and was centred on a good quality of life for all now and in the future. The consortium hoped to capture the essence of sustainability without falling into quarrels about the notion itself. The researchers operationalized the concept of sustainability in four dimensions:

- (1) Environmental thinking (awareness of nature and natural resources),
- (2) Social thinking (consideration and acknowledgement of self and others),
- (3) Time horizon (short and long term) and
- (4) Interregional thinking (connection with other parts in the world, near and far).

These dimensions of sustainability thinking were to be used in the facilitation of the processes (Wittmayer et al. 2012). For the action research practice, this meant that the researchers provided space for the participants to decide what is important for them and their local community. In the discussions the four dimensions were used to motivate people to think in the direction of sustainability (for details, see [110]). The term sustainability was used, though it was not given a very prominent role in the process.

The presented case studies have been selected as they represent two of a small number of transition management processes that have been applied at the local level so far (e.g., [31,48]). Regarding the research process, both cases followed the typical transition management methodology, the transition arena adapted to the local level. In this regard the cases allow us to explore the societal effects of typical transition management processes. Besides the methodology, cases show similarities with regard to the number of inhabitants and being located in a Western European context. Regarding the type of settlement, they differ strongly: One case is located in a rural area and consists of an agglomeration of a number of villages, while the other is located in a neighbourhood of a larger city. Thus, Finkenstein and Carnisse may be used as contrasting cases [111] to explore the bandwidth of potential applications and the effects of transition management at the local level.

3.2. Operationalization of Impacts, Data Collection and Interpretation

We propose operationalizing and assessing the three key concepts outlined in Figure 2, summing up the various aspects related to the outlined impacts (cf. Table A1 in the Appendix A for details). While the proposed operationalization could generally be used for the assessment of the transition area instrument in various contexts (e.g., companies, cities or regions), it specifically suits the local level, as outlined in the consecutive case study analysis. The operationalization builds on the literature reviewed (Sections 2.1 and 2.2) and the derived descriptions of impacts (Table 1). Each impact is differentiated into a number of aspects, some of which describe the impact per se, and some of which try to capture its relationship to sustainability. Thereby impacts are sensitizing concepts. Their meaning needs to be explored in empirical research.

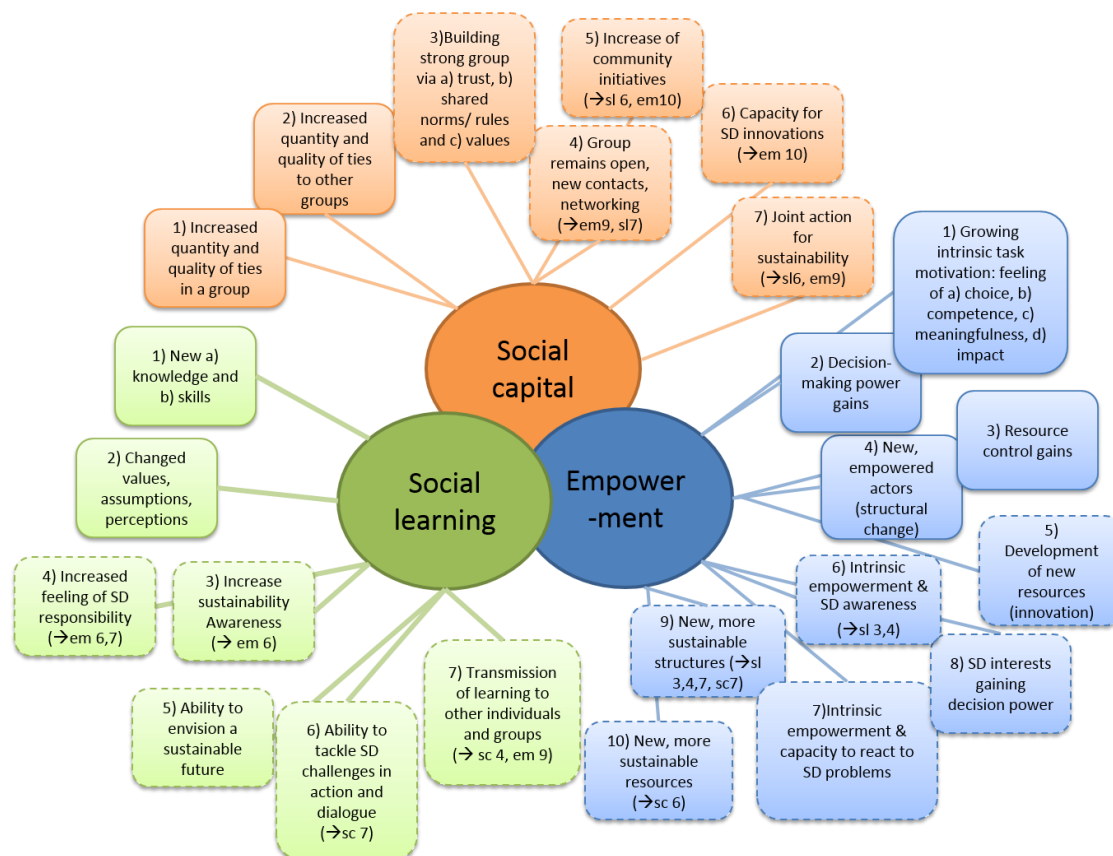


Figure 2. Graphical overview of operationalizing different societal effects for assessment. This figure shows the operationalization of each impact in two areas: first, it depicts aspects to generally characterize the effect (regular borders). Second, it includes aspects allowing us to assess the relationship of the societal effect to sustainability (dashed borders). Aspects are drawn from the review of the literature (Table 1). Small arrows indicate conceptual overlap and therefore possible interlinkages between different aspects (e.g., → sl 6 means “related to aspect 6 of social learning”). Abbreviations: sl = social learning, em = empowerment, sc = social capita, SD = sustainability. Each aspect is substantiated for its direct (building on participants’ self-reporting) and indirect (building on document analysis and participant observations) assessment (see Table A1 in the Appendix A for details).

Our empirical analysis is focused on research activities and the data generation that took part during the lifetime of the two local case study projects (see Supplementary Material Description S4 for details on processes). When research projects ended, processes initially facilitated by researchers were handed over to local participants. Participatory evaluation workshops marked the end of the research process in both communities. Setting temporal boundaries for the analysis was necessary for practical, e.g., funding reasons. While this allows us to capture a range of impacts, the mid- and long-term effects generated by the project are excluded (for the outcomes, see Figure 1).

For gathering and interpreting data on impacts, various methods were used (see Supplementary Material Description S5 for details on methods). This included participatory evaluation workshops and qualitative and semi-qualitative interviews (for detailed reporting see project deliverables [17,110,112–115]). Evaluation workshops were approximately five hours long and included group discussion, discussions in smaller groups, plenaries, a world café and joint assessments and ratings. Reflections included questions on learning, empowerment and social capital developments as well as the overall community arena process, content and results and an outlook on the future. In Finkenstein 25 persons participated, in Carnisse 7. In Finkenstein the workshop was prepared with a preceding semi-structured online survey (15 responses) as well as in-depth qualitative telephone-interviews (eight interviewees).

In Carnisse it was prepared and enriched by 13 semi-structured interviews (seven mid-term interviews and six interviews at the end). In both cases the core outputs of the case studies at the level of products are additionally used as data sources. This includes the vision documents as well as concrete and experimental services developed by participants (see Supplementary Materials Description S6 for a detailed outline).

The consecutive assessment does both: it directly assesses impacts and it indirectly gathers information about them by analysing the outputs generated by project participants. For direct assessment, participants were asked to report on various aspects of the impacts as part of the participatory evaluation workshop and respective interviews in the final phase of the case studies. For indirect assessment and reflection of direct data sources, researchers analysed a) participant observations of the arena process creating these outputs and, where possible b) the indication of developed outputs (e.g., the vision documents) with regard to the impacts. Jointly, these three assessments form a triangulation, complementing one another to a multifaceted picture on the creation of impacts. Due to the nature of the data (self-reported observations of participants, participant observations, and document analysis of visions) and the small sample size, the analysis is of a qualitative and explorative nature.

4. Results

Results for each impact are presented in the form of an overview table (Tables 2–4), capturing core insights regarding each impact and aspects from the two cases. (For a detailed report of empirical observations please see Supplementary Materials Tables S1–S3.) These results are then discussed alongside four questions in two steps. First it is discussed: (A) was the impact observed? (B) how was the impact empirically related to sustainability? (C) what adverse or limiting effects occurred (see Table 1, right column)? Second, a comparative discussion addressed: (D) what were the similarities and differences between the two cases? Conceptual overlaps and potential interlinkages between aspects that originated from the literature review are taken into account for data collection and attribution. If the data from overlapping aspects appear relevant to the aspect in question, they are reproduced and the overlap is indicated.

Table 2. Overview of social learning results. (Aspects are assessed using both direct reporting of participants (formatting: regular) and indirect assessments based on researcher observations and analysis of secondary sources (formatting: *italic*). Underlying operationalization of each aspect includes brief propositions for direct and indirect assessment (see Appendix A for details). Abbreviations used are P = Participants, R = Researchers, sc = social capital, em = empowerment, SD = sustainability; interlinkage with aspects of other impacts are indicated (→)).

No	Aspects	Finkenstein	Carnisse
1a	New skills	Several survey R discovered new competencies: speaking one's own mind in public, better communication, creativity, organisation, leadership, an increase in self-reflexivity and the feeling of responsibility as well as the ability to work in a team and the understanding for political work—R made similar observations.	Diverse new skills reported: speaking one's own mind in public, sharing knowledge and perspectives, put things in a broader perspective, R made similar observations. Additionally observed skills: working respectfully together, chairing group session, reporting outcomes.
1b	New knowledge	P reported some surprises, insight that individual worries (but also ideas) are shared by others; a general increase in knowledge. <i>Ps learned about the idea of transitions, sustainability transitions, participatory methods and issues related to different areas such as mobility, energy, local economic affairs; knowledge repercussions in outputs generated.</i>	P reported more knowledge and awareness on what was happening around them, the neighbourhood and its dynamics and the history of Carnisse. Legal, financial and institutional know-how related to a community centre was gained. R observed participants getting acquainted with new perspectives.
2	Changed values, assumptions and perceptions	P reported increased trust, more openness, fewer prejudices, positive attitudes to change and more long-term thinking, personal growth and a higher motivation to engage. <i>No particular observations.</i>	P reported awareness that they can make a difference; arena re-affirmed their current perspectives and values; vision gave them nice ordering of their assumptions and perspectives on change. R observed P starting to feel that change is necessary and possible, a continuous process that comes from within.
3	Increased sustainability awareness	P stated sustainability is a very important issue. <i>Working groups explicitly or implicitly deal with sustainability; experiments address sustainability challenges; the vision includes sustainability goals.</i>	All P found a clear connection between sustainability and the vision; interpretations of sustainability differed, but the common denominator was a focus on the long term. <i>Sustainability was multi-interpretable, no consensus on priorities was reached, the vision created awareness of the interconnectedness of different scales.</i>
4	Increased feeling of responsibility for sustainability	P partially feel responsible; in general increased feeling of responsibility of own actions. <i>Working on a common vision including sustainability increased sustainability awareness; the vision attributes responsibility to the current generation. It was agreed upon by all participants.</i>	P reported tackling neighbourhood problems (not specific sustainability problems), felt responsible for participating in the arena and lamented the absence of institutional actors from the arena process and the outsourcing of responsibility. N/A
5	Ability to envision a (sustainable) future	N/A. <i>A joint vision was developed, agreed upon by all, to include sustainability. Radical change was constantly promoted by single participants only; participants reacted rather annoyed, and the arena stuck to envisioning soft changes.</i>	All P found a clear connection between sustainability and the vision; interpretations of sustainability differed, but the common denominator was a focus on the long term. Some reported the vision was too utopian, while others stated that it wasn't radical enough. <i>A joint vision was developed, with input from group discussions and 1-on-1 interviews. It includes ecological and mostly social aspects of sustainability. Vision was agreed upon in the arena; however, most participants did not own the vision.</i>

Table 2. Cont.

No	Aspects	Finkenstein	Carnisse
6	Tackling sustainability in actions & dialog	P stated that the project would be beneficial for future generations and other regions and would benefit sustainability in Finkenstein. <i>Eight working groups, several actions and events in many parts relating to sustainability were developed.</i> Nine out of 15 participants stated that the project implements measures that are future-oriented and benefit other parts of the world. A “climate energy model-region” was applied for and got accepted. Working groups are related to sustainability. An institutional structure for further implementation of the vision has been built, establishing a local steering committee. (→sc aspect 7).	For most P neighbourhood development (so not SD) was a collaborative effort par excellence and working collaboratively was the guiding principle of the vision. Sustainability was operationalized in relation to social challenges. <i>Collaborative actions were initiated in the experiments.</i> Directly: No explicit joint action for sustainability was mentioned; the community centre reopening was a reaction to local, social problems. Indirectly: three newly arena-initiated experiments related to social aspects of sustainability. (→sc aspect 7)
7	Transmission of (sustainability) learning	P stated that they have frequently talked with other citizens about the project, and met with some interest and some scepticism. <i>Results presented to the transition team (local politicians) as well as to the interested public.</i> Following the arena process, a successful application was launched to become a “climate-energy-model-region”, building on insights from the arena process and supported by local officials. (→sc aspect 4).	Vision was being distributed during a network event. P talked to other residents about ‘Bloeieind Carnisse’, the development vision for Carnisse. People who were not engaged in the process were mainly sceptical; although they liked the vision, but considered it too abstract. <i>Similar observations, plus the vision was presented in the media. General focus on internal group process.</i> The experiment of reopening a community centre under self-maintenance attracted the interest of officials of the Rotterdam municipality and was interpreted as a potential model for mitigating the crisis of the welfare state within the city. (→sc aspect 4)

Table 3. Overview of results regarding empowerment. (Aspects are assessed using both direct reporting of participants (formatting: regular) and indirect assessments by researchers (formatting: *italic*). Underlying operationalization of each aspect includes brief propositions for direct and indirect assessment (see Appendix A for details). Abbreviations: P = Participants, R = Researchers, sl = social learning, sc = social capital; interlinkage with aspects of other impacts are indicated (→)).

No	Aspects	Finkenstein	Carnisse
1	Growing intrinsic task motivation via A) choice, B) competence, C) meaningfulness and D) impact.	(A) P reported they were able to choose the agenda. <i>Vision written by researchers but developed and agreed upon by the community arena, with working groups and actions led by P.</i> (B) Cf. social learning/new skills; P took roles depending on competences they became aware of during the arena, and new skills got developed. (C) Good scores for bringing in their own input and topics, open agenda, majority of P had the feeling of doing something meaningful; R made similar observations. (D) P believe they have an impact on the local environment; the steps taken were quite small; some changes were based on assumptions about their own ability to impact development; 50% of P reported increase in possibilities to shape Finkenstein; attitudes towards the future changed in a positive way; <i>experiments impacted upon local developments in the form of raising attention, attracting additional participants and finally the validation of the climate energy model region in Finkenstein.</i>	(A) All P reported being able to choose the agenda. <i>The arena process helped to voice perspectives on the state of Carnisse.</i> (B) P reported gains in confidence to speak in public (see ‘skills’ in social learning table); P took different roles, could employ their competences in the arena when necessary. (C) Scores P gave for being able to bring in their own input and topics were good; P felt vision was a great result, appreciated the exchange of perspectives. <i>Motivation in group was very apparent during the whole process, a symptom of a meaningful process.</i> (D) Scores P gave to level of impact they are having were good. P stated they were able to make a difference. Some had this feeling prior to the arena. Others stated the arena-process did not develop sufficient tangible actions for people to make an impact. P, in re-opening of the community centre, stated they can make a direct impact in the here and now. <i>Re-opening the community centre made a direct impact; presentation of vision to broader audience had impact.</i>

Table 3. Cont.

No	Aspects	Finkenstein	Carnisse
2	Gains in decision-making power with regard to local developments	Change in perception of local politics: realizing own ability to shape local politics, taking responsibility for local developments, recognition of the value of local politics. The majority of P agreed that they can bring their own requests/ideas to the municipality. <i>No formalized decision-making power granted by local politics, but increased influence on local development; working groups started activities, organized courses and events, brought new ideas to the community council.</i>	Most P reported being decision-makers with power, but also reported that the most important decision-makers were not present in the arena process and that they needed to be involved. <i>Arena had strong emphasis on 'power to the people', managed to influence a large-scale networking event and to put its transition agenda on the table.</i> (See also aspect 1/impact above)
3	Gains of control over resources by arena participants	Nothing to report. <i>Very few concrete resources granted; intangible resources difficult to observe. Actions by arena P frequently undertaken without waiting for permission or resources from the community council.</i>	Direct effect was generated by taking control over the closed community centre, participants stated actors who control resources should step up. <i>Resource of symbolic legitimization, financial and physical capital to re-open and manage the community centre. New social capital (ties and networks of engaged residents and volunteers) and symbolic capital (the group became a powerful actor in the institutional network of Carnisse).</i>
4	Changes in local structures (e.g., new actors)	Nothing to report: <i>Arena established itself as a new, but temporal actor in the local system. It gained more and more publicity; supporting group of local officials (the transition team); a local steering committee was elected</i>	Nothing to report. <i>Community arena did not appear as a new actor much, because it was kept in the shadows/margins. But group action- around the community centre gained considerable influence (because of their central position in the neighbourhood and influential networks).</i>
5	Development of new resources (innovation)	Nothing to report. <i>Nothing to report.</i>	Nothing to report. <i>Symbolic capital: vision and the arena became a symbol to relate to. See aspect 3/resource gains on new social capital and symbolic capital strengthening the new actor.</i>
6	Empowerment contributes to sustainability if increasing meaningfulness (aspect 1) relates to sustainability	R stated sustainability is a very important issue. <i>Working groups explicitly or implicitly deal with sustainability; experiments o address sustainability challenges; the vision includes sustainability goals.</i> P partially feel responsible; in general they have an increased feeling of responsibility for their own actions. <i>Working on a common vision including sustainability increased sustainability awareness; the vision attributes responsibility to the current generation. It was agreed upon by all participants. (→sl aspect 3, 4)</i>	All respondents found a clear connection between sustainability and the vision, but the interpretation of sustainability differed. Focus on the long term and local problems such as social challenges. Some participants reported that they were engaged because they felt responsible for solving these challenges. Long-term thinking and awareness of the interlinkages between different scale levels were strengthened. <i>Sustainability was interpreted in different ways by the different participants, but the vision created awareness on the interconnectedness of different scales. Vision shows sustainability in social, ecological and economical dimensions. This potentially was influenced by the writing by the researchers.</i> →social learning 3 P reported on tackling neighbourhood problems (not specific sustainability problems), felt responsible for participating in the arena and lamented the absence of institutional actors from the arena process and the outsourcing of responsibility. <i>N/a</i> →social learning 4

Table 3. Cont.

No	Aspects	Finkenstein	Carnisse
7	Feeling of (increased) capacity to react to sus. problems	The vision exerted pull and encouraged participants to build pathways for reaching the vision; attempts to directly influence the decisions of the community council were only partially successful. <i>Rs made similar observations.</i>	P reported community centre reopening as a reaction to local, social problems. <i>Vision of arena and arena process focussed on “power to the people”, independence from local institutional structures, embeddedness of new actions in the local communities.</i>
8	New sustainability-related decision-making capacities	Nothing to report; <i>working groups influenced local developments with their actions, including sustainability-related experiments.</i>	Nothing to report. Only with regard to social aspects of sustainability as part of the re-opened community centre.
9	A sustainability orientation of new actors and changing of local structures	<p>P stated sustainability is a very important issue and they partially feel responsible for it; in general they have an increased feeling of responsibility for their own actions.</p> <p><i>Indirectly: The arena group and related working groups established themselves as new local actors. The developed vision shows the high value of sustainability; Some working groups and activities highlighted the value of sustainability (→sl aspect 3, 4)</i></p> <p>P stated that they have frequently talked with other citizens about the project, and were met with some interest but also some scepticism. <i>Results presented to the transition team (local politicians) as well as to the interested public. Following the arena process, a successful application was launched to become a climate energy model region, building on insights from the arena process and supported by local officials. (→sl aspect 7)</i></p> <p>P stated that the project was beneficial for future generations and other regions and could benefit sustainability in Finkenstein. <i>Eight working groups; several actions and events in many parts relating to sustainability were developed.</i></p> <p>Nine out of 15 participants stated that the project implements measures that are future-oriented and benefit other parts of the world. <i>A “climate-energy-model-region” was applied for and got accepted. Working groups are related to sustainability. An institutional structure for further implementation of the vision has been built, establishing a local steering committee. →social capital 6</i></p>	<p>Nothing to report. <i>The foundation board, as a new local actor, had a certain (implicit) sustainability orientation. The experiment run by the foundation board of reopening a community centre under self-maintenance attracted the interest of officials of the Rotterdam municipality and was interpreted as a potential model for mitigating the crisis of the welfare state within the city.</i></p> <p>All P found a clear connection between sustainability and the vision; the interpretation of sustainability differed, but the common denominator was a focus on the long term. <i>Sustainability was interpreted in different ways; no consensus on priorities was reached, but the vision created awareness of the interconnectedness of different scales. →social learning 3</i></p> <p>P reported on tackling neighbourhood problems (not specific sustainability problems), felt responsible for participating in the arena and lamented the absence of institutional actors from the arena process and the outsourcing of responsibility. <i>N/a→social learning 4</i></p> <p>Vision was being distributed during a network event. P talked to other residents about ‘Bloeiend Carnisse’, the development vision for Carnisse. People who were not engaged in the process were mainly sceptical; although they liked the vision, it was considered too abstract. <i>Similar observations, plus the vision was presented in the media. General focus on internal group process. The experiment of reopening a community centre under self-maintenance attracted the interest of officials of the Rotterdam municipality and was interpreted as a potential model for mitigating the crisis of the welfare state within the city.→social learning 7</i></p> <p>Directly: No explicit joint action for sustainability was mentioned; the community centre reopening was a reaction to local, social problems. <i>Indirectly: three newly arena initiated experiments, related to social aspects of sustainability.→social capital 7</i></p>
10	Developed resources to contribute to sustainability	Nothing to report	Nothing to report. <i>Vision as a symbol including sustainability aspects may implicitly promote sustainability in neighbourhood development. (→sc aspect 6)</i>

Table 4. Overview of results regarding social capital. (Aspects are assessed using both direct reporting of participants (formatting: regular) and indirect assessments by researchers (formatting: *italic*). Underlying operationalization of each aspect includes brief propositions for direct and indirect assessment (see Appendix A for details), Abbreviations: P (Participants) and R (Researchers), sc (Social capital), em (Empowerment); interlinkage with aspects of other impacts are indicated (→)).

No	Aspects	Finkenstein	Carnisse
1	Quantity and quality of ties within a group, i.e., the community arena	Approximately 60 P meet regularly; many of them did not know each other before. Collaboration with like-minded people was appreciated. P perceived themselves as “one group”; development of very good relationships, more trustful relationships and connection to new milieus. <i>The group was quite diverse; participants did not know each other; trustful atmosphere; group feeling.</i>	67 P in total made contact with each other. Participants did not know each other beforehand and were quite diverse. They did not see the arena as a stable group with a lot of cohesion and interactions were very informal, loose and short-term. A shared feeling of responsibility for Carnisse was expressed. <i>The arena group was exclusive in participation. Ties within the arena group were rather distant. Different phases can be observed: from open and flexible to a closed core group that was opening up again.</i>
2	Quantity and quality of ties with other groups, i.e., other groups within or beyond the community	Quantity not concretely assessed. P frequently talked with other citizens about the project and met with some interest and some scepticism. Criticism of P regarding lack of public interest. <i>Arena connected to public in three broadening events; connected with policy makers in three meetings. Ties to Slovenian minority in Finkenstein could not be established.</i>	Quantity not concretely assessed. Outside contact on the topic of the arena did not really take place. In regard to the experiment, there was a lot of exchange. <i>One public broadening event with 100+ participants, contact established with local municipality and government. Work on the opening of the community centre established further contact with the Rotterdam municipality, housing cooperations, local schools, etc. Ties to inhabitants with immigrant backgrounds were difficult to establish and maintain in deliberative processes, but for visitors of the community centre and participants in workshops and activities new ties were established</i>
3a	Building strong group via a) development of trust within the group	Growing trust was reported, as well as working together in a respectful and constructive way. <i>Trust could be observed.</i>	Group feeling was not really created. <i>Not observed.</i>
3b	Building strong group via b) development of shared rules and norms within group	Similar concerns among the participants; communication became more appreciative. <i>The steering committee was elected by a mutually agreed voting procedure; communication guidelines were developed.</i>	Not assessed. <i>The common denominator of the group was a shared connection and responsibility to the neighbourhood.</i>
3c	Building strong group via c) development of shared values within the group	Initially divagating interests and aims were transferred into a shared vision and actions benefitting the common good. <i>Some activities show shared values (mostly social); the vision includes a number of value statements and was endorsed by the whole arena group.</i>	Not assessed. <i>Shared values of group centred around social morals for community; also apparent in the vision.</i>

Table 4. Cont.

No	Aspects	Finkenstein	Carnisse
4	Group shows openness towards new contacts, networking	<p>Process sparked interest in and respect for other persons, increased self-reflexivity and led to fewer prejudices. <i>Working groups focussed on establishing exchange.</i></p> <p>P stated that they have frequently talked with other citizens about the project, meeting with some interest and some scepticism. <i>Results presented to the transition team (local politicians) as well as to the interested public. Following the arena process, a successful application was launched to become a “climate-energy-model-region”, building on insights from the arena process and supported by local officials. (→sl aspect 7, em 9)</i></p>	<p>Some participants reported that they had sparked interest in other participants. <i>Efforts were made by the arena group to invite new contacts to each meeting, but these were not very effective.</i></p> <p><i>The experiment run by the foundation board of reopening a community centre under self-maintenance attracted the interest of officials of the Rotterdam municipality and was interpreted as a potential model for mitigating the crisis of the welfare state within the city (→sl aspect 7, em 9)</i></p>
5	Quantity and quality of sustained or new community initiatives	<p>Quantity: 60 participants in eight working groups meet regularly; eight arena workshops with 10–30 participants each took place; Quality: new ways of working together. <i>Quantity: eight collective actions were started. Quality—nothing to report. (→sl aspect 6)</i></p>	<p>N/A <i>Three types of innovative practices: newly arena initiated experiments; participants engaged in own (innovative) activities; innovative ideas communicated through the vision and a networking event. (→sl aspect 6)</i></p>
6	Capacity for sustainability-related innovations	<p>Nothing to report. <i>Nothing to report.</i></p>	<p>Nothing to report. <i>Vision as a symbol including sustainability aspects may implicitly promote sustainability in neighbourhood development. (→em aspect 10)</i></p>
7	Joint action for sustainability	<p>Nine out of 15 participants state that the project implements measures that are future-oriented and benefit other parts of the world. <i>A “climate-energy-model region” was applied for and got accepted. Working groups are related to sustainability. An institutional structure for further implementation of the vision has been built, establishing a local steering committee. (→em aspect 9)</i></p> <p>P stated project was beneficial for future generations and other regions and would benefit sustainability in Finkenstein. <i>Eight working groups, several actions and events in many parts relating to sustainability were developed. (→sl aspect 6)</i></p>	<p>Directly: No explicit joint action for sustainability was mentioned; community centre reopening was a reaction to local, social problems. Indirectly: <i>three newly arena initiated experiments, related to social aspects of sustainability. (→em aspect 9)</i></p> <p>For most P, neighbourhood development (so not SD) was a collaborative effort par excellence and working collaboratively was the guiding principle for the vision. Thereby, sustainability was operationalized in relation to social challenges. <i>Collaborative actions were initiated in experiments. (→sl aspect 6)</i></p>

The following analysis builds on Table 2 to discuss social learning results:

(Add A) In Finkenstein first- and second-order learning was observed (aspects 1a,b and 2). Furthermore, participants' learning was partially transmitted to wider groups (aspect 7). Thus, social learning took place. In Carnisse mostly first-order learning was reported, complemented by some second-order learning. Both types of learning were observed by researchers, while the transmission of learning to wider groups was reported and observed only to a limited extent. Overall, social learning took place.

(Add B) Via the learning process in Finkenstein, sustainability gained an important role: participants learned to counter sustainability challenges by developing a joint vision prominently including sustainability and initiated actions and dialogue towards realizing this vision (aspects 5, 6). Therefore, it is likely that learning on sustainability-related issues got transferred into the vision and actions. Some aspects of second-order learning, e.g., increased attribution of responsibility for one's own actions (aspect 4), as well as increased openness to change and a positive attitude towards the future, are likely to positively affect participants' motivation for sustainability-related actions. An increase in sustainability awareness was not reported, but awareness was generally high (aspect 3).

It remains difficult to evaluate the relationship of learning and sustainability in Carnisse, since sustainability was open to different interpretations in the arena process. Sustainability was mainly linked to 'the social' and 'the local' (aspects 4 and 6). In addition, there was some awareness gained on long-term processes and different scales related to local development (aspect 3). Overall, social learning can only be partially related to sustainability. For both cases critical aspects of social learning, like the blocking of radical change by a strong impetus on consensus, are difficult to decide upon (aspect 5). There are some indications that the vision developed in Finkenstein includes rather soft but radical changes. In Carnisse different opinions were raised with regards to the developed vision being either too utopian or not radical enough.

The following analysis builds on Table 3 to answer the outlined questions for empowerment:

(Add A) In Finkenstein there was empowerment happening in different areas. A psychological empowerment of participants was observable on all four indicators (aspect 1). On the organization and political level, some aspects of empowerment were observable (aspects 2–4). Participants perceived their influence on local politics to be growing and reported a growing appreciation of the work of local politicians (aspect 2). A new actor (the community arena and related working groups) was established and its decision-making capacities increased during the lifetime of the project (aspect 4). At the end of the project this actor got institutionalized in the form of a self-standing local steering committee. Still, resources were developed or gained control on very little (aspects 3 and 5). Critically reflecting empowerment in Finkenstein reveals the establishment of dependency relationships between more and less powerful participants as well as with regard to local politics. Still, this dependency was limited since the arena acted largely independently of local politics, e.g., not drawing on resources provided by local politics.

In Carnisse a psychological empowerment of participants was observed and reported with regard to all four indicators (aspect 1). In organizational and political terms, empowerment took place to a certain degree when the transition arena and the respective vision gained symbolic capital (aspects 4 and 5). A stronger empowerment took place via the re-opening of the community centre, which included a gain in decision-making power, new resources and establishing a new actor in the local community (aspects 2–4). A limiting factor was the low connection of the arena to current policy and governmental structures, with important decision-makers being absent from the process (aspect 3). Dependency relationships in Carnisse can be observed in the toleration of the actions, e.g., the squatting at the community centre, by the municipality and the high-level political support of this.

(Add B) In Finkenstein, sustainability is part of the new actors' agenda and actions. As part of the social learning process, sustainability became more important to the participants. Participants felt capable of actively influencing local development, including sustainability-related activities (aspect 7). An increase in sustainability awareness was not reported, but awareness was generally

high (aspect 6). The orientation of the newly developed actor towards sustainability was high and influenced local structures to some extent (aspect 9). Therefore, sustainability and empowerment emerged simultaneously. Sustainability-related formalized decision-making power or resources were nevertheless not gained (aspect 8).

In the community arena in Carnisse, its vision and experiments, sustainability was considered in limited and more implicit ways (aspect 6). Rather, the focus was on local and social challenges. In this way, sustainability was part of the empowerment that took place via resource and decision-making power gains as well as the establishment of a new actor (aspects 8–10). Beyond this, generic sustainability dimensions can be traced in the vision, which functioned as a symbol for local development (aspects 6 and 9). While the community centre did not appear as a new local actor, the foundation board running the major experiment did gain influence in local development as well as support from city officials. It had a certain sustainability orientation, focusing on social issues (aspect 9). Relatedly, participants increased their capacity to react to local social problems (aspect 7).

The following analysis builds on Table 4 to answer the aforementioned questions related to social capital:

(Add A) In Finkenstein there was social capital development clearly visible with regard to the arena group itself. Formerly, unknown persons developed new relationships characterized by trust and shared communication guidelines, and self-selected a steering committee (aspects 1, 3a–c). The group was able to perform joint actions (aspects 5, 7). Prejudices against unknown persons and politicians were reduced (aspect 4). More people got involved in working groups adhering to joint guidelines and the vision (aspect 3). Still, establishing contacts beyond the scope of the arena and working group participants was only partially successful (aspect 2). In Carnisse social capital was developed in terms of establishing new contacts and the ability to work together with a group of quite diverse people (aspect 1). Still, a group feeling was not developed and the group was loose rather than cohesive. Thus developing new shared rules, trust or values was not really visible (aspects 3a–c). Participants were initially led by shared social concerns for the community and developed joint actions as well as individual actions to tackle social challenges (aspects 5 and 7). Contact with people beyond the group was somewhat established, e.g., in a large public event. Different stages of the process can be differentiated and bridging beyond the arena was mostly part of the latter stages (aspect 2). The community centre experiment created far more connections and relationships than the actual arena meetings. Experiments seem crucial for social capital development as well as (public) places where people meet and develop activities together.

(Add B) In Finkenstein sustainability was clearly supported by a number of newly formed community initiatives, building on shared vision, communication guidelines and a trustful and cooperative atmosphere as well as shared understandings of, e.g., local challenges (aspect 5). Openness towards new contacts, fewer prejudices and networking attempts supported the communication and local support for sustainability-related joint actions (aspect 7). The process in Carnisse was not explicitly oriented towards sustainability, but towards addressing local social problems. Working together was oriented towards a common goal, to take responsibility for the neighbourhood (aspect 7). Newly formed initiatives may support the social sustainability of the community (aspect 5).

(Add C) The comparison of both cases builds on results for all three impacts as outlined above. The comparison of the cases reveals the following (see Figure 3 for an overview): Aspects of social learning could be reported for both cases—most strongly first-order learning (SL aspect 1). Although transmission of learning was aimed for, this remained limited in Carnisse and Finkenstein (sl aspect 7). A major difference is how sustainability was related to learning: while awareness and felt responsibility for sustainability potentially increased in Finkenstein, the arena in Carnisse had a more open focus, directed towards neighbourhood problems and social issues with a mixed attribution of responsibilities (sl aspects 3 and 4). Joint action for solving local challenges was given in both communities, while the underlying vision was embodied more by participants in Finkenstein than in Carnisse (sl aspects 5 and 6). None of the arenas developed alternatives as part of the vision or experiments that could be considered radical (sl aspect 5).

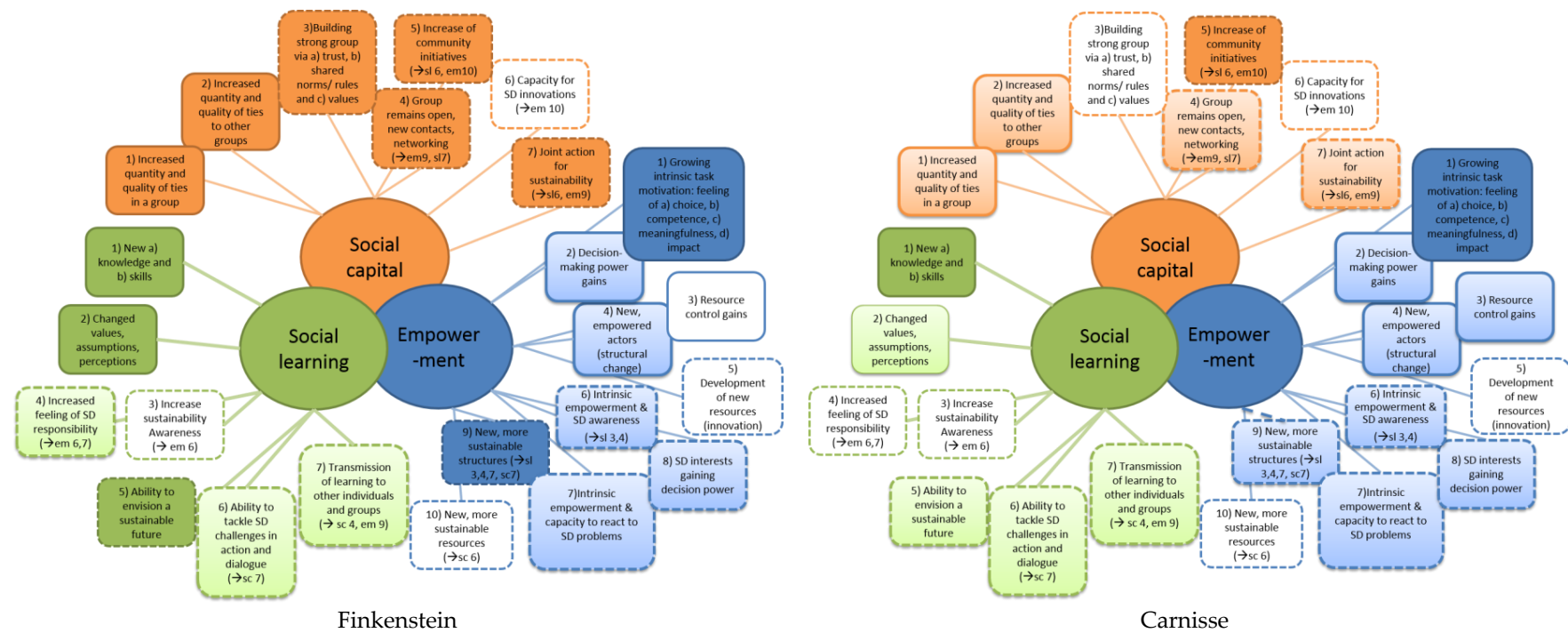


Figure 3. Impacts of transition management processes in Finkenstein and Carnisse. The figures give an overview of the results of both case studies. Indication: fully coloured boxes: impact observed/reported; light coloured: impact partly observed/reported; no colour: impact not or little observed or no assessment possible. Arrows (→) indicate interlinkages between aspects.

Regarding empowerment, the cases show similarities and differences. In both cases, participants felt psychologically empowered and established a new actor to influence local developments (em aspect 1, 4). This was achieved in different ways. While participants in Finkenstein gained insight to be capable of influencing local politics, increasingly appreciating local political work and collaborating with local politics via a supporting group, the participants in Carnisse partially perceived themselves as powerful actors from the beginning, focusing on “power to the people” instead of institutionalized collaboration, and squatted in a municipality-owned building (em aspects 2, 3 and 5). Finally, sustainability was related to empowerment in quite diverging ways: being an essential part of the ongoing empowerment in Finkenstein, and being rather implicitly and in limited ways related to empowerment in Carnisse (em aspects 6–9). Innovation towards sustainable resources was not seen in either case (em aspect 10).

Regarding social capital, in both processes a relatively small and diverse number of people were engaged, developing bonds between them (sc aspect 1). In later process stages, these groups reached out to the public, albeit with some difficulties (sc aspect 4). Both groups performed joint actions (sc aspect 7). Besides similarities, some differences exist. In Finkenstein there was more cohesion and trust building was visible (aspect 3). Later a large number of working groups were established, involving more people (sc aspects 2 and 5). In Carnisse, cohesion was lower, and besides collective actions there were individual actions pursued as well (sc aspect 3). A core action, the reopening of the community centre, relied on a small number of individuals only (aspects 2, 5). While actions related more broadly to sustainability in Finkenstein, sustainability did play a major role in Carnisse, primarily with regard to social aspects (sc aspect 7). Innovation of products towards sustainability was not achieved in either case (sc aspect 6).

The developed framework allows us to discern, describe and systematically address the impacts of transition management. Direct and indirect assessment led to complementary results. Observed overlaps and interlinkages of impacts do not significantly differ between the two cases. On a general level, interlinkages occurred mostly with regard to sustainability-related aspects in general (boxes with dashed borders). They mostly occurred in relation to aspects that connected scale levels, e.g., transmission of learning to more people or changing local structures when small projects gain more influence (sl aspect 7, em aspect 9, sc aspect 4). In addition, the transmission of sustainability-related learning results to social capital and empowerment aspects relating to sustainability occurred (sl aspects 3, 4, 7).

5. Discussion

The core research question we address in this paper is: What are relevant criteria to assess the contribution of transdisciplinary transition management processes towards sustainability, focusing on core societal effects and the local level? To answer this question, in the preceding section we addressed three interrelated objectives: first, to conceptualize a framework to assess societal effects of transdisciplinary transition management, including their relationship with sustainability. Second, to operationalize this framework for empirical application at a local level. Third, to test and apply it empirically to local transdisciplinary transition management processes. In this section we address our fourth objective, critically discussing our findings regarding the core research question, taking into consideration conceptual and empirical insights.

Our main results indicate that the societal effects of transdisciplinary transition management projects can be divided into different categories, namely outputs, outcomes and impacts mediating between outputs and outcomes. For an analysis of transition trajectories these impacts (including social learning, empowerment and social capital) are of key importance, as they are tangible and indicative of an orientation towards sustainability. The impacts can be differentiated into numerous aspects to capture both their essence as well as their contribution to sustainability. This is done by taking into account the transdisciplinary sustainability literature, as well as transition management and sustainability science literature. Empirical analysis shows development of all three impacts

for both cases studied. Aspects of impacts contributing to sustainability were found in both cases, although with a lower frequency. Overall, the developed framework allows us to discern, describe and systematically address the impacts of transition management. The following discussion focuses on three crosscutting aspects regarding the contribution of transdisciplinary transition management processes to sustainability. These are the interplay of impacts, their multi-scalar nature and their suitable facilitation.

5.1. *Interplay of Societal Effects Contributing to Sustainability Transitions*

The transition arena process can be understood as a social experiment aimed at societal effects. The developed framework allows us to assess changes regarding these societal effects, focusing on the impacts, which in turn reflect the ability of participants to shape their local context (e.g., via growing innovation capacities of participants, increasing networks, trustful cooperation, etc.). The three societal effects are in small ways overlapping, but do highlight complementary aspects of how transition management facilitates sustainability transitions. Broadly speaking, social learning changes the orientation of the process towards sustainability and increases the capacity to successfully deal with sustainability challenges. Empowerment makes sustainability-oriented actors and initiatives more powerful. Social capital, finally, may support sustainability attempts to be more resilient and innovative. Nevertheless, these sustainability contributions are dependent on the character of the social learning, on who is being empowered to do what, and on whose social capital is increased.

On a general level, societal effects' development may be mutually supportive, e.g., social learning supports social capital development when the new insights of collaborators allow for a trustful exchange. Social learning in terms of new skills may benefit empowerment. Social capital, e.g., in the form of new networks, may benefit empowerment as well. This interplay is particularly apparent when we focus on the normative orientation of the societal effects, meaning their relatedness to sustainability. As an example, social learning contributing to growing sustainability awareness and a feeling of responsibility may strengthen the sustainability orientations of empowered actors. This was visible in the cases: empowerment and sustainability-related social learning emerged together. The interplay—potentially multiplying facilitated changes via positive feedback loops between societal effects—should be taken into account when designing and facilitating transition management processes.

Interplays between impacts are a complex matter that warrants more investigation, e.g., to differentiate between conceptual overlap and synergies. Future analysis should include empirical work to test the hypothesis on relationships between societal effects more broadly. This would require going beyond in-depth studies on single impacts that exist in large numbers (compare Section 2) and could build on the limited number of existing studies linking diverse societal effects (e.g., [45,46,101]).

5.2. *Multi-Scalar Effects*

All three concepts are bridging different scale levels, from the individual to the group, the community and beyond. Thus, the impacts show a multi-scalar character. This (a) has a procedural dimension, and (b) influences the overall societal effect of the transition management project.

With regard to the procedural dimension, the observed developments were not linear, but dependent on process steps. Social capital, for example, developed differently in the initial arena process (bonding with like-minded people) and the later experiments of respective working groups (bridging with others). Similarly, sustainable community initiatives were first developed at a small scale and then became more public. Gaining power for sustainability-oriented action in both cases was a process of giving and taking when facing local politics. On the one hand, arena groups were supported; on the other hand they were “just acting” without the permission of local politicians (e.g., when squatting at the community centre in Carnisse). In both cases people started to “use” the local (power) system differently and gained a new understanding of their potential role(s) in shaping the local context. While this is generally in line with transition management scholarship [49,116], our

sustainability-related perspective in this article helps us to understand what the empowerment gained is used for.

Regarding the overall societal effect in view of the scalability of analysed impacts, the effect of transition management expanded beyond the original process participants, and thus may have contributed to the overall aim of facilitating a transition as a larger process of systemic change [39]. Empirical examples from the cases relating the local process to higher scale levels include, e.g., the successful application of Finkenstien to be a “climate-energy-model-region,” as well as city officials referring to the Carnisse community centre experiment as a flagship for overall Rotterdam development. This supports the hypothesis of transition management and strategic niche management scholars on the transfer of learning results via networks, e.g., in the form of visions, narratives or expectations [39,109]. However, upscaling processes may have adverse influences on the original transition management process, such as losses in ownership, the disempowerment of participants or losses of the original sustainability character of developed solutions. While our approach generally allows us to capture these tendencies, more research is needed to develop strategies for influencing them appropriately. To do so, action research scholarship [117,118] and recent transition management [22,116] contributions may be a suitable starting point.

5.3. Facilitating and Assessing Sustainability in Relation to Societal Effects

There is, as mentioned, an inherent tension present when aiming to evaluate transition management's contribution to facilitate a sustainability transition. This is the tension between the open-endedness and complexity of transitions and the attempt to govern them in direction of a normative goal, namely sustainability. In our research we have tried to discern the interrelations between sustainability and societal effects, so to develop qualitative indicators for assessing the direction of transition trajectories (cf., [32]). When exploring these links in more depth, we found that it is possible to include sustainability as an inherent quality of the aforementioned societal effects. Our analysis, furthermore, suggests that transition management in the cases studied contributed to the enhancement of the communities' potential to respond to societal challenges and shape sustainability locally. In these cases we used an open yet reflexive facilitation technique to discuss the future of Finkenstien and Carnisse, bringing in sustainability considerations via reflexive questions. This contributed to the discerned effects on the level of social learning, empowerment and social capital and their relationship with sustainability.

Therefore, we propose a conceptual as well as empirically tested approach to link the “open-endedness” and the direction towards sustainability in transition management approaches by adding a normative orientation to the processes. This way the impacts of transition management processes can be empirically and systematically researched. Still, we conclude that there is no inherent relationship between the societal effects and sustainability. They remain two different things, which may be related (conceptually, empirically and process-wise). As such, processes can be oriented toward bringing about societal effects and sustainability together. However, this draws attention to the character of the learning that is facilitated, to the selection of the participants and the overall framing of the process goals, visions and experiments. How sustainability was approached differed in the empirical cases and showed the context dependency and pluralistic nature of how sustainability takes form locally. To further develop a facilitation approach that fruitfully combines open-endedness and normative orientations in pluralistic settings, existing work on facilitating learning in transition management [29] and reflexive monitoring [37] may offer valuable insights. This may be combined with empirically applying the scheme to other types of transdisciplinary sustainability research, which allows for comparing facilitation techniques with different grades of openness, reflexivity and normative orientation.

6. Conclusions

We conceptually developed and empirically tested an approach to understand and assess the contribution of transdisciplinary transition management processes to sustainability. The approach allows us to discern, describe and systematically address the impacts of transition management. It also allows us to capture a semi-open and reflexive approach to facilitating sustainability transitions. Contrasting approaches relying on a small set of indicators, it draws a broad picture including interplays between societal effects and the various aspects composing each effect.

Empirical results highlight the possibility of addressing sustainability as an inherent quality of the societal effects aimed for. When so doing, the focus on the three impacts as criteria to assess the contribution of transition management processes towards sustainability may provide a number of advantages: first, to gain synergies from jointly addressing impacts – instead of treating them as separate concepts as often done in the literature; second, to intentionally influence changes towards sustainability at higher levels (e.g., the niche and regime) when working with individuals and groups in the community arena; third, to use the tension of open-ended facilitation and sustainability reflection as a fruitful tension for nurturing sustainability oriented change in community arenas.

Thus, our results contribute to broadening the understanding of how transition management contributes to sustainability (e.g., [24,25]) and therefore has implications for the overall policy and governance of transition processes. The results suggest that we should include normative aspects in the processes and assessment of transition management and other reflexive governance approaches in general. In so doing, approaches would correspond to the dual nature of the topic they are dealing with, as being both a normative aim (sustainability) and a process of realizing this aim (a transition) [48]. A central research demand remaining is the analysis of the long-term effects of transition management regarding societal change. This longitudinal research would further allow us to substantiate the claim that societal effects have an indicator function for the direction of change.

Supplementary Materials: The following are available online at www.mdpi.com/2071-1050/9/5/su9050737/s1, Table S1: Detailed results social learning, Table S2: Detailed results empowerment, Table S3: Detailed results social capital, Description S4: Process steps of the community arena methodology, Description S5: Data collection and interpretation. Description S6: Detailed outline of experiments in Finkenstein and Carnisse, Description S7: Vision documents from Finkenstein and Carnisse.

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Author Contributions: The first author (Niko Schöpke) was responsible for the paper writing process, wrote large parts of the paper, and led the development of the framework as well as the data analysis. He was engaged in the evaluation process of the Finkenstein case study. The second author (Ines Omann) contributed to the development of the framework and the data analysis. She contributed data, and facilitated and supervised the Finkenstein case study. The third author (Julia Wittmayer) contributed to the development of the framework and the analysis. She contributed data and planned, facilitated and evaluated the Carnisse case study. The fourth author (Frank van Steenberg) contributed to the analysis. He contributed data and planned, facilitated and evaluated the Carnisse case study. The fifth author (Mirjam Mock) contributed data and planned, facilitated and evaluated the Finkenstein case study.

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Appendix A

Table A1. Operationalization of societal effects for assessing transition management projects. (Formatting: regular—effects directly reported, *italic*—effects indirectly assessed by researchers.)

Societal Effect	Aspects Composing the Societal Effect	Operationalisation of Aspects
Social Learning	1. (A) New skills	1. (A) Directly: People report new skills, new types of tasks completed; <i>Indirectly: Production of outputs includes new tasks and skills.</i>
	(B) New knowledge	(B) Directly: People report to have acquired new knowledge, insights, etc.; <i>Indirectly: Developed outputs include generation of knowledge.</i>
	2. Changes of values, assumptions and perceptions	2. Directly: People report changes of values, assumptions and perceptions; <i>Indirectly: Changes in the arena discourse are observable, changes of ways of behaviours of participants observable.</i>
	3. (Increased) Awareness of sustainability problems and persistent problems in the area and in general	3. Directly: People (increasingly) express concern about/awareness of sustainability problems; <i>Indirectly: Developed products address sustainability problems (explicitly or implicitly).</i>
	4. (Increased) Feeling of responsibility of people to react to these sustainability problems	4. Directly: People report themselves to be (increasingly) responsible for causing and/or solving sustainability problems; <i>Indirectly: Developed products attribute responsibility for sustainability problems (explicitly or implicitly) to the local community, developed products outline the role of the community in causing/solving sustainability problems.</i>
	5. Ability to jointly develop a vision of a sustainable future (including radical change)	5. Directly: Participants report the development of a joint vision of a sustainable future; <i>Indirectly: A shared vision and narrative of a sustainable future is developed including radical change.</i>
	6. (Increased) Ability to adapt and react to sustainability challenges through collaborative action and dialogue	6. Directly: Participants report increased collaborative action and dialogue on sustainability challenges; <i>Indirectly: Developed outputs include collaborative action and dialogue towards solving sustainability challenges; changes of reactions of participants to problems become visible.</i>
	7. Spreading of (sustainability) insights from individuals to further group members and beyond	7. Directly: Participants report that they have learned from one another. Participants report the uptake of learning from the arena by other local actors, e.g., as part of the working groups; <i>Indirectly: Outputs involve participation of other local actors; observation of uptake of arena ideas by other local actors.</i>

Table A1. Cont.

Societal Effect	Aspects Composing the Societal Effect	Operationalisation of Aspects
Empowerment	1. A growing intrinsic task motivation via (a) choice, (b) competence, (c) meaning and (d) impact	1. (a) Directly: Participants report their arena-related behaviour as self-determined (choice); <i>Indirectly: Products are decided upon and/or carried out by participants in self-determined ways</i> ; (b) Directly: Participants report a feeling of competence with regards to their arena-related behaviour; <i>Indirectly: Participants possess the skills needed for the tasks they are to carry out in the arena; participants are observed to be carrying out their arena-related behaviours/tasks successfully</i> ; (c) Directly: Participants report appreciation for the activities performed in/by the arena; <i>Indirectly: Participants are observed as being intrinsically motivated for arena activities</i> ; (d) Directly: Participants report a feeling of having an impact on the output of the arena and the local environment; <i>Indirectly: Actions performed by participants create impact</i> .
	2. Gains in decision-making power with regard to local developments	2. Directly: Participants report increased decision-making capacities with regards to local development; <i>Indirectly: Transfer of decision-making capacities to the community arena is observed; output development builds on (new) decision-making capacities</i> .
	3. Gains of control over resources by arena participants	3. Directly: Participants report themselves of resources they gain control upon; <i>Indirectly: outputs involve usage of (new) resources</i> .
	4. Changes in local structures (new, empowered actors/decreased dependencies)	4. Directly: Participants report themselves/the arena as a new, influential local actor with low dependencies on other actors; <i>Indirectly: Output realization involved establishing new, independent actor(s)</i> .
	5. Development of new resources (innovation)	5. Directly: Participants report that they have developed new resources as part of the arena process; <i>Indirectly: Outputs generated involve new resources (e.g., natural or cultural resources, technologies)</i> .
	6. Empowerment involves sustainability, if increased meaningfulness (aspect 1) relates to sustainability	6. Directly / <i>Indirectly: cf. Social learning 4/5</i> .
	7. Feeling of (increased) capacity of people to react to these sustainability problems	7. Directly: People report an increasing capacity to react to sustainability problems. <i>Indirectly: Changed and more motivated discourse in group on solving SD problems is observable; developed products address sustainability problems (explicitly or implicitly)</i> ;
	8. New decision-making capacities with regard to sustainability-related issues	8. Directly: People report gains in decision-making capacity over sustainability-related issues as part of the arena process; <i>Indirectly: Realisation of outputs involves making decisions about sustainability-related issues (formerly decided by other actors)</i> ;
	9. A sustainability orientation of new actors and changing of local structures	9. Directly: Participants forming new actors highlight sustainability as a goal of the new actor; <i>Indirectly: Outputs related to the actions of the new actor make the sustainability orientation explicit</i> ;
	10. Developed resources contribute to sustainability	Directly: Participants report mainstreaming and trendsetting alternatives; <i>Indirectly: Generated outputs are taken up by actors beyond the participants</i> . 10. Directly: Participants report the development of a sustainable resource; <i>Indirectly: Outputs generated include sustainable resources</i> .

Table A1. Cont.

Societal Effect	Aspects Composing the Societal Effect	Operationalisation of Aspects
Social Capital	1. Quantity and quality of ties within a group, i.e., the community arena	1. Directly: Quantity—Participants report (increased) meetings and information exchange with other members of the community arena; Quality—Participants describe the working atmosphere within the arena; <i>Indirectly (quantity and quality): Observable meetings and working atmosphere in the arena and when experimenting.</i>
	2. Quantity and quality of ties with other groups, i.e., other groups within or beyond the community	2. Directly: Quantity—Participants report (increased) meetings and information exchange (in relation to the arena process) with people from the community and beyond; Quality—Participants describe the type of exchange with others; <i>Indirectly (quantity and quality): Observable meetings and working atmosphere of arena with other groups.</i>
	3. Building a strong group via:	3. Building a strong group:
	a. Development of trust within the group	(a) Directly: Participants report (growing) trust amongst each other; <i>Indirectly: Outputs highlight the value of trust or depend on the development of trusting relationships.</i>
	b. Development of shared rules and norms within the group	(b) Directly: Participants report that they have established common rules amongst them; <i>Indirectly: Outputs highlight or are based upon common rules.</i>
	c. Development of shared values within the group	(c) Directly: Participants report that they have developed shared values; <i>Indirectly: Products build or express shared values (e.g., vision).</i>
	4. Openness towards new contacts/networking	4. Directly: Participants report openness towards new contacts and networks; <i>Indirectly: products build upon or value new contacts and networks.</i>
	5. Quantity and quality of sustained or newly developing sustainability-oriented community initiatives	5. Directly: Quantity—Participants report on community initiatives; Quality—Participants report initiatives as being oriented towards joint purposes. <i>Indirectly (quantity and quality): Outputs include the establishment or maintenance of (joint, purpose-oriented) initiatives.</i>
	6. Capacity for sustainability-related innovations	6. Directly: Participants report that they have developed new, sustainability-related resources as part of the arena process; <i>Indirectly: Outputs generated involve new resources (e.g., natural or cultural resources, technologies) with relation to sustainability.</i>
	7. Joint action for sustainability	7. Directly: Participants report joint activities for sustainability; <i>Indirectly: products build upon joint action and relate to sustainability.</i>

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