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**ORIGINAL PAPER**

# Competences for Environmental Sustainability: A Systematic Review on the Impact of Absorptive Capacity and Capabilities

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## Abstract

Responsible management competences are the skills of managers to deal with the triple bottom line, stakeholder value and moral dilemmas. In this paper, we analyse how managers develop responsible management competences and how the competences interact with capabilities at the organisational level. The paper contributes to the responsible management literature by integrating research on absorptive capacity and organisational learning. By creating intersections between these disparate research streams, this study enables a better understanding of the development of responsible management competences. The paper is a systematic literature review on environmental competences, which are a type of responsible management competences referring to the managerial skills aimed at improving environmental sustainability. The findings demonstrate that managers who are able to recognize and acquire external knowledge develop environmental competences, and organisations capable of assimilating, transforming and exploiting knowledge develop environmental capabilities. The paper establishes that a dynamic and recursive relation exists between environmental competences and capabilities. Antecedents and contextual conditions specific to a sustainability context, such as eco-centric values and stakeholder pressures, influence the development of environmental competences. The study shows that environmental competences have a positive direct effect on environmental performance, and an indirect effect as a mediator between environmental capabilities and performance.

**Keywords** Responsible management competences · Environmental competences · Absorptive capacity · Environmental capabilities · Environmental performance

## Introduction

Growing public awareness and concerns over environmental sustainability are pushing businesses to integrate sustainability into their strategies and operations (Baumgartner and Winter 2014; Borland et al. 2016). The rise of environmental sustainability as an area of competitive advantage has triggered management scholars to identify competences and capabilities of managers and businesses that enhance environmental performance (van Kleef and Roome 2007; Hesselbarth and Schaltegger 2014). One area of research that studies the competences of managers for sustainability,

responsibility and ethics (SRE) is the field of responsible management (Verkerk et al. 2001; Hilliard 2013; Laasch and Conaway 2015). The responsible management literature has made significant contributions to the education sciences by analysing the roles of universities and business schools in the development of responsible management competences in education settings (e.g. Nonet et al. 2016).

However, the work on responsible management remains distinct from research on organisational learning. Although there have been studies that analyse responsible management competences in business organisations (e.g. Verkerk et al. 2001), the literature on responsible management has not connected with the literature on organisational learning to understand how competences for SRE develop and how these managerial competences lead to capabilities for SRE at the organisational level. In a recent review of the literature on responsible management competences, Laasch and Moosmayer (2015, p. 28) argue for more research on the relation between SRE competences and capabilities: "*the question, if and how competences for SRE on an individual*

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*level translate to organizational competences for SRE, and ultimately to the creation of sustainable, responsible, and ethical businesses is of utmost practice relevance and of theoretical interest*" (Laasch and Moosmayer 2015, p. 28). "*Organizational level SRE competence may conversely also benefit individual responsible management competence*" (Laasch and Moosmayer 2015, p. 28).

In this paper, we address this gap in the literature and focus on a particular type of responsible management competences, which are the competences of managers for environmental sustainability, or in other words, the 'environmental competences' of managers. We analyse how these competences contribute to the development of environmental capabilities at the organisational level, and how environmental capabilities in turn may aid managers in developing their environmental competences. An example of an environmental competence that affects capabilities is transdisciplinarity. Through its focus on collaboration and the combination of different disciplinary sets of knowledge, transdisciplinarity facilitates the transfer of individual knowledge to the organisational level (Schaltegger et al. 2013). In order to study the relation between competences and capabilities, the paper focuses on absorptive capacity, which is a multi-level learning process that contains dimensions of learning at the individual and organisational levels (e.g. Sun and Anderson 2008). These dimensions include recognising the value of external knowledge and knowledge acquisition at the individual level, and knowledge assimilation, transformation and exploitation at the organisational level (Todorova and Durisin 2007; Sun and Anderson 2008). Insights from this absorptive capacity literature allow us to better understand the relation between environmental competences and environmental capabilities and their development over time. The purpose of this paper is thus to create intersections between the responsible management literature and the organisational learning literature on absorptive capacity, and to enhance our understanding of responsible management learning by connecting these disparate research streams (see Golden-Biddle and Locke 2007, pp. 33, 34).

Our paper responds to the call for more research on the relation between environmental competences and capabilities by reviewing 154 articles published in the fields of management and environmental studies. On the basis of an extensive coding and re-interpretation of these articles, the paper establishes that a dynamic and recursive relation exists between environmental competences and capabilities. The findings demonstrate that managers who are able to recognise and acquire external knowledge are more likely to develop environmental competences, and organisations that are capable of assimilating, transforming and exploiting knowledge are more likely to develop environmental capabilities. The study illustrates that antecedents and contextual conditions that are specific to a sustainability context, such

as eco-centric values and stakeholder pressures, have an impact on the development of environmental competences. And finally, the study also shows that environmental competences have a positive impact on environmental performance, either directly or as a mediator between environmental capabilities and performance.

The paper is structured as follows. First, we introduce the literature on responsible management, competences, capabilities and absorptive capacity. Second, in the methods section, we describe how we have selected and coded the articles in our systematic review. We explain that we engage in a subset analysis and that we focus our analysis on environmental competences and its relations with adjacent concepts. Third, we present the findings of the review in the results section. On the basis of our findings, we formulate several propositions on the relation between environmental competences and capabilities, which serve to inform future empirical research. Finally, in the discussion section, we summarise our findings, highlight our contributions and present future research suggestions.

## Theory

### Responsible Management Learning and Responsible Management Competences

The responsible management literature makes a distinction between responsible business at the organisational level and responsible management at the level of the individual manager (Laasch and Conaway 2015, p. viii). Responsible businesses and managers assume responsibility for the triple bottom line (environmental, social and economic sustainability), stakeholder value (responsibility), and moral dilemmas (ethics) (Laasch and Conaway 2015, pp. 25, 27). In a recent study on responsible management, Nonet et al. (2016, pp. 728, 729) describe responsible management as including the development of formal knowledge, critical thinking and soft skills, a broad and holistic triple-bottom-line understanding of management, the development of a shared vision for all stakeholders, and a process of continuous improvements through self- and group-reflection. This definition illustrates that responsible management is fundamentally grounded on the essential role of learning, and that a necessary prerequisite for the development of responsible management competences is learning.

Laasch and Moosmayer (2015, p. 4) conceptualise responsible management learning as learning for SRE (sustainability, responsibility and ethics), not only in explicit educational settings, but also on the job and in other implicit learning environments. They offer a classification of responsible management competences that allocates the competences to four categories: to know, to do, to interact, and to

be (Laasch and Conaway 2015) (see Table 1). The first category of responsible management competences ('to know') involves domain-specific knowledge such as the technical knowledge on sustainability, responsibility and ethics. The second category ('to do') includes systems thinking, trans- or interdisciplinary work and the ability to make sustainable, responsible and ethical decisions. The third category ('to interact') are the social competences that enable a manager to interact with stakeholders. The final category ('to be') consists of the 'self-competences' such as the ability to take a meta-perspective and to feel empathy for social, environmental and ethical issues (Laasch and Conaway 2015, pp. 38, 39). The study by Nonet et al. (2016) also provides a classification of responsible management competences that is very much in line with the one by Laasch and Conaway (2015). This study argues that responsible management

should start at the individual level (being, understanding/knowing, and doing), and while relying on self-awareness and knowledge, the individual will reach out and interact with others in the implementation of responsible management practises (Nonet et al. 2016, pp. 728, 779). These two classifications of responsible management competences thus make a distinction between competences at the individual level (to know, to do, to be) and those in which individuals interact with others. This conceptualization of responsible management competences is in line with research in which the interaction between individuals' competences is crucial for the development of capabilities at the organisational level.

There are, however, only a few studies in the responsible management literature that report on a relationship between individual level responsible management competences and

**Table 1** Types of responsible management competences and environmental competences

| Competence group | Responsible management competences | Environmental competences |
|---|---|---|
| Domain (to know) | Responsible management background domains: SRE<br>Responsible management tools | Knowledge of environmental sustainability (2, 10, 11, 13, 17, 30, 36, 49, 50, 59, 66, 67, 68, 70, 73, 76, 77, 79, 86, 109, 110, 114, 116, 124, 132, 139, 140, 141, 145, 146)<br>Responsibility (for the environment) (2, 13, 60, 68, 79, 84, 110, 139)<br>Cosmopolitan perspective and cross-cultural understanding (2, 11, 44, 60, 68, 79, 136, 148) |
| Procedural (to do) | Systems thinking<br>Trans- or interdisciplinary work<br>SRE decision making | Systems thinking/holistic thinking (7, 10, 11, 50, 60, 68, 70, 76, 78, 79, 80, 90, 104, 106, 107, 124, 130, 136, 139, 140, 146, 148)<br>Trans- or interdisciplinary work and integrative work (2, 7, 10, 11, 44, 50, 60, 68, 70, 76, 80, 107, 136, 146, 148)<br>**Competences for learning and development; handling complex information** (2, 36, 44, 50, 60, 68, 70, 129, 136, 140, 148) |
| Social (to interact) | Stakeholder networking and communication competences<br>Change agency skills (leadership)<br>Critical skills | Stakeholder networking competences and collaboration competences (60, 68, 76, 80, 136, 148)<br>Communication skills (10, 50, 57, 59, 68, 76, 124, 136, 139, 140, 148)<br>Competence to bring change (68, 79, 80, 92, 107, 136, 139, 148)<br>Strategic thinking (21, 36, 80, 107, 148)<br>Critical thinking (2, 10, 11, 50, 60, 68, 78, 136, 148)<br>**Entrepreneurial thinking** (2, 30, 36, 49, 50, 57, 67, 68, 78, 109, 124, 129, 136, 140, 148)<br>**Interactive problem solving** (2, 11, 30, 50, 57, 60, 68, 73, 78, 107, 109, 136, 139, 145, 148)<br>**Emotional intelligence** (11, 36, 68, 79, 129, 139, 148)<br>**Conflict management** (50, 60, 68, 136, 148)<br>**Competence in self-motivation and motivating others** (2, 11, 68, 79, 140, 148) |
| Self (to be) | Meta-perspective<br>Empathy (for responsibility issues and stakeholders)<br>Embracing attitude (toward RM practises)<br>Problem awareness<br>Sense of urgency<br>Self-perception | New attitudes towards nature/personal concern for environmental issues (2, 44, 60, 107, 141, 148)<br>**Future orientation** (2, 11, 44, 50, 68, 79, 80, 107, 139, 148) |
| | *Source* Laasch and Conaway (2015, p. 37) | *Source* Articles in our review; contribution to Laasch and Conaway framework in **bold** |

organisational level responsible management capabilities. Using data from an experiment at a Spanish university, Hilliard (2013, p. 373) shows that the productivity of employees increases when the employer engages in responsible management and signals responsibilities in supporting social causes. The findings illustrate that the employees were intrinsically motivated to contribute to the social cause (Hilliard 2013, p. 372). Verkerk et al. (2001) have shown that a democratic approach to management in which there is room for participatory processes involving employees has two positive impacts on the implementation of ethics programmes by employees. First, the democratic approach leads to the internalisation of ethical values by employees. Employees develop ethical values for themselves and strive for continuous improvement with legal regulations seen as standards to be surpassed (Verkerk et al. 2001, p. 375). Second, the approach leads to the contextualization of ethical norms by employees, meaning that corporate norms will be elaborated in the context of each employee's workplace in order for their meaning, reach and limitations to be understood (Verkerk et al. 2001, p. 375).

This paper aims to contribute to this research and analyse the relation between managers' competences and organisations' capabilities. We focus on the competences for environmental sustainability or on '*environmental competences*',

and thus on one aspect of the competences for SRE. Figure 1 demonstrates that environmental sustainability is a subcategory in the responsible management domain and thereby highlights the position of this paper in the broader responsible management research. Figure 1 also illustrates the relation between 'environmental competences' that aim to foster a firm's environmental sustainability and 'responsible management competences' that aim to foster a firm's sustainability, responsibility and ethics. The box on the left offers examples of responsible management competences, and the box on the right illustrates that environmental competences are a subcategory of responsible management competences (see for more detail Table 1). The arrows in the figure highlight the location of responsible management and environmental competences.

As an example of the relation between responsible management competences and environmental competences, we discuss transdisciplinarity, which takes complex real-world problems as its starting point and develops solutions by combining different disciplinary sets of knowledge through practise-academia collaboration (Schaltegger et al. 2013; Shrivastava et al. 2013). Real-world problems may operate at the intersection of sustainability, responsibility and ethics, and transdisciplinary work will need to draw on disciplines that can collaboratively tackle these problems.
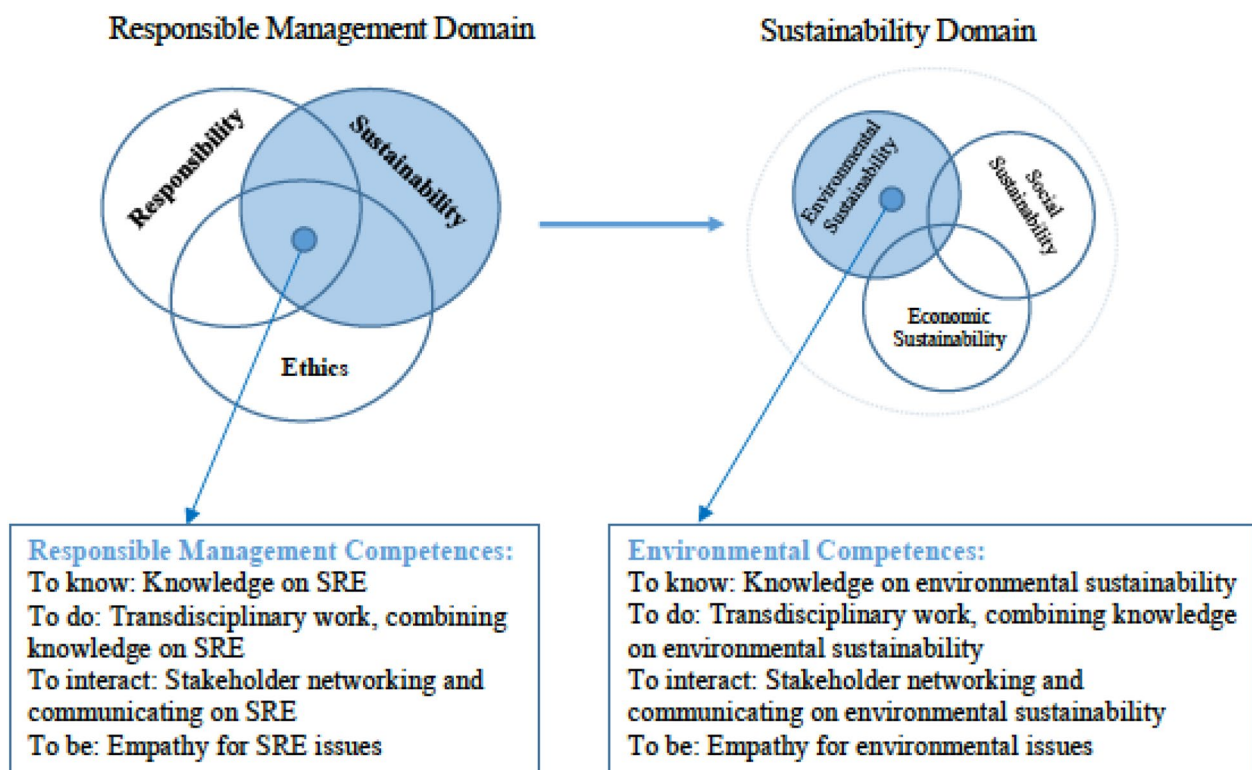


**Fig. 1** Position of this paper: Focus on sustainability within responsible management domain; and focus on environmental sustainability within sustainability domain ( adapted from Laasch and Conaway 2015)

However, transdisciplinary work may also be relevant within the boundaries of the subcategory of environmental sustainability. For instance, a study by Sahamie et al. (2013) illustrates that experts from the natural sciences (including biology, chemistry and physics), and experts from the engineering sciences and management sciences collaborate to improve the environmental sustainability of closed-loop supply chains.

## The Impact of Absorptive Capacity on Competences and Capabilities

In order to connect managerial competences with organisational capabilities, and to link individual and organisational learning, we rely on a concept that explains the multi-dimensionality of learning and competence/capability development in business organisations. This concept is absorptive capacity, which is a higher-order and dynamic capability that enables the adjustment of managerial competences and organisational capabilities. It is conceptualised as consisting of multiple dimensions of learning that link individual learning to competence development, and organisational learning to the development of capabilities (Sun and Anderson 2008; Vera et al. 2011). Absorptive capacity links "knowledge generated outside the company to knowledge generated within the company", illustrating how individuals acquire external knowledge and transform this knowledge into organisational capabilities (Gluch et al. 2009). We select the absorptive capacity concept because of its ability to explain learning of individuals and organisations both driven internally and through inter-organisational processes and its ability to connect literature on competences and capabilities with the literature on managerial and organisational learning (see for extensive reviews Zahra and George (2002), Todorova and Durisin (2007), Sun and Anderson (2008) and Volberda et al. (2010)).

*Absorptive capacity* has been defined as a dynamic capability that purposefully creates, extends, and modifies a firm's resource base (Lane and Lubatkin 1998; Zahra and George 2002), and as a higher-order capability that enables the development of competences and capabilities (Eisenhardt and Martin 2000). In the organisational learning literature, *competences* are defined as the existing repertoire of possible actions of managers and organisational members (Nooteboom 2009), and as a combination of skills, knowledge and attitudes of individuals (Lambrechts et al. 2013; Dlouhá and Burandt 2015). *Capabilities*, on the other hand, are the existing repertoire of possible actions of organisations (Nooteboom 2009), that have also been described as routinised processes embedded in an organisation (Winter 2003).

Absorptive capacity is a multi-level learning process in which its dimensions are associated with learning at the level of individuals and organisations (Sun and Anderson 2008). Todorova and Durisin (2007) suggest that absorptive capacity has five distinct dimensions: recognition, acquisition, assimilation, transformation and exploitation of external knowledge. The first dimension, *recognizing the value of external knowledge*, refers to the process of searching by individuals to identify and assess knowledge existing outside the firm that has the potential to add value if acquired (Todorova and Durisin 2007). Individuals recognise the value of external knowledge through their intuitive and cognitive processes (Sun and Anderson 2008). The second dimension, *knowledge acquisition*, refers to the effort of gathering knowledge (Todorova and Durisin 2007) which is also a socio-psychological process of intuition and cognition (Sun and Anderson 2008). New external information that is acquired by managers needs to be translated by these individuals to the organisational context (Sun and Anderson 2008). *Knowledge assimilation and transformation* are processes of analysing, interpreting and understanding the external sources of knowledge in the context of the organisation (Sun and Anderson 2008). Assimilation involves interpretation, dialogue and knowledge exchange among members of the organisation that usually form a culturally distinct sub-unit or group within the larger organisation (Sun and Anderson 2008). Transformation happens when knowledge of that sub-unit is transferred to the entire organisation. It requires the integration of new knowledge while changing old routines (Todorova and Durisin 2007; Sun and Anderson 2008). *Knowledge exploitation* refers to a firm's ability to leverage the new knowledge and realise benefits (Zahra and George 2002; Todorova and Durisin 2007). It is related to the value created from the institutionalisation of this new knowledge as a new norm, hence a sign of learning at the level of the organisation (Sun and Anderson 2008).

The literature on absorptive capacity thus argues that learning processes at the individual level (recognising the value of external knowledge and knowledge acquisition) develop managerial competences, and learning processes at the organisational level (knowledge assimilation, transformation, exploitation) develop organisational capabilities. The fact that "a firm's absorptive capacity has an individual and a collective dimension" (Van Wijk et al. 2011, p. 278) and that these dimensions are interrelated, enable us to study the development and interaction of environmental competences and capabilities.

## Methods

We conducted a systematic literature review: a systematic, transparent and reproducible way of analysing literature (Tranfield et al. 2003; Adams et al. 2017). Systematic reviews receive increasing attention in sustainable and

responsible management research (Parris and Peachey 2012; Hansen and Schaltegger 2014; McLeod et al. 2014; Amui et al. 2017; Watson et al. 2018). We implemented our review in three stages: searching; screening; and extraction and synthesis (Tranfield et al. 2003; Watson et al. 2018).

### Searching

We searched for articles within EBSCO Business Source Premier because it provides a reliable coverage of high impact factor journals within the field of business and management (Niesten and Jolink 2015). We conducted two searches: the first was aimed at finding articles that explicitly analyse absorptive capacity in a corporate sustainability context, and the second was aimed at finding articles on environmental competences and capabilities. Hence, the first search was the combination of the terms "absorptive capacity" with "environmental", "ecological", "green" or "sustainable" in academic peer-reviewed journals from 2008 to 2017. The second search was the combination of the terms "environmental", "ecological", "green" or "sustainable" with "competences" and "capabilities" in academic peer-reviewed journals from 2008 until 2017. We searched for these terms in the abstracts of the articles using the Boolean operator "OR" and found 18 articles in the first, and 476 articles in the second search. Table 2 in Appendix provides the search strings used in this systematic review.

### Screening

We screened the articles based on two criteria: journal category and type of competences and capabilities. We selected only the journals in the categories of "Business", "Management", "Green & Sustainable Science & Technology" and "Environmental Studies" in the science and social science citation indexes. We only included the articles that are related to environmental competences of employees and managers and environmental capabilities of organisations. In total, we found 124 articles that are relevant for our review. After reviewing these articles, we added 30 articles that were not identified in the initial search following a method that is often called "snowballing technique" (Battilana and Dorado 2010). This technique helped us cover other articles that are highly relevant but did not emerge in the initial search because they may use a slightly different terminology (Battilana and Dorado 2010). The articles that were added through snowballing include some of the most influential articles before 2008, hence expanded the coverage of our review. Our review consists of 154 articles of which 20 are in the period 1995–2007 (Table 3 in Appendix includes the full list of articles).

### Extraction and Synthesis

We used NVivo 11 software to code the selected articles, and used three types of coding: structural coding; in vivo coding; and matrix coding (Saldana 2009). First, we implemented structural coding for the categories environmental competences and capabilities, absorptive capacity (including recognising value of external knowledge, knowledge acquisition, assimilation, transformation, exploitation), antecedents, contextual conditions and environmental performance. This is in line with the theory-led approach of our review. Second, we used in vivo coding to identify more specific codes within each category. For instance, while the structural code determined the code "environmental competence", the specific competences such as the "competence to bring change" or "responsibility" were determined through different stages of in vivo coding. Third, we used matrix coding to analyse relationships between different codes. For instance, using matrix coding, we analysed how environmental competences and environmental capabilities are inter-related. Table 4 in Appendix provides examples of these different types of coding.

Since the contribution of our paper is to study the relation between environmental competences and capabilities and to analyse the impact of absorptive capacity, we focused our analysis on a subset of 84 articles. These articles define and explain "environmental competences" and demonstrate the relationships between "environmental competences, environmental capabilities and absorptive capacity". Following a similar approach to Laasch (2018), we used these 84 articles to analyse environmental competences and assess their relationship with capabilities and absorptive capacity in more detail. Table 3 in Appendix mentions which articles are part of the subset analysis, and summarises which concepts are analysed in these articles. This appendix also illustrates that the excluded articles focus only on environmental capabilities, but they do not directly contribute to our understanding of the development of environmental competences.

### Results

In this section, we will present our findings on environmental competences and their relation with absorptive capacity and environmental capabilities. Since the development of environmental competences takes place in diverse empirical contexts, our analysis resulted in the incorporation of antecedents, contextual conditions and performance in the model on environmental competences. We formulate six propositions that reflect our findings on the development of environmental competences. Figure 2 summarises these findings and visualises the propositions. Table 3 in Appendix complements Fig. 2 by illustrating which articles contribute

to the emergence of the model, and thus by listing the concepts and propositions that the articles in our review discuss.

## Environmental Competences

The review demonstrates that environmental competences have been defined in various ways (see Table 5 in Appendix for a list of definitions of environmental competences). Based on these definitions, we refer to e*nvironmental competences as the knowledge, skills, attitudes, behaviours and personal traits of individuals and managers that lead to the solution of complex environmental problems, and hence contribute to the achievement of a sustainable future* (Lambrechts et al. 2013; Subramanian et al. 2016). Studies in education sciences focus on what environmental competences are and how they can be developed by analysing the role of higher education in building environmental competences for sustainable development (Adomßent et al. 2014; Dlouhá and Burandt 2015). Others analyse how environmental competences vary based on job duties building a competence matrix (Hesselbarth and Schaltegger 2014), or study the managerial competences required for environmental innovations (van Kleef and Roome 2007). Our review has identified different types of environmental competences (see Table 1) with some receiving more attention than others from the reviewed articles. Prominent environmental competences include systems thinking, trans-or interdisciplinary work, entrepreneurial thinking, interactive problem solving, and future orientation.

Systems thinking implies that managers cannot explore or seek to understand a phenomenon like environmental sustainability as an independent process, but it has to be understood as a dynamic, interrelated complex system (Ryan et al. 2012, p. 584). Managers must understand that individual organisational actions cannot be viewed in isolation from their impact on the whole system (Ryan et al. 2012, p. 584).

Trans- or interdisciplinary work involves the ability to communicate across the boundaries of different disciplines and discourses (Dlouhá and Burandt 2015). Several articles in our review use the terms transdisciplinarity and interdisciplinarity interchangeably, but a few are more explicit about the difference between the two terms (e.g. Adomßent et al. 2014). Interdisciplinarity refers to the ability to cooperate with scholars from different disciplines, whereas transdisciplinarity extends the collaboration to practitioners (Adomßent et al. 2014). In the context of a company's sustainable practises, the interpretation of sustainability principles does not only require knowledge from different disciplines (and thus the ability to identify and listen to experts such as physicists, biologists, process engineers or psychologists), but also the ability to apply this knowledge to business operations (Kurucz et al. 2017, p. 197). Managers should consider the complex interrelations between the technological and organisational aspects of environmental sustainability (Mulder 2014; Azeiteiro et al. 2015).

Entrepreneurial thinking has been associated with innovativeness, creativity, and with being a visionary able to tackle ecological problems with entrepreneurial means
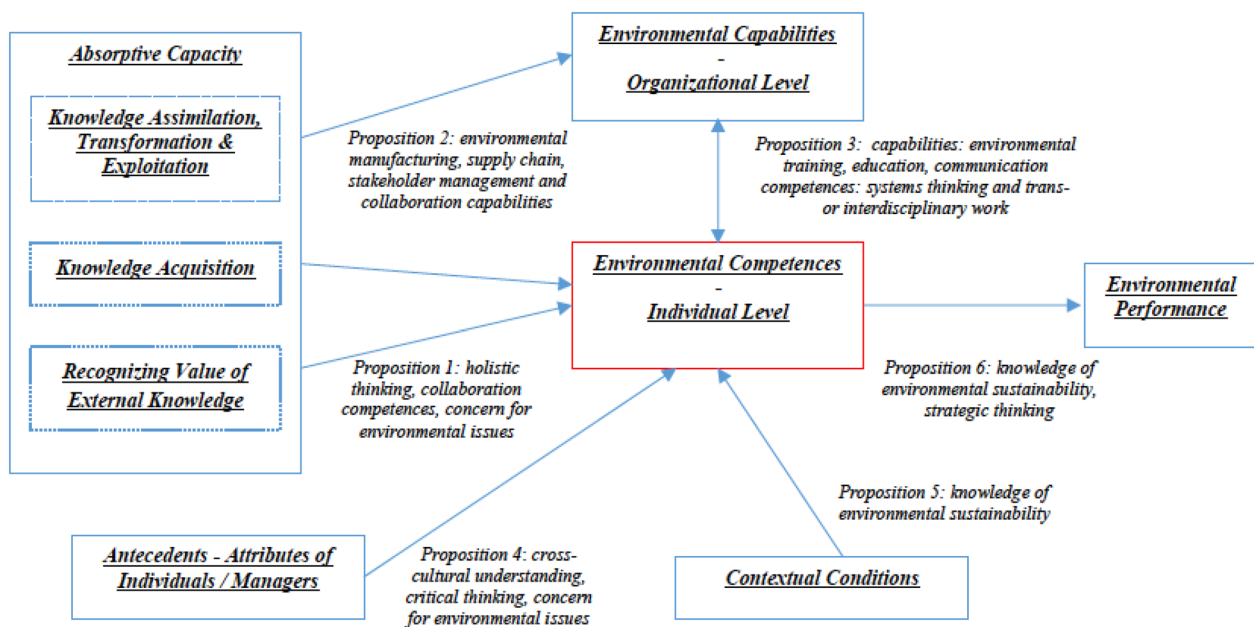


**Fig. 2** A Model of the Development of Environmental Competences (see Table 3 in Appendix for articles that report on the different categories and propositions in this model)

(Van Kleef and Roome 2007; Dibrell et al. 2015; Hesselbarth and Schaltegger 2014).

Several studies in our review argue that actions towards sustainable development—whether these include developing a corporate environmental strategy or innovating for environmental sustainability—require interactive problem solving skills (Verhulst and Van Doorsselaer 2015; Van Kleef and Roome 2007; Walls et al. 2011). Managers need to develop trust-based collaborative relationships with stakeholders to complement deficiencies of resources and technical know-how and to enable joint problem solving that promotes environmental sustainability (Journeault 2016; Pace 2016).

Finally, future orientation is a "capacity to deal with uncertainty and future prognoses, expectations and plans, and … being able to think beyond the present" (de Haan 2006, p. 22). Several studies demonstrate that without employees with future orientation, organisations cannot build scenarios regarding their emissions, anticipate changes in future regulations and develop environmental technologies to design the future (de Haan 2006; Wiek et al. 2011). These different types of environmental competences demonstrate the complexity of the corporate sustainability context and the necessity for trans- or interdisciplinary and inter-organisational collaboration to develop creative and system-wide solutions for environmental problems.

## The Impact of Absorptive Capacity on Environmental Competences

We have argued that absorptive capacity is a higher-order learning capability (Chen et al. 2015a) that acts upon, develops and alters competences. It is a multi-level learning process in which the two dimensions 'recognising the value of external knowledge' and 'knowledge acquisition' operate at the level of the individual. Our findings illustrate that these two dimensions of absorptive capacity have an impact on environmental competences.

### Recognising the Value of External Knowledge

The first dimension, recognising the value of external knowledge, is often described as searching and scanning by individuals for new technological opportunities with a "green lens" (Borland et al. 2016; Pace 2016; Amui et al. 2017). The literature has recognised that this attribute of absorptive capacity occurs at the individual level: "it is managers who must sense the environment and changes in technology, customers, suppliers, and so forth" (Borland et al. 2016, p. 303). Managers with an eco-centric mindset are more likely to extend their search from the business ecosystem to the natural ecosystem that embraces both the human and biophysical

worlds (Borland et al. 2016, pp. 303, 304). Several articles in our review have argued that employees and managers that search and scan the environment for knowledge on sustainability are more likely to develop environmental competences (Hashim et al. 2015; Borland et al. 2016; Buil-Fabregà et al. 2017). For instance, Ryan et al. (2012, p. 586) claim that "the mental models, which individual organisational actors adopt to scan and understand the market environment, work to filter incoming network knowledge and can lead to knowledge renewal. Where ecological sustainability becomes part of these mental models, the knowledge renewal process … can generate ecological value." Dibrell et al. (2015) argue that scanning the environment enhances the ability of managers to collaboratively address sustainability challenges: "An environmental awareness of managers creates increased openness to new perspectives and new approaches which are brought inside of the organisation and manifested through increased interactions among individuals" (Dibrell et al. 2015, p. 599). Waddock (2007) suggests that those individuals that recognise the value of interrelationships between the economy and the natural world build environmental competences, such as collaboration competences.

### Knowledge Acquisition

The second dimension of absorptive capacity at the individual level is knowledge acquisition. Amui et al. (2017, p. 30) have argued that knowledge acquisition in the context of sustainable development can be viewed as an individual dynamic capability, because it is used to change the business environment or to adapt to sudden changes, in order to solve the specific challenges of sustainable production. Several articles have proposed that knowledge acquisition by employees will contribute to the development of their environmental competences (e.g. Hashim et al. 2015; Papagiannakis et al. 2014; Wiek et al. 2011). Buil-Fabregà et al. (2017, pp. 374, 375) have shown that managers' ability to "acquire new information" and to "seek new information actively" is related to the "environmental commitment of the manager so that managers are more sensitive to environmental issues, such as climate change or green products and services, thus helping to boost the deployment of environmental measures in the company". Gluch et al. (2009, p. 459) state that "well-working acquisition processes can … be seen as a knowledge gate through which external influences and inspiration travel." They argue that these knowledge acquisition processes "strengthen the possibility of viewing the products and services from a holistic perspective" (Gluch et al. 2009, p. 459). To promote the development of environmental competences, organisations also need individuals with collaboration competences (i.e. the competences to link different communities of practise containing different knowledge sets arising inside and outside a company) who supply their

colleagues with external information and provide the basis for commitment building, creativity and learning about environmental sustainability (Van Kleef and Roome 2007, p. 47).

Based on these insights from the articles in our review, we formulate a proposition that argues that managers' capacity to recognise and acquire external knowledge contributes to the development of their environmental competences:

**Proposition 1** *The two dimensions of absorptive capacity operating at the individual level (recognising the value of external knowledge and knowledge acquisition) have a positive impact on the development of environmental competences, such as holistic thinking, collaboration competences and concern for environmental issues.*

### Environmental Capabilities

The articles in our review provide several definitions of environmental capabilities. They are "a firm's [abilities] to carry out its productive activities in ways that limit damage to the natural environment" (Madsen 2009). In other words, "a firm's environmental capabilities are those that allow it to reduce its ecological footprint" (Baranova and Meadows 2016). These definitions focus on the reduction of unsustainability in firms' activities. Another definition refers to ecocapacity, a firm's capacity to develop environmental, human, business, and technology resources to enhance firm performance and conserve the environment (Amui et al. 2017). Based on these studies, we define *environmental capabilities as "an organisation's abilities to either reduce the damage to or create benefits for the natural environment, while managing the tensions between environmental and economic bottom lines".*

The review demonstrates a hierarchical difference between environmental function capabilities and environmental organisation capabilities (Gavronski et al. 2011; Iles and Martin 2013; Eltantawy 2016; Liu et al. 2016; Dangelico et al. 2017; Inigo et al. 2017). *Environmental function capabilities* are routines that operate on existing resources of a function while integrating environmental objectives in the daily routines (Ehrgott et al. 2013; Chen et al. 2015a). They refer to group level environmental practises within organisations that reduce environmental harm (Chakrabarty and Wang 2012; Hajmohammad et al. 2013). Examples include human resources (Renwick et al. 2016), information communication technologies (Cooper and Molla 2014, 2017), marketing (Mariadoss et al. 2011), research and development (Lee and Min 2015), supply chain (Reuter et al. 2010; Luthra et al. 2017), and manufacturing and production (Vickers 1999). *Environmental organisation capabilities* reconfigure, develop and integrate environmental function capabilities while taking into account the demands of external stakeholders and managing firms' relationship with the

natural environment (Gavronski et al. 2011; Liu et al. 2016). Examples include environmental management (Aragón-Correa and Sharma 2003), stakeholder management and collaboration (Baranova and Meadows 2016), environmental training and education (Baumgartner and Winter 2014), cross-functional integration (Metta and Badurdeen 2013), environmental performance management (Björklund et al. 2012; Sihvonen and Partanen 2017) and change management capabilities (Borland et al. 2016).

### The Impact of Absorptive Capacity on Environmental Capabilities

The third dimension of absorptive capacity, knowledge assimilation, is associated with single loop learning, while the fourth dimension, knowledge transformation, is associated with double loop learning (Journeault 2016). Assimilation is reducing unsustainability of existing practises (Melissen et al. 2016), while transformation is a step towards strong sustainability. Transformation requires unlearning of existing unsustainable practises, building cognitive structures for true sustainability (Maletič et al. 2014; Kurucz et al. 2017), and re-defining or rethinking value propositions (Ryan et al. 2012; Mulder 2014; Inigo et al. 2017). Assimilation and transformation are followed by the exploitation phase in which environmental knowledge is leveraged (Abareshi and Molla 2013; Cooper and Molla 2014). This fifth dimension, exploitation, is also referred to as the utilisation of environmental knowledge (Chen et al. 2015a), seizing of environmental opportunities (Borland et al. 2016), or reaping the benefits of environmental knowledge and embedding it in the organisation (Borland et al. 2016). It is positioned as an organisational phenomenon, because it is "firms that modify existing configurations of capabilities for energy innovations and exploit external knowledge sources for strategic innovation" (Pace 2016).

Environmental capability development entails a change in practises, routines and activities at the level of the organisation to align the firm with sustainable development goals (Inigo et al. 2017). Either explicitly or implicitly studies refer to absorptive capacity as a source of environmental capabilities (Pinkse et al. 2010; Delmas et al. 2011; Cooper and Molla 2017). Abareshi and Molla (2013) link absorptive capacity with the development of environmental capabilities, since absorptive capacity explains the integration of external, complex and cross-disciplinary environmental knowledge into the organisation. Others demonstrate the link between environmental capability development and absorptive capacity implicitly, by referring to knowledge assimilation, transformation or exploitation (e.g. Williander 2007). For instance, the integration and accumulation of external knowledge has been shown to improve environmental function capabilities, such as environmental product

development and manufacturing (Dangelico et al. 2013), environmental R&D (Papagiannakis et al. 2014), and environmental supply chain capabilities (Oelze et al. 2016). In a study on the Round Table on Sustainable Palm Oil Platform, firms demonstrate absorption of their partners' knowledge in response to deforestation concerns that arise from palm oil supply. Thanks to their absorptive capacity, they build both stakeholder management and collaboration capabilities and environmental supply chain capabilities through identification of alternative sources of palm oil (Parmigiani et al. 2011). In line with these studies, we propose that an organisation's absorptive capacity has a positive impact on its environmental capabilities:

**Proposition 2** *The three dimensions of absorptive capacity operating at the organisational level (knowledge assimilation, transformation and exploitation) have a positive impact on the development of environmental capabilities, such as environmental manufacturing, supply chain, stakeholder management and collaboration capabilities.*

## The Interaction Between Environmental Competences and Capabilities

We find evidence that environmental capabilities contribute to the development of environmental competences, but also that competences have an impact on environmental capabilities. Hence, the relationship between environmental competences and environmental capabilities is dynamic and recursive. We will offer several examples from the literature that illustrate this relationship.

Firms stimulate the development of environmental competences in employees by offering training and education on environmental technologies and practises, in the form of management games, business simulation or the creation of eco-committees (Gluch et al. 2009; Baumgartner and Winter 2014, p. 169; Li et al. 2014, p. 231; Pace 2016, p. 417). Formal training of employees enhances their motivation and ability to implement innovative ideas that promote sustainable practises, in other words it stimulates learning at the individual level (Pace 2016, p. 411). Dibrell et al. (2015, pp. 593, 594) argue that an environmental capability is the capacity of an organisation to structure a network that enables the communication of the organisation's environmental orientation across departments. It involves the firm's capacity to introduce and share ideas on sustainability inside the organisation, and to align individual committed behaviours and knowledge sharing with operational processes (see also Lahneman 2015). This environmental capability influences the development of environmental competences, by enhancing "an individual's ability to become more curious about improving existing environmental practises, developing creative suggestions to environmental problems, and doing

tasks differently to benefit the environment" (Dibrell et al. 2015, p. 593). It also leads to "individuals feeling a greater sense of meaning for their work…and a greater environmental self-efficacy", and it motivates "employees to engage in environment-oriented activities" (Dibrell et al. 2015, pp. 594, 600). In line with these findings is the study by Perez-Valls et al. (2016), who argue that effective and timely top-down information flows improve the implementation of environmental practises, and the work by Gluch et al. (2009, pp. 451, 452) who propose that a wider adoption of green innovations and ideas depends on the ability of managers to communicate these ideas so that employees perceive them as motivating.

Several studies have focused on the reverse relation, which is a more bottom-up process, in which environmental competences of individual managers or employees affect the development of environmental capabilities at the organisational level (e.g. Amui et al. 2017; Borland et al. 2016; Spicer and Hyatt 2017). For instance, Lans et al. (2014) point out that environmental competences, such as systems thinking and trans- or interdisciplinary work, contribute to the design of sustainable enterprises. Vickers (1999, pp. 86, 87) has referred to the key individuals that introduce green values in organisations as "green champions" or "environmental advocates". These individuals reveal a high level of environmental awareness and they consistently think in a manner that goes 'beyond the job' and 'beyond the product'. Vickers (1999, p. 87) described this as "a combination of personal awareness and systems thinking", two attributes of environmental competences (see Table 1). These green champions are crucial to initiating and facilitating organisational responses to environmental pressures, in particular when they "occupy a position of some influence and responsibility, and also one where the individual concerned is able to span internal boundaries in order to influence the different functions" (Vickers 1999, pp. 87, 88). Other studies suggest that creativity and the responsibility of organisational members may contribute to the development of environmental capabilities (Verhulst and Van Doorsselaer 2015; Chen and Chang 2013). Employees will contribute to an organisation's pursuit of green innovation when they can work with a degree of autonomy, creativity and diversity of opinions (Hashim et al. 2015).

Amongst others, Lozano (2006) considers the relationship between environmental competences and capabilities in the two directions. Lozano (2006) especially focuses on an individual's competence to bring change and the environmental capability associated with it (i.e. a change management capability). According to his model, lack of environmental competences may yield resistance to organisational change. Equally, the existing organisational capabilities may also disable the development of competences to bring change. This dynamic and recursive relation between environmental

capabilities and competences is reflected in the following proposition:

**Proposition 3** *Environmental capabilities, such as environmental training, education and communication, lead to the development of environmental competences and conversely environmental competences, such as systems thinking and trans- or interdisciplinary work, lead to the development of environmental capabilities.*

## Antecedents, Contextual Conditions and Environmental Performance

Our analysis has identified several other factors that contribute to the development of environmental competences. We have categorised these factors into antecedents and contextual conditions of environmental competences. It also emerged from our analysis that several articles in our review focused on the relation between competences and environmental performance.

### Antecedents of Environmental Competences

Our review of the literature has identified managerial antecedents that can have an impact on the sustainable behaviour of managers and employees and the extent to which they engage in eco-friendly practises. These antecedents include the perception or cognition of individuals (Borland et al. 2016; Lahneman 2015), their values, motivation and commitment (Buil-Fabregà et al. 2017; Vickers 1999; Wiek et al. 2011), and the leadership of managers in an organisation (Chen and Chang 2013; Ryan et al. 2012). Studies attribute these managerial antecedents to top managers, employees, boundary spanners and to middle managers as a bridge between strategy and action (e.g. Ryan et al. 2012; van Kleef and Roome 2007). This shows that managers at different levels, or actors with different roles, can act as change agents to drive environmental sustainability in business organisations (Hesselbarth and Schaltegger 2014). Several studies explicitly discuss the impact of these antecedents on the development of environmental competences. Borland et al. (2016), for instance, refer to the importance of eco-centric beliefs of managers, a long-term managerial mindset toward ecological sustainability, and to eco-centric leadership. Vickers (1999, p. 86) introduces the term "values-led learning" and argues that values and the commitment of people within organisations to environmental sustainability is of great importance to learn about eco-friendly practises (see also Lambrechts et al. (2013) on value-driven competences). As an example

of values-led learning, Papagiannakis et al. (2014, p. 257) argue that "managers with strong environmental values and attitudes are more likely to view environmental issues as opportunities, initiating environmental decisions and supporting relative actions. This may increase environmental knowledge and confidence among organisational members and affect their commitment, which in turn influences the quality and quantity of environmental outcomes". Green transformational leadership has been shown to build creativity-relevant processes of problem construction and problem solving, which have been identified as environmental competences (see Table 1) (Chen and Chang 2013). Waddock (2007), similarly, highlights the role of leadership in driving environmental competences such as critical thinking and cross-cultural understanding. The following proposition links these managerial antecedents to the development of environmental competences:

**Proposition 4** *Attributes of managers, such as their cognition, values, motivation and leadership, have an impact on the development of environmental competences, such as cross-cultural understanding, critical thinking and concern for environmental issues.*

### Contextual Conditions of Environmental Competences

Contextual conditions refer to the pressures from regulators, suppliers, consumers and NGOs, but also to the degree of complexity, uncertainty and turbulence in an environment (Leonidou et al. 2016; Ryan et al. 2012). Stakeholders and institutions exert pressures on firms to improve their environmental performance. Several studies in our review discuss the impact of these contextual conditions, and mainly the impact of the regulatory context, on environmental competences (e.g. Papagiannakis et al. 2014). In a study on the implementation of environmental standards, Lahneman (2015) finds that organisations with the most demanding and detailed implementation of these standards had the highest environmental competences, measured by shared knowledge of environmental sustainability. Similarly, it has been shown that independent environmental audits are explicitly treated by managers as opportunities for advancing in-house expertise (Vickers 1999, p. 82). Vickers and Lyon (2014, p. 451) discuss that 'green stimulus' packages of governments may involve the creation of 'green-collar jobs', promoting the development of environmental competences. In addition to these examples on "regulation-led learning" (Vickers 1999), several other studies have pointed to the impact of consumers and their demand for sustainable products (e.g. Dibrell

et al. 2015). Buil-Fabrega et al. (2017) find that changing demands in the market regarding environmental sustainability require managers to acquire knowledge and consequently to gain environmental competences. Vickers (1999, p. 82) has referred to the impact of the market on environmental competences as "market-led learning". The following proposition links these contextual conditions to the development of environmental competences:

**Proposition 5** *Contextual conditions, such as pressures from stakeholders and environmental uncertainty, have an impact on the development of environmental competences, such as knowledge of environmental sustainability.*

### The Impact of Environmental Competences on Environmental Performance

Environmental performance has been measured in different ways, by a reduction in $CO_2$ emissions (Abareshi and Molla 2013; Chen et al. 2015a), a reduction in water use, waste disposal and energy consumption (Albino et al. 2012; Hajmohammad et al. 2013), and by the development and adoption of clean technologies (Aguilera-Caracuel et al. 2012; Dangelico and Pontrandolfo 2015; Journeault 2016). It has been shown that environmental competences have a positive impact on environmental performance (e.g. Perez-Valls et al. 2016; Renwick et al. 2016). For instance, Li et al. (2014, p. 231) demonstrate that "experience and knowledge on green building projects are very important for improving environmental performance". A few studies have analysed the impact of specific types of environmental competences on performance, such as green transformational leadership, environmental awareness of employees, and strategic thinking (Chen and Chang 2013; Buil-Fabregà et al. 2017). Others have argued that in order for this positive effect on performance to occur, environmental competences need to be developed by proactive organisational practises (e.g. Papagiannakis et al. 2014). For instance, Subramanian et al. (2016) demonstrate that environmental human resource capabilities contribute to the development of environmental competences which then yield greater environmental performance. The environmental awareness among employees can be cultivated through education and training (Baumgartner and Winter 2014; Hashim et al. 2015). These studies show that environmental competences impact performance when organisations invest resources to develop environmental capabilities. The direct effect of competences on environmental performance and the indirect effect, conditional on

the presence of environmental capabilities, is summarised in the following proposition:

**Proposition 6** *Environmental competences, such as knowledge of environmental sustainability and strategic thinking, have a positive impact on environmental performance, either directly or as a mediator between environmental capabilities and performance.*

## Discussion

Our review on environmental competences contributes to the responsible management literature by expanding the classification of responsible management competences and by demonstrating that absorptive capacity leads to the development of responsible management competences. Our review also contributes to the absorptive capacity literature by showing that absorptive capacity is a multi-level learning process in the context of environmental sustainability. In addition, our analysis identifies antecedents and contextual conditions specific to the sustainability context, such as eco-centric values and stakeholder pressures, that drive the development of competences. We will discuss the contributions of this paper in detail in this section.

First, our findings demonstrate that the reviewed articles analyse environmental competences that are similar to the responsible management competences (in black in third column of Table 1). They are a subcategory of responsible management competences with a more specific focus on environmental sustainability, as compared to a focus on SRE. Our review has, however, also identified several competences that have not been identified by the responsible management literature but that can be allocated to one of the four categories of responsible management competences and are thus in line with the current categorization (in bold in Table 1). For example, the articles in our review often discuss emotional intelligence as an important environmental competence. We have allocated this competence to the social interaction category, because emotional intelligence has been defined as an attribute of a sustainable professional who is able "to recognise and respect values and actions of other people and cultures" and who is able to "listen to opinions and emotions of others" (Lambrechts et al. 2013, p. 68). Another example is entrepreneurial thinking, which has been defined as a skill important to a change agent for sustainability, which is "an actor who deliberately tackles social and ecological problems with entrepreneurial means to put sustainability management into organisational practise

and to contribute to a sustainable development of the economy and society" (Hesselbarth and Schaltegger 2014, p. 26). Since change agency skills are part of the social interaction category, we have included entrepreneurial thinking in that same category. Entrepreneurial skills for sustainable development involve social competences, and thus the ability to interact with others and "to build up and maintain relationships, externally as well as internally" (Lans et al. 2014, p. 39).

Second, in this review, the articles demonstrate that absorptive capacity, as a higher-order capability, plays an important role in the development of environmental competences. While the literature on corporate strategy and innovation had already conceptualised absorptive capacity as a higher-order capability (Zahra and George 2002; Lane et al. 2006; Volberda et al. 2010; Flatten et al. 2011; Vasudeva and Anand 2011), our paper illustrates the added value of absorptive capacity in the context of environmental sustainability. The paper contributes to the responsible management literature, by providing evidence on the relation between absorptive capacity and responsible management competences. A critique of the absorptive capacity literature has been the lack of conceptualisation of absorptive capacity as a multi-level learning construct (Sun and Anderson 2008; Van Wijk et al. 2011; Vera et al. 2011; Marabelli and Newell 2014). Our review offers evidence from the literature on environmental competences and capabilities that indeed absorptive capacity plays a critical role in the development of environmental competences through multiple levels of learning.

Third, our review has shown that environmental competences of individuals can stimulate the development of environmental capabilities of organisations. Trans- or inter-disciplinary work, as an example of an environmental competence, is in particular valuable to the development of environmental capabilities (e.g. Lans et al. 2014). This finding builds on earlier research on transdisciplinarity as a responsible management competence (Elliot 2013; Laasch and Moosmayer 2015, pp. 53, 54; Schaltegger et al. 2013). In a corporate sustainability context, transdisciplinary responses start by creating awareness and knowledge among employees (e.g. on carbon footprint, energy consumption, waste), which serve as input for collaborations between different functions inside the organisation, and these collaborations ultimately result in implementing organisation-wide strategies and integrating solutions across the organisation (Elliot 2013). Our findings on the impact of environmental competences on capabilities thus resonate with earlier findings that show that "transdisciplinarity was found to play an essential

role in problem solving and organisational learning" (Elliot 2013, p. 280).

Finally, the context of environmental sustainability and more broadly of responsible management offers interesting insights for the absorptive capacity literature. Most important to these insights is the role of antecedents and contextual conditions. The review of Van Wijk et al. (2011) lists antecedents, such as the characteristics of knowledge (degree of complexity or tacitness), characteristics of organisations (such as organisational structure or incentives) or characteristics of networks (such as type of alliances, similarity of dominant logics). However, our results demonstrate very different antecedents to environmental competence development. The emphasis on eco-centric culture and eco-centric values (Borland et al. 2016) and the role of managerial motivation and cognitive styles (Sweet et al. 2003) show that the antecedents in a sustainability context are different from the ones in more traditional business contexts focused on generating private value. An important contextual condition is the pressure from consumers and regulators demanding more environmentally friendly products. This contextual condition that drives environmental competence development may also bring a different perspective to the absorptive capacity literature, as it emphasises the creation of public value or the combined focus on public and private value.

## Future Research Suggestions

On the basis of a review of existing studies, our paper has proposed a model on the development of environmental competences. We contribute to the literature on responsible management learning and absorptive capacity by formulating five propositions that link absorptive capacity, environmental capabilities, antecedents and contextual conditions to the development of environmental competences and one proposition that suggests a positive relation between environmental competences and performance. Our study is, however, restricted by the re-interpretation of existing studies. Future empirical research is needed that tests the six propositions in both quantitative and qualitative research. Survey items can be developed and tested that enable the analysis of absorptive capacity in a responsible management context. In order to address some of the problems with the operationalization of absorptive capacity (Van Wijk et al. 2011), these survey items could specify the different dimensions of absorptive capacity, take into account individual and organisational levels, and differentiate between different domains in which knowledge is developed (e.g. sustainability, responsibility and ethics). In order to study the impact of contextual

conditions on the development of responsible management competences, case studies may prefer empirical contexts in which new rules and regulations have been introduced or stakeholder pressures are prominent. This would contribute to a research agenda that offers insights into what type of responsible management competences develop depending on the prevalent driver that is demanding change in companies' responsible practises (Laasch and Conaway 2015, pp. 3, 9, 10).

A second future research suggestion concerns the extension of our paper beyond its focus on environmental competences. Figure 1 in the theory section of this paper visualised that a focus on environmental competences covers just one aspect of sustainability (i.e. environmental sustainability), and that sustainability is just one aspect of responsible management. Several studies have argued that the three domains of responsible management (sustainability, responsibility and ethics) are complementary and mutually reinforcing (Laasch and Conaway 2015, p. viii). For instance, Morioka and Monteiro de Carvalho (2016, p. 141) have argued that the promotion of sustainable performance in business includes a commitment to ethics. Even though our Table 1 has illustrated that there is indeed an overlap between environmental competences and the broader set of responsible management competences, future research should study the competences for sustainability, responsibility and ethics in more detail. This research could identify these competences and study how the development of competences for sustainability interacts with the development of competences for responsibility and ethics. A focus on trans- or interdisciplinary work would be a good starting point to study the interaction between different sets of knowledge and skills (Laasch and Conaway 2015; Schaltegger et al. 2013), in particular because intra-firm collaboration between different organisational functions and inter-organisational collaboration have a prominent role in transdisciplinarity (Schaltegger et al. 2013).

A third future research direction is informed by the recent reviews on the absorptive capacity literature (Lane et al. 2006; Volberda et al. 2010; Van Wijk et al. 2011; Marabelli and Newell 2014). These reviews demonstrate that power relationships may be an important antecedent of absorptive capacity and may determine which capabilities are prioritised for development and therefore which knowledge should be required (Volberda et al. 2010; Marabelli and Newell 2014). The study of Marabelli and Newell (2014) re-conceptualises absorptive capacity as a process of power relationships. An absorptive capacity approach that incorporates power processes can contribute to the responsible management learning literature. Especially, empirical research in this field could demonstrate to what extent these power relationships support the top-down development of competent managers in responsible organisations or to what extent power relationships support the bottom-up development of responsible management capabilities enforced by competent employees. Doing so, it can also demonstrate empirical support for Proposition 3 in our study, while integrating a different theoretical approach.

Finally, our study has shown that contextual conditions, such as pressures from regulators, consumers and NGOs to improve environmental performance, have a direct impact on environmental competences. In addition to these direct effects of contextual conditions, two studies in our review have identified moderation effects. Dibrell et al. (2015) show that environmental competences have a positive effect on the performance of firms (measured by innovativeness), and that this relation is stronger when firms are more aware of and responsive to external demands. Journeault (2016) finds that environmental competences only indirectly impact environmental performance through stakeholder integration, which is defined as the level of attention paid to environmental NGOs, community, suppliers, employees, government and customers. Considering the important role of environmental competences in stimulating environmental performance, we propose that future research continues along this research trajectory of Dibrell et al. (2015) and Journeault (2016) to study how institutional conditions and stakeholders affect the relation between competences and environmental performance.

## Managerial Implications

This research is relevant for managers with an objective to implement responsible management practises. In a recent survey, PWC finds that most managers identify change towards responsible management as an important trend. In fact, their study shows that in the US 90% of survey respondents suggest that they seek out companies that reflect their values with regards to corporate responsibility (PWC 2016). However, a recent study by Accenture (reported in Laasch and Conaway 2015, p. 17) shows that one of the inhibitors of responsible management is a lack of skills of middle and senior management. Clearly, this shows that while employees seek work in responsible companies, companies need to integrate responsibility into their operations and to develop environmental competences and capabilities. Companies

may need to engage with change agents, such as organisational development specialists and learning and development consultants, to develop environmental competences and capabilities (PWC 2016).

Our study shows that aside from planned interventions through training and development as is the case for change agents, environmental competences also develop on the job. As companies integrate environmental sustainability into their strategy, employees also learn experientially and through dialogue with stakeholders and employees that are involved in different corporate functions. This shows a reciprocal relationship; responsible companies can foster responsible managers, while responsible managers drive change towards responsible practises in their organisations. Therefore, while selection of employees, building incentives for responsible behaviour, managing performance of employees with regards to responsible behaviour, and education and training for responsibility are important (Subramanian et al. 2016; Renwick et al. 2016), the manager of the future will gain environmental competences on the-job through involvement with various stakeholders and networks and practicing responsibility on a day-to-day basis. The absorptive capacity literature illustrates that indeed this is possible if managers recognise the value of responsibility and acquire knowledge to develop responsible behaviour. This literature shows that individual absorptive capacity is more likely to lead to the creation of new knowledge, and organisational absorptive capacity to the extension of existing knowledge (Van Wijk et al. 2011, p. 290). Managers should therefore provide employees with the time and opportunity to absorb new knowledge on responsible practises in order to develop responsible management competences.

# Appendix

See Tables 2, 3, 4 and 5.

**Table 2** Search and screening for article selection

| | Theme | Search string | | Inclusion criteria | | Inclusion criteria | | Snowballing | Final |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Absorptive Capacity in the Environmental Sustainability Context | "absorptive capacity sustainab*" OR "absorptive capacity green" OR "absorptive capacity ecological" OR "absorptive capacity environmental" | 18 | "Business", "Management", "Green & Sustainable Science & Technology" and "Environmental Studies" in Social Science Citation Index | 14 | Related to environmental sustainability and Related to organisations or managers/ professionals | 6 | 8 | 14 |
| 2 | Environmental Competences and Capabilities | "environmental competenc*" OR "ecological competenc*" OR "green competenc*" OR "sustainab* competenc*" OR "environmental capabilit*" OR "ecological capabilit*" OR "green capabilit*" OR "sustainab* capabilit*" | 476 | "Business", "Management", "Green & Sustainable Science & Technology" and "Environmental Studies" in Social Science Citation Index | 229 | Related to environmental sustainability Related to organisations or managers/ professionals | 118 | 22 | 140 |

**Table 3** List of articles in the review and their contribution to the model

| No | Authors | Subset or not | Categories | Propositions |
|---|---|---|---|---|
| 1 | Abareshi and Molla (2013) | Subset | Knowledge assimilation/transformation, knowledge exploitation, environmental capabilities, environmental performance | 2 |
| 2 | Adomßent et al. (2014) | Subset | Environmental competences, antecedents | |
| 3 | Aguilera-Caracuel et al. (2012) | Subset | Knowledge assimilation/transformation, knowledge exploitation, environmental capabilities, environmental performance | 2 |
| 4 | Ajamieh et al. (2016) | Subset | Knowledge assimilation/transformation, knowledge exploitation, environmental capabilities | 2 |
| 5 | Albino et al. (2012) | | Environmental capabilities | |
| 6 | Amores-Salvadó et al. (2014) | | Environmental capabilities | |
| 7 | Amui et al. (2017) | Subset | Recognising value of external knowledge, knowledge acquisition, environmental competences, environmental capabilities, contextual conditions | 3 |
| 8 | Aragón-Correa (1998) | | Environmental capabilities | |
| 9 | Aragón-Correa and Sharma (2003) | | Environmental capabilities | |
| 10 | Ashton et al. (2017) | Subset | Environmental competences, environmental capabilities, antecedents, contextual conditions | 3, 6 |
| 11 | Azeiteiro et al. (2015) | Subset | Knowledge acquisition, environmental competences, antecedents | |
| 12 | Baranova and Meadows (2016) | Subset | Knowledge assimilation/transformation, knowledge exploitation, environmental capabilities | 2 |
| 13 | Baumgartner and Winter (2014) | Subset | Knowledge acquisition, environmental competences, environmental capabilities, environmental performance | 3, 6 |
| 14 | Berchicci et al. (2012) | Subset | Knowledge assimilation/transformation, knowledge exploitation, environmental capabilities | 2 |
| 15 | Björklund et al. (2012) | | Environmental capabilities | |
| 16 | Bocken and Allwood (2012) | | Environmental capabilities | |
| 17 | Borland et al. (2016) | Subset | Recognising value of external knowledge, knowledge exploitation, environmental capabilities, environmental competences, antecedents, contextual conditions | 1, 3, 4 |
| 18 | Bratt et al. (2011) | | Environmental capabilities | |
| 19 | Brockhaus et al. (2017) | | Environmental capabilities | |
| 20 | Bu and Wagner (2016) | | Environmental capabilities | |
| 21 | Buil-Fabregà et al. (2017) | Subset | Recognising value of external knowledge, knowledge acquisition, environmental competences, environmental performance, antecedents, contextual conditions | 1, 6 |
| 22 | Busse et al. (2016) | | Environmental capabilities | |
| 23 | Buysse and Verbeke (2003) | | Environmental capabilities | |
| 24 | Castellano et al. (2011) | Subset | Knowledge assimilation/transformation, knowledge exploitation, environmental capabilities | 2 |
| 25 | Chabowski et al. (2011) | | Environmental capabilities | |
| 26 | Chakrabarty and Wang (2012) | | Environmental capabilities | |
| 27 | Chang (2016) | Subset | Knowledge assimilation/transformation, knowledge exploitation, environmental capabilities | 2 |
| 28 | Chatterji et al. (2009) | | Environmental capabilities | |
| 29 | Chen (2008) | Subset | Environmental competences, contextual conditions | 5 |
| 30 | Chen and Chang (2013) | Subset | Environmental competences, environmental capabilities, environmental performance, antecedents, contextual conditions | 3, 4, 6 |
| 31 | Chen et al. (2012) | | Environmental capabilities | |
| 32 | Chen et al. (2015a) | Subset | Knowledge assimilation/transformation, knowledge exploitation, environmental capabilities, environmental performance | 2 |
| 33 | Chen et al. (2015b) | | Environmental capabilities | |
| 34 | Chen et al. (2016) | | Environmental capabilities | |
| 35 | Christmann (2000) | | Environmental capabilities | |
| 36 | Collins (2017) | Subset | Environmental competence, antecedents, contextual conditions | |

**Table 3** (continued)

| No | Authors | Subset or not | Categories | Propositions |
|---|---|---|---|---|
| 37 | Cooper and Molla (2014) | Subset | Knowledge assimilation/transformation, knowledge exploitation, environmental capabilities | 2 |
| 38 | Cooper and Molla (2017) | Subset | Knowledge assimilation/transformation, knowledge exploitation, environmental capabilities | 2 |
| 39 | Dabhilkar et al. (2016) | | Environmental capabilities | |
| 40 | Dangelico (2015) | | Environmental capabilities | |
| 41 | Dangelico and Pontrandolfo (2015) | | Environmental capabilities | |
| 42 | Dangelico et al. (2013) | Subset | Knowledge assimilation/transformation, knowledge exploitation, environmental capabilities | 2 |
| 43 | Dangelico et al. (2017) | Subset | Knowledge assimilation/transformation, knowledge exploitation, environmental capabilities | 2 |
| 44 | De Haan (2006) | Subset | Environmental competences | |
| 45 | Delgado-Ceballos et al. (2012) | | Environmental capabilities | |
| 46 | Delmas (2001) | | Environmental capabilities | |
| 47 | Delmas et al. (2011) | Subset | Knowledge assimilation/transformation, knowledge exploitation, environmental capabilities | 2 |
| 48 | Delors (2013) | Subset | Knowledge acquisition, environmental competences, antecedents | 1 |
| 49 | Dibrell et al. (2015) | Subset | Recognising value of external knowledge, knowledge acquisition, environmental competences, environmental capabilities, contextual conditions, antecedents | 1, 3, 5 |
| 50 | Dlouhá and Burandt (2015) | Subset | Knowledge acquisition, environmental competences | |
| 51 | Ehrgott et al. (2013) | Subset | Knowledge assimilation/transformation, knowledge exploitation, environmental capabilities | 2 |
| 52 | Eltantawy (2016) | Subset | Knowledge assimilation/transformation, knowledge exploitation, environmental capabilities | 2 |
| 53 | Fernández-Manzanal et al. (2015) | Subset | Environmental competences, antecedents | |
| 54 | Finster and Hernke (2014) | | Environmental capabilities | |
| 55 | Flint and Golicic (2009) | | Environmental capabilities | |
| 56 | Foerstl et al. (2010) | | Environmental capabilities | |
| 57 | Fuisz-Kehrbach (2015) | Subset | Knowledge acquisition, environmental competences, environmental capabilities, contextual conditions | 1, 3 |
| 58 | Gavronski et al. (2011) | Subset | Knowledge assimilation/transformation, knowledge exploitation, environmental capabilities | 2 |
| 59 | Gluch et al. (2009) | Subset | Knowledge acquisition, knowledge assimilation/transformation, knowledge exploitation, environmental capabilities, environmental competences, antecedents, contextual conditions | 1, 2, 3 |
| 60 | Gombert-Courvoisier et al. (2014) | Subset | Environmental competences | |
| 61 | Govindan and Sivakumar (2015) | | Environmental capabilities | |
| 62 | Hajmohammad et al. (2013) | | Environmental capabilities | |
| 63 | Hänninen and Karjaluoto (2017) | | Environmental capabilities | |
| 64 | Hart (1995) | | Environmental capabilities | |
| 65 | Hart and Dowell (2011) | | Environmental capabilities | |
| 66 | Hartmann and Germain (2015) | Subset | Environmental competences, environmental capabilities, contextual conditions | |
| 67 | Hashim et al. (2015) | Subset | Recognising value of external knowledge, knowledge acquisition, knowledge assimilation/transformation, knowledge exploitation, environmental competences, environmental capabilities, environmental performance, antecedents | 1, 3, 6 |
| 68 | Hesselbarth and Schaltegger (2014) | Subset | Environmental competences, environmental capabilities, antecedents | 3 |
| 69 | Hofmann et al. (2012) | | Environmental capabilities | |
| 70 | Holton et al. (2010) | Subset | Environmental competences, environmental capabilities, contextual conditions, antecedents | 3 |
| 71 | Iles and Martin (2013) | | Environmental capabilities | |

**Table 3** (continued)

| No | Authors | Subset or not | Categories | Propositions |
|---|---|---|---|---|
| 72 | Inigo et al. (2017) | Subset | Knowledge assimilation/transformation, knowledge exploitation, environmental capabilities | 2 |
| 73 | Journeault (2016) | Subset | Recognising the value of external knowledge, knowledge acquisition, knowledge assimilation/transformation, knowledge exploitation, environmental competences, environmental capabilities, contextual conditions, antecedents, environmental performance | 3 |
| 74 | Kim et al. (2015) | | Environmental capabilities | |
| 75 | Kirchoff et al. (2016) | | Environmental capabilities | |
| 76 | Kurucz et al. (2017) | Subset | Knowledge transformation, environmental competences, antecedents | |
| 77 | Lahneman (2015) | Subset | Environmental competences, environmental capabilities, antecedents, contextual conditions | 3, 5 |
| 78 | Lai et al. (2015) | Subset | Environmental competences, environmental capabilities, contextual conditions | 3 |
| 79 | Lambrechts et al. (2013) | Subset | Environmental competences, antecedents | 4 |
| 80 | Lans et al. (2014) | Subset | Recognising the value of external knowledge, environmental competences, environmental capabilities | 1, 3 |
| 81 | Lee and Klassen (2008) | | Environmental capabilities | |
| 82 | Lee and Min (2015) | | Environmental capabilities | |
| 83 | Lenox and King (2004) | Subset | Knowledge assimilation/transformation, knowledge exploitation, environmental capabilities | 2 |
| 84 | Leonidou et al. (2016) | Subset | Recognising value of external knowledge, environmental competences, environmental capabilities, environmental performance, antecedents, contextual conditions | 6 |
| 85 | Leonidou et al. (2017) | | Environmental capabilities | |
| 86 | Li et al. (2014) | Subset | Recognising value of external knowledge, environmental competences, environmental capabilities, antecedents, environmental performance | 1, 3, 6 |
| 87 | Liang and Liu (2017) | | Environmental capabilities | |
| 88 | Lieb and Lieb (2010) | | Environmental capabilities | |
| 89 | Lin et al. (2016) | | Environmental capabilities | |
| 90 | Lindsey (2011) | Subset | Environmental capabilities, environmental competences, antecedents | |
| 91 | Liu et al. (2016) | | Environmental capabilities | |
| 92 | Lozano (2006) | Subset | Environmental competences, environmental capabilities | 3 |
| 93 | Luken et al. (2008) | | Environmental capabilities | |
| 94 | Luthra et al. (2017) | | Environmental capabilities | |
| 95 | Madsen (2009) | | Environmental capabilities | |
| 96 | Maletič et al. (2014) | Subset | Knowledge assimilation/transformation, knowledge exploitation, environmental capabilities | 2 |
| 97 | Malik (2014) | | Environmental capabilities | |
| 98 | Marcus and Geffen (1998) | Subset | Knowledge assimilation/transformation, knowledge exploitation, environmental capabilities | 2 |
| 99 | Mariadoss et al. (2011) | | Environmental capabilities | |
| 100 | Marnewick (2017) | | Environmental capabilities | |
| 101 | Martín-de Castro et al. (2016) | | Environmental capabilities | |
| 102 | Mazzi et al. (2016) | | Environmental capabilities | |
| 103 | Meinlschmidt et al. (2016) | Subset | Knowledge assimilation/transformation, knowledge exploitation, environmental capabilities | 2 |
| 104 | Melissen et al. (2016) | Subset | Knowledge assimilation, environmental competences, environmental capabilities | 3 |
| 105 | Metta and Badurdeen (2013) | | Environmental capabilities | |
| 106 | Morioka and de Carvalho (2016) | Subset | Environmental competences, environmental capabilities, contextual conditions, antecedents | |
| 107 | Mulder (2014) | Subset | Knowledge transformation, environmental competences | |

**Table 3** (continued)

| No | Authors | Subset or not | Categories | Propositions |
|---|---|---|---|---|
| 108 | Oelze et al. (2016) | Subset | Knowledge assimilation/transformation, knowledge exploitation, environmental capabilities | 2 |
| 109 | Pace (2016) | Subset | Recognising value of external knowledge, knowledge assimilation/transformation, knowledge exploitation, environmental capabilities, environmental competences, antecedents | 1, 2, 3 |
| 110 | Papagiannakis et al. (2014) | Subset | Knowledge acquisition, knowledge assimilation, environmental competences, environmental capabilities, antecedents, contextual conditions, environmental performance | 1, 2, 3, 4, 5, 6 |
| 111 | Parmigiani et al. (2011) | Subset | Knowledge transformation, environmental capabilities | 2 |
| 112 | Paulraj (2011) | | Environmental capabilities | |
| 113 | Pereira-Moliner et al. (2015) | | Environmental capabilities | |
| 114 | Perez-Valls et al. (2016) | Subset | Environmental competences, environmental capabilities, environmental performance, contextual conditions | 3, 6 |
| 115 | Pinkse et al. (2010) | Subset | Knowledge assimilation/transformation, knowledge exploitation, environmental capabilities | 2 |
| 116 | Renwick et al. (2016) | Subset | Environmental competences, environmental capabilities, antecedents, environmental performance | 3, 4, 6 |
| 117 | Reuter et al. (2010) | | Environmental capabilities | |
| 118 | Rodriguez and Wiengarten (2017) | | Environmental capabilities | |
| 119 | Roy and Khastagir (2016) | Subset | Knowledge assimilation/transformation, knowledge exploitation, environmental capabilities | 2 |
| 120 | Roy and Thérin (2008) | Subset | Knowledge assimilation/transformation, knowledge exploitation, environmental capabilities | 2 |
| 121 | Rueda-Manzanares et al. (2008) | | Environmental capabilities | |
| 122 | Rugman and Verbeke (1998) | | Environmental capabilities | |
| 123 | Russo and Fouts (1997) | | Environmental capabilities | |
| 124 | Ryan et al. (2012) | Subset | Recognising value of external knowledge, knowledge transformation, environmental competences, environmental capabilities, antecedents, contextual conditions | 1, 5 |
| 125 | Sharma and Vredenburg (1998) | Subset | Knowledge assimilation/transformation, knowledge exploitation, environmental capabilities | 2 |
| 126 | Shevchenko et al. (2016) | | Environmental capabilities | |
| 127 | Sihvonen and Partanen (2017) | | Environmental capabilities | |
| 128 | Singh et al. (2016) | | Environmental capabilities | |
| 129 | Siqueira and Pitassi (2016) | Subset | Environmental competences, environmental capabilities, environmental performance, antecedents | 3, 6 |
| 130 | Spicer and Hyatt (2017) | Subset | Recognising value of external knowledge, environmental competences, environmental capabilities, antecedents | 3 |
| 131 | Stubbs and Cocklin (2008) | | Environmental capabilities | |
| 132 | Subramanian et al. (2016) | Subset | Knowledge acquisition, environmental competences, environmental capabilities, environmental performance, antecedents, contextual conditions | 1, 3, 4, 6 |
| 133 | Sweet et al. (2003) | Subset | Environmental competences, environmental capabilities, antecedents | 3 |
| 134 | Triguero et al. (2016) | | Environmental capabilities | |
| 135 | Vachon and Klassen (2006) | | Environmental capabilities | |
| 136 | van Kleef and Roome (2007) | Subset | Environmental competences, environmental capabilities, knowledge acquisition, antecedents | 3 |
| 137 | Varadarajan (2017) | | Environmental capabilities | |
| 138 | Varnäs et al. (2009) | | Environmental capabilities | |
| 139 | Verhulst and Van Doorsselaer (2015) | Subset | Environmental competences, environmental capabilities, antecedents, contextual conditions | |

**Table 3** (continued)

| No | Authors | Subset or not | Categories | Propositions |
|---|---|---|---|---|
| 140 | Vickers (1999) | Subset | Recognising value of external knowledge, knowledge acquisition, knowledge assimilation/transformation, knowledge exploitation, environmental competences, environmental capabilities, antecedents, contextual conditions | 2, 3, 4, 5 |
| 141 | Vickers and Lyon (2014) | Subset | Environmental competences, environmental capabilities, contextual conditions | 5 |
| 142 | Vinodh and Rathod (2010) | | Environmental capabilities | |
| 143 | Von Blottnitz (2006) | Subset | Environmental competences, knowledge acquisition | 1 |
| 144 | Waddock (2007) | Subset | Environmental competences, antecedents, recognising value of external knowledge | 1, 4 |
| 145 | Walls et al. (2011) | Subset | Environmental competences, environmental capabilities, antecedents | 3 |
| 146 | Wals (2014) | Subset | Environmental competences, antecedents | |
| 147 | Wassmer et al. (2014) | | Environmental capabilities | |
| 148 | Wiek et al. (2011) | Subset | Knowledge acquisition, environmental competences, antecedents | 1, 4 |
| 149 | Williander (2007) | Subset | Knowledge assimilation/transformation, knowledge exploitation, environmental capabilities | 2 |
| 150 | Wong (2013) | Subset | Knowledge assimilation/transformation, knowledge exploitation, environmental capabilities | 2 |
| 151 | Woo et al. (2016) | Subset | Knowledge assimilation/transformation, knowledge exploitation, environmental capabilities | 2 |
| 152 | Wu (2015) | | Environmental capabilities | |
| 153 | Xie et al. (2016) | Subset | Knowledge assimilation/transformation, knowledge exploitation, environmental capabilities | 2 |
| 154 | Zhu et al. (2013) | | Environmental capabilities | |

**Table 4** Examples of different coding types

| References | Structural coding | In vivo coding | | Matrix coding (relationship between environmental competences and capabilities) |
|---|---|---|---|---|
| | | First stage | Second stage | |
| Papagiannakis et al. (2014) | Environmental competences | "The importance of managers' values and environmental attitudes suggests that considerable attention should be given to the individuals who bear the responsibility of environmental decision making. When hiring or upgrading, candidates could be screened based on their values and ecological worldviews" | Responsibility | "The undertaking of large-scale environmental investments, combined with a profound diffusion and integration of environmental responsibilities among organisational members, facilitated companies B and D to experience superior outcomes, associated with the emergence of organisational capabilities" |
| Hesselbarth and Schaltegger (2014) | Environmental competences | "Change agents are opinion leaders and driving forces in change processes. They convince superiors, form coalitions, allay fears as well as motivate and inspire employees and teams to leave old paths and take responsibility for social and environmental issues" | Competence to bring change | "A change agent for sustainability is an actor who deliberately tackles social and ecological problems with entrepreneurial means to put sustainability management into organisational practise and to contribute to a sustainable development of the economy and society" |

**Table 5** Examples of definitions of environmental competences

| Definition | References |
| --- | --- |
| "[Green competences] (GC) are the requisite ecological knowledge, skills and other socioeconomic behaviour an individual has to help him/her behave and act rightly and responsibly toward the overall well-being of his/her immediate environment. Understanding GCs of individuals can significantly enhance the GHRM role in its functions such as hiring and training employees toward green objectives of firms. This is because GC motivates individuals to always ensure they only engage in resource-conserving and environmentally friendly activities" | Subramanian et al. (2016) |
| "a complete set of knowledge, skills, values, and attitudes necessary to ensure today's students and future leaders are ready to deal with complex issues regarding sustainability, and achieve a sustainable future" | Lambrechts et al. (2013) |
| "Competence-oriented educational concepts focus on the 'output' of educational processes whereas the conventional pedagogic paradigm emphases the 'input' (contents and subjects) which students should learn. The output approach does not primarily ask what should be taught, but starts with the question what should be learnt: What kind of managing abilities, which analytical concepts and problem solving strategies should students have acquired as a result of the learning process?… common elements typically mentioned in definitions of competency. Apart from a broad foundation of disciplinary and interdisciplinary knowledge also cognitive and practical skills as well as attitudes and capabilities to successfully perform complex tasks in real life work environments are emphasised together with the ability to cooperate and motivate" | Hesselbarth and Schaltegger (2014) |
| "We employ in this article the definition of competence as a functionally linked complex of knowledge, skills, and attitudes that enable successful task performance and problem solving. Applied to competencies in sustainability, these are complexes of knowledge, skills, and attitudes that enable successful task performance and problem solving with respect to real-world sustainability problems, challenges, and opportunities…" | Wiek et al. (2011) |

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