Individual Sustainability Competences for Eco-design Infrastructure

Name: Elles de Wringer
Studentnumber: 834650471
Date: September 2017
Examinator: Dr. Wim Lambrechts
Reader: Prof. Dr. Janjaap Semeijn
Faculty: Management, Sciences & Technology
Specialisation: Master of Science in Management
Summary

Background – Sustainability in the broadest sense of the term has become an undeniable aspect of corporate dealings this day and age. The advent of Corporate Social Responsibility as a morally sound issue has been caught up by market-oriented, profit-driven motivations for ‘greening’ the business. Also, new generations of professionals are growing up more environmentally aware than ever and eager to put their beliefs and attitudes into practice. And while improving corporate sustainability is an important topic in all fields of business, progress made in the Supply Chain Management field has attracted a great deal of academic attention. Research has been done into conditional aspects of sustainable performance and study has been made of the practical implications of greening supply chains. The study at hand aims to focus on that area where those two come together and where educational vision is applied to business context. More specifically we try to explore the use of individual sustainability competences in corporate infrastructural projects. Definition of those competences is based on a framework proposed by Lans, Blok, and Wesselink (2014) and validated by Ploum, Blok, Lans, and Omta (2017) which is considered an important tool for monitoring students’ sustainable entrepreneurship in school-based environments.

Purpose – The main objective of this study is to find validation for the following: “Embracing individual competences for sustainable development positively supports eco-oriented design and build in corporate infrastructural initiatives”.

Methodology – Qualitative research was undertaken based on interviews with respondents who played an active role in a sustainable infrastructure project. Case companies were chosen based on the sustainability certification (or ambition thereto) their infrastructural project had achieved. Interviews were conducted with eleven professionals employed by four case companies, using the Critical Incident Technique to collect data on application of individual sustainability competences related to the issues they dealt with during the building project they were responsible for. Findings were categorized using labels derived from Ploum et al. (2017), Wesselink, Blok, van Leur, Lans, and Dentoni (2015) and Martens, Roorda, and Cörvers (2010).

Findings – Results from these interviews suggest that the propositions formulated in this study are positively supported. During the eleven interviews twenty-five incidents were recalled where application of competences was recognized. Categorization using labels linked the observed behaviour to five out of the six individual sustainability competences formulated in literature where all competences are recognized except for the normative aspect. In application of specific Individual Sustainability Competences three distinct phases are distinguished: initial inspiration, out-of-the-box thinking and engaging stakeholders.
Managerial implications – Practical recommendations focus on increasing corporate knowledge of- and familiarity with competences in general. Project teams working on sustainable SCM projects could benefit from training specifically on the impact of individual sustainability competences. Another recommendation concerns higher education institutes, who could be increasing the effort to raise the level of awareness on sustainability competences with students to reach a more ingrained belief or attitude.

Research implications – Recommendations for future research could centre on extending research from the rather homogenous group of SME companies studied here to include larger –multinational- corporations. Also, future research could include checks and balances concerning aspects of biases as documented in the field of behavioural economics and calibrating the Critical Incident Technique used in the interview methodology. Other interesting avenues of future research could include the conceptualization of the normative competence considering the absence noted in our findings and further research into reducing thresholds toward sustainable building by applying rewards.

List of Abbreviations:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>(G) (S) SCM</td>
<td>(Green) (Sustainable) Supply Chain Management</td>
</tr>
<tr>
<td>CSR</td>
<td>Corporate Social Responsibility</td>
</tr>
<tr>
<td>(G) (S) HRM</td>
<td>(Green) (Sustainable) Human Resource Management</td>
</tr>
<tr>
<td>(SM) ER</td>
<td>(Supply Management) Ethical Responsibility</td>
</tr>
<tr>
<td>SD</td>
<td>Sustainable Development</td>
</tr>
<tr>
<td>PPP</td>
<td>People Profit Planet</td>
</tr>
<tr>
<td>HE(I)</td>
<td>Higher Education (Institute)</td>
</tr>
<tr>
<td>CIT</td>
<td>Critical Incident Technique</td>
</tr>
<tr>
<td>SME</td>
<td>Small to Medium-Sized Enterprise</td>
</tr>
<tr>
<td>IPCC</td>
<td>Intergovernmental Panel on Climate Change</td>
</tr>
<tr>
<td>DGBBC</td>
<td>Dutch Green Building Council</td>
</tr>
<tr>
<td>BREEAM</td>
<td>Building Research Establishment’s Environmental Assessment Methods</td>
</tr>
<tr>
<td>LEED</td>
<td>Leadership in Energy and Environmental Design</td>
</tr>
<tr>
<td>GPR</td>
<td>Gemeentelijke Praktijk Richtlijn (translates into: municipal practice guideline)</td>
</tr>
</tbody>
</table>
Contents

1. Introduction ................................................................................................................................ 5
  1.1 Research problem ................................................................................................................ 5
  1.2 Research question ............................................................................................................... 8
  1.3 Relevance ............................................................................................................................ 8
  1.4 Research Design .................................................................................................................. 8

2. Theoretical background .............................................................................................................. 9
  2.1 Competences ....................................................................................................................... 9
    Individual Competences ........................................................................................................ 9
    Competences for Sustainability ............................................................................................ 10
    Competence-based education ............................................................................................... 11
  2.2 Sustainable Supply Chain Management ............................................................................. 12
    Different paths ....................................................................................................................... 12
    Embedding through Organizational Strategy and Leadership ................................................ 14
  2.3 Sustainable design and building of commercial infrastructure ............................................. 15
    Certification assessment standards ....................................................................................... 15
    Certification tool BREEAM-NL ............................................................................................... 16
    Link to research on Competences ......................................................................................... 18
  2.4 Conceptual model and propositions .................................................................................... 19
    Conceptual Model ................................................................................................................. 19

3. Methodology ............................................................................................................................ 20
  3.1 Developing interview protocol ............................................................................................. 20
  3.2 Consolidation and analysis of the results ............................................................................ 22
  3.3 Selection of case companies .............................................................................................. 25
  3.4 Selection of respondents .................................................................................................... 25

4. Results ..................................................................................................................................... 26
  4.1 The case companies and their respondents ....................................................................... 26
    Vencomatic Group BV ........................................................................................................... 26
    Holmatro BV ......................................................................................................................... 27
    Datacon BV/FAXX gebouw .................................................................................................. 27
    Orangeworks BV .................................................................................................................. 28
  4.2 Critical Incidents and the application of Individual Sustainability Competences ................. 29
    Phase 1. Initial inspiration for sustainability in building........................................................... 30
    Phase 2. Out-of-the-box thinking ........................................................................................... 32
    Phase 3. Engaging stakeholders ........................................................................................... 33

5. Discussion, conclusion and recommendations ......................................................................... 37
  5.1 Discussion .......................................................................................................................... 37
  5.2 Conclusion .......................................................................................................................... 41
  5.3 Recommendations for practitioners .................................................................................... 42
  5.4 Recommendations for future research ................................................................................ 43

References .................................................................................................................................. 45
1. Introduction

1.1 Research problem

The integration of Sustainable Supply Chain practices in business environments is a growing field of interest (Quarshie, Salmi, & Leuschner, 2016). Suppliers, for example, are increasingly required to adhere to certifications centred on sustainable business practices such as ISO 14001 in dealing with general sustainable business performance. Not only research but also practical application of sustainable supply chain management should be a diversifying field. Seuring and Müller (2008) show that most research is still dominated by environmental issues and more recently Beske and Seuring (2014) helped by identifying five key categories which are of high importance for the sustainable management of supply chains, these being: orientation toward SCM and sustainability, continuity, collaboration, risk management and proactivity. They subsequently describe distinctive practices which can help organizations to reach sustainability performance in SCM.

The body of research into competences linked with Corporate Social Responsibility (CSR) is also well developed. More specifically literature research and empirical analysis of key competences for sustainable development have brought us a number of models to work with. Twelve key sustainability competences have been defined by Rieckmann (2012) and cross-referenced with SCM literature by Lambrechts, Semeijn, Gelderman, Ghijsen, and Liedekerke (2017). A more general CSR oriented framework by Osagie, Wesselink, Blok, Lans, and Mulder (2014) defining 8 distinct CSR-related competences and the framework as defined by Wiek, Withycombe, and Redman (2011) focusing towards systems thinking competence, anticipatory competence, normative competence, strategic competence and interpersonal competence as the key definitive competences in sustainable development.
Research by Verhulst and Lambrechts (2015) expands on those models by defining four clusters of influencing factors to improve our understanding of those barriers related to human factors for integrating sustainable development. This model is shown in figure 1.

Figure 1: Conceptual model of integration process of SD and four clusters of human factors. Source (Verhulst & Lambrechts, 2015)

Preliminary results of a systematic literature review on aspects of competences –here defined as incorporating knowledge, skills, attitudes and values- linked with sustainable development and their role in supply chain management (SCM) settings show that there is still ground to cover.

Lambrechts et al. (2017) conclude that although individual competences for sustainable development have been well defined and conceptualized in different settings, their applicability in the field of supply chain management is only broadly described. There is an apparent need for further detailed research into the effect of Individual Sustainability Competences in ‘greening’ the field of SCM and more specifically into the ethical dilemmas SCM management might face when dealing with the growing complexity and uncertainty of sustainability issues.

In an effort to bridge those two more separately evolved lines of research -the first concerning SCM integration and the second concerning Corporate Social Responsibility- we find an up-and-coming field of interest in which to explore and integrate those two research threads to be the adoption of ‘green building’ in the construction phase of commercial real
Eco-design of products has been explored by Boks (2006) and has been mentioned in the research undertaken by Jabbour and de Sousa Jabbour (2016) on linking the Green HRM and Green SCM fields of study.

But research on the aspect of Eco-design in tendering infrastructural business assets is more limited. Yet there is much to gain in fostering corporate social responsibility and green behaviour by employing firm infrastructure that is specifically designed to enhance the sustainability of the business processes involved.

The World Green Building Council provides international guidance in this area and is one of the organizations active in fostering sustainable thinking in designing and building new business real estate and reconstructing existing property. They propagate the BREEAM certification standard to that effect. Other standards such as GPR-Gebouw (a municipal government sponsored tool) and GreenCalc are also widely used to assess sustainability as applied in the construction industry. A more in-depth analysis on the use of the different tools and a comparison of their applicability is documented in the master thesis of Neimann (2012).

A Web of Science™ search on articles related to BREEAM shows several literature references including a study on the effects and influence of the Building Research Establishment's Environmental Assessment Methods (BREEAM) on construction professionals as examined by Schweber (2013) and directed more towards the effect of BREEAM on visibilities, knowledge, techniques and professional identities using Foucault's theory of 'governmentality'.

Furthermore we find research analysis by Tabassi et al. (2016) showing that leadership competences, as well as the transformational leadership qualities of project managers as second-order reflective constructs experience a direct impact on the success criteria for sustainable buildings. The role of Innovation Brokers is discussed by Winch and Courtney (2007) suggesting that the key role played by innovation brokers in the innovation process is the independent validation of new ideas, thereby facilitating diffusion.

An interesting angle from which to look at this research topic is the concept of supply management ethical responsibility (SMER) defined by Eltantawy, Fox, and Giunipero (2009) as "managing the optimal flow of high-quality, value-for-money materials, components or services from a suitable set of innovative suppliers in a fair, consistent, and reasonable manner that meets or exceeds societal norms, even though not legally required". Findings of this study show that ethical responsibility is a valuable component of supply managements’ perceived reputation and may provide strategic marketing advantage.
1.2 Research question

How do individual competences for sustainable development support Eco-design infrastructural initiatives (with specific focus on BREEAM guidelines) in a corporate context?

- Which competences do purchasers, managers and other SCM staff recognisably apply in their effort to comply with ‘green’ and sustainable guidelines during infrastructural projects?

- Are certain competences prioritized over others in Sustainable SCM projects focusing on infrastructure?

- How do competences based on (business) ethical components relate to Sustainable SCM projects focusing on infrastructure?

1.3 Relevance

More research into the specific use of competences in SCM business environments can add perspective to a more holistic approach in educating future generations of SCM-professionals on implementing sustainable development as a core approach in their field. Thus making an effort in bridging focus in education on sustainability with focus in education on entrepreneurship as (Lans et al., 2014) suggested is lacking. Specifically noting that none of the current references linked to BREEAM brings focus on the subject of competences and skills it seems that outcome of this research proposal would be able to add some insight into that area.

As a current search does not bring up any references on the integration of sustainability competences into BREEAM – guided sustainable investment projects it seems that adding research on applicable sustainability competences in that area of facility management and supply chain management might enhance the knowledge necessary to educate and search for professionals equipped for this sustainable Supply Chain Management behaviour.

1.4 Research Design

To generate data necessary for testing propositions qualitative research based on interviews is carried out. A minimum of 10 interviews is conducted with purchasers, managers and other key personnel actively involved in managing green construction projects. In these interviews the focus is on the recognition of applicable sustainability competences using a semi-structured interview method. (Osagie et al., 2014)

We have extended their method of analysis in prioritizing and combining competences into different roles in the Supply Chain Management field and more specifically the infrastructural construction area.
2. Theoretical background

This chapter will first explore existing literature on individual competences, their role in sustainable development (SD) and their application in higher education (HE). This is followed by a review of research pertaining to the field of supply chain management (SCM) and how sustainability has become an integral part of that field. To conclude the theoretical background for this thesis a scan of research is made concerning the specific field of sustainability in infrastructure projects. To identify suitable sustainable infrastructure projects a search using different certification assessment methods is conducted. These assessment methods include BREEAM (Building Research Establishment Environmental Assessment Method), LEED (Leadership in Energy and Environmental Design), GPR-Gebouw (Gemeentelijke Praktijk Richtlijn) and Greencalc.

2.1 Competences

Individual Competences

Literature research on individual competences shows that study on that subject is longstanding. Competences can be defined in general as a cluster of related knowledge, skills, attitudes and values that enable a person to act effectively in a job or situation. There is general agreement that over time three dominant approaches to conceptualizing competences can be recognized (Ploum et al., 2017). Neumann (1979) introduced a behavioral approach which eventually was criticized because of the mechanistic way of looking at atomized work descriptions. This led to a more generic or worker-oriented approach developed by Eraut (1994) in which perceiving individual competences as underlying characteristics make it possible to distinguish between more or less successful performers. Here however, the connection to context was seen as too limited for use in the complexity of professional—and changing—environments. (Osagie et al., 2014). Acknowledging this shortcoming led to research on a comprehensive conceptualization by Delamare Le Deist and Winterton (2005) and Wesselink, de Jong, and Biemans (2010) seeking to clarify the competence concept by incorporating knowledge, skills, attitudes and values within a holistic competence typology and arguing that such a comprehensive framework would be useful in identifying the combination of competences that would be necessary for particular occupations. In this approach individual competences are viewed as a person’s integrated performance-oriented ability to achieve specific objectives, where ‘integrated’ refers to a cohesive and complex set of knowledge, skills, attitudes and values seen in the context in which successful performance has to take place (M. Mulder, 2014). It is noted that during these periods the different conceptualizations of competences have intertwined and definitions have become too elastic. W. Lambrechts and Van Petegem (2016) expand on this theory by exploring the relation between competences for SD and the research competences in general upon which education in HE institutes is based. They find that a more conscious method of acquisition of competences is needed for students to successfully tackle the complex issues regarding SD they might face as future professionals.
**Competences for Sustainability**

In line with general agreement on the importance of sustainable thinking and corporate social responsibility (CSR), research regarding the definition of competences tied to sustainable development (SD) started in the world of education with studies by De Haan (2006), Barth et al. (2007), Rowe (2007), (Wiek et al., 2011) and Rieckmann (2012). Although most were instrumental in identifying competences for sustainable development in a work/business context the results were also criticized for being mere ‘laundry lists’ and effort was undertaken by Wiek et al. (2011) to develop a more convergent competence framework. Several authors (Wesselink et al., 2015), (Hesselbarth & Schaltegger, 2014) and (Osagie et al., 2014) proposed more or less comparable constructs where competences are grouped into sets of 5 up to 8 CSR-related competences. Validation study done by Ploum et al. (2017) starts with the 7 factor competence framework by Lans et al. (2014) and suggests a good model fit after combining two competences (Strategic management competence and Action competence) and coming to the following 6 factor framework.

- **Strategic management competence and Action competence:** The ability to collectively design projects, implement interventions, transitions, and strategies for sustainable development practices and the ability to actively involve oneself in responsible actions for the improvement of the sustainability of social–ecological systems.
- **Embracing diversity and interdisciplinary competence:** The ability to structure relationships, spot issues, and recognize the legitimacy of other viewpoints in business decision making processes; be it about environmental, social, and/or economic issues.
- **Systems thinking competence:** The ability to identify and analyze all relevant (sub) systems across different domains (people, planet, profit) and disciplines, including their boundaries.
- **Normative competence:** The ability to map, apply, and reconcile sustainability values, principles, and targets with internal and external stakeholders, without embracing any given norm but based on the good character of the one who is involved in sustainability issues.
- **Foresighted thinking –or anticipatory- competence:** The ability to collectively analyze, evaluate, and craft “pictures” of the future in which the impact of local and/or short-term decisions on environmental, social, and economic issues is viewed on a global/cosmopolitan scale and in the long term.
- **Interpersonal competence:** The ability to motivate, enable, and facilitate collaborative and participatory sustainability activities and research.

According to Lans et al. (2014) an important purpose of a comprehensive framework is ‘providing stepping stones for monitoring students’ sustainable entrepreneurship in school-based environments’.

The importance of acquiring these SD-related competences is also increasingly recognized in economic circles and substantiated by the mapping of future skills outlined in the 2016
report of the World Economic Forum (WEF, 2016, p. 22) where it is shown that skills such as complex problem solving, critical thinking and judgment and decision making are gaining more importance in the top 10 skills list at the expense of for example negotiation or quality control. The fact that there is a manifest overlap of the competences promoted by the WEF and competences found to be linked with SD is another important incentive to expand research on the employment of those competences in business environments.

Overall this reveals a gap in the existing research on competences for SD: where they are thoroughly defined, discussed and researched in the field of HE, their application in business-settings is only limitedly documented. The majority of published research on competences for SD is executed in educational settings. It shows the urgent need to start documenting the results of competence-based education and the effect of thus educated professionals in their work environment on progress being made on the SD issues they handle. This is also stressed by Ploum et al. (2017, p. 15) when they state that ‘whether nascent or established entrepreneurs also recognize themselves in these competences was beyond the scope of this research’ and ‘future research could focus on …..whether the framework for sustainable entrepreneurship could be supporting for these entrepreneurs’ and Lans et al. (2014) when they advise repeating the research with focus groups of sustainable entrepreneurs and/or sustainable venture capitalists and thus creating the possibility of exploring the boundaries of sustainable entrepreneurship more carefully.

An interesting aspect of this respect is the introduction of a virtue perspective on the moral competences related to sustainability. Blok, Gremmen, and Wesselink (2016) argue that as sustainability is a highly complex or ‘wicked’ problem it is necessary to properly understand both the normative competence and the action competence as they are considered the moral competences in the field. They first propose that these competences are different in that the normative competence is about acknowledging responsibility and being held responsible while action competence centers on actually taking action and taking responsibility. Furthermore, they describe a tension between the two competences where ‘application of universal norms and principles seems to stress the universality of ethical judgment, while the actions involved in the action competence seem to highlight the singularity of ethical decision making processes’ Blok et al. (2016, p. 4). This situation, where a competence-educated professional in the field of SD is being torn between expressing one view and exercising another would be interesting to evaluate in the effort to show that competences can both be dormant or acquired.

**Competence-based education**

Boyatzis (2008) has elaborated on program design and teaching methods focused on developing competences in adults. Recognition of the importance of competences in management practice has led to the rise of competence-based education. Especially in higher education institutes (HEI’s) effort has been made to integrate the competence concept in curricula but critics argue that integrating ‘measurable’ items such as
competences has negatively affected the –hard to measure- values inherent to education (Cheetham & Chivers, 1996). Lambrechts, Mulà, Ceulemans, Molderes, and Gaeremynck (2013) also state that trying to incorporate competences for sustainable development (SD), which are fundamentally based on values and ethics, into HE seems to be contradictory with competence-based education programs. W. Lambrechts and Van Petegem (2016, p. 792) find that ‘HEI’s are far from integrating these competences in a structured and systematic manner’, they propose a more holistic framing of these competences within the concept of sustainable development.

K. F. Mulder (2017) goes so far as to state that ‘raising engineering students in strong disciplinary paradigms is probably responsible for their diminishing public engagement over the course of their studies’. El-Zein and Hedemann (2016) add to this discourse by arguing that –higher- engineering education’s focus on problem solving affects the profession’s attempt to maintain relevance in this era of growing attention for sustainable development.

Apart from these discussions on definitions research has also advanced on how to embed sustainable thinking in companies and organizations. One path is through integration of sustainability in higher education (HE). Wiek et al. (2011, p. 203) already noted that while “for more than a decade, sustainability courses have been developed and taught in HE, yet comprehensive academic programs in sustainability, on the undergraduate and graduate level, have emerged only over the last few years.” Since then progress has been made and research by Lozano, Lukman, Lozano, Huisingh, and Lambrechts (2013, p. 10) for example propose “that for universities to become sustainability leaders and change drivers, they must ensure that the needs of present and future generations be better understood and built upon, so that professionals who are well versed in SD can effectively educate students of ‘all ages’ to help make the transition to ‘sustainable societal patterns’”. Research by Verhulst and Lambrechts (2015) shows that their conceptual model, linking human factors to the sustainable development integration process in HE, helps to get a better understanding of the human-related barriers encountered as well as teaching us the importance of continuously supporting ambassadors of sustainable integration on this process.

2.2 Sustainable Supply Chain Management

Different paths

Reviewing literature on sustainability and supply chain management (SSCM) shows that while SD has increasingly come into focus in this field, digression on different paths is occurring. Where Eltantawy et al. (2009) wrote almost a decennium ago that ethical responsibility in the field of supply management cannot be ignored by companies, Quarshie et al. (2016) reveal that research on sustainability and corporate social responsibility (CSR) has still developed mostly separately along the two streams of supply chain management (SCM) literature and the business ethics field. This further illustrates the standoff between the educational and business environments concerning prioritizing ethical responsibility.
This gap created by inconsistent definitions of sustainability and ‘the relatively a-theoretical conceptual and empirical research found in extant sustainability literature’ is also addressed by Carter and Rogers (2008, p. 362) with their proposed framework of SSCM. Their definition of SSCM is based on both the triple bottom line and four supporting facets of sustainability they derive from their literature research – risk management, transparency, strategy and culture. They have conceptualized this in figure 2. shown below from (Carter & Rogers, 2008, p. 369). They contend that firms who will attempt to simultaneously maximize performance of all three dimensions will outperform those that concentrate on just one of the dimensions.

Figure 2: Framework for SSCM, source (Carter & Rogers, 2008)

While Seuring and Müller (2008) argue that research is dominated by green/environmental issues and that integration of social aspects is rare, Ahi and Searcy (2013, p. 339) still feel the need to converge definitions on green SCM and sustainable SCM to propose a more encompassing definition including “economic, environmental and social considerations” while “meeting stakeholders requirements and improving the profitability, competitiveness, and resilience of the organization over the short- and long-term” thus showing again that reaching common ground takes time. And while some (Beske & Seuring, 2014) agree on emphasizing the movement of SCM toward sustainability in this manner during recent years, others (Pagell & Shevchenko, 2014) criticize these popular triple bottom line (PPP) conceptualizations due to the supremacy of financial and economic dimensions they invoke. According to them sustainable SCM might be defined as follows as they quote from an
earlier study by Pagell and Wu (2009, p. 45): ‘To be truly sustainable a supply chain would at worst do no net harm to natural or social systems while still producing a profit over an extended period of time’.

Another take on promoting entrepreneurial action towards sustainability is advocated by Dean and McMullen (2007, p. 51). They argue that ‘the growing desire of many individuals in the marketplace for the cessation of environmentally degrading activities, combined with a willingness to pay for reduction of these activities, represents opportunity for entrepreneurial action that can lead to enhancement of ecological sustainability’ thus making sustainable entrepreneurship a more profit-driven conception and an interesting item for research into competences and drivers concerned.

Embedding through Organizational Strategy and Leadership

Another path leads us to literature zooming in on the organizational effort of advancing strategic perspectives and enhancing leadership-roles. Baumgartner and Rauter (2017) applied propositions ordered along three dimensions: strategy process, strategy content and strategy context, to reveal relationships between strategic management and sustainable development. They argue that integrating strategy context -defined as the conditions surrounding the strategic activities- is necessary to create business value and that matching strategy content –defined as the output of the strategy process- to societal needs allows a company to create societal value. Roos (2017) agrees on business education's need to start playing a bigger role in developing the skills required to tackle the challenges of sustainability and he posits a framework based on adding a third argument –governance, defined as based on a kind of informed and wise leadership- to the two most common used arguments being the moral case –built on ethical principles- and the business case where the profit motive is the dominant foundation. Also geared towards enhancing ethical leadership roles a framework based on care ethics and sustainability ethics is suggested by Jones, Michelfelder, and Nair (2017). They argue that the resulting engineering ethic can support project and line managers in influencing team members to adopt the moral characteristics necessary to engineer sustainable projects as part of their everyday practice. In their reference to the importance of role models of ethical leadership by Brown and Treviño (2006) several of individual sustainability competences as defined by Ploum et al. (2017), Lans et al. (2014) and Wesselink et al. (2015) can be recognized.

Jones et al. (2017) warn that embedding sustainability in daily practice –next to formulating and propagating relevant engineering codes- is also reliant on development at educational level by making sustainability part of the formal engineering curriculum.
2.3 Sustainable design and building of commercial infrastructure

Choosing the building industry to address the issue of sustainable development is underscored by the fact that popular acknowledgement of the responsibility this sector has for CO2 emissions is growing rapidly. In a recent article in the Financeel Dagblad by Grol and Rooijers (2017) reference is made to a statistic reporting that buildings are causing 40% of the CO2 emissions in The Netherlands. This popular belief is substantiated by scientific research done by Metz, Davidson, Bosch, Dave, and Meyer (2007) on a worldwide scale for the International Panel on Climate Change (IPCC) and referred to by Fien and Winfree (2014) when they state that construction is not the only driver in the sustainable development of the construction sector. They point towards the growing importance of building information management systems, the trend towards the factory manufacturing of components and onsite assembly in construction and they refer to the Green Skills Agreement that the Australian Government is endorsing as an example of how to build sustainable skills capacity in the construction industry.

The research documented in this thesis will have a specific focus on sustainable development in the design and construction of commercial infrastructure. Preliminary investigation for this project taught us about the BREEAM guideline. This certification standard assesses a broad spectrum of issues concerning sustainability ranging from material use, energy consumption, CO2 emission to employee welfare. In the Netherlands, advice on application and certification of this guideline is propagated by the Dutch Green Building Council ([www.dbgc.nl](http://www.dbgc.nl)).

Certification assessment standards

Other standards such as GPR-Gebouw (a municipal government sponsored tool) and GreenCalc are also widely used. A more in-depth analysis on the use of the different tools and a comparison of their applicability is documented in the master thesis of Neimann (2012) and his research reveals “that clients from real estate development projects have different motives to use a sustainability instrument. Some motives are to formulate their sustainability ambitions and to make them more concrete, because clients often have a limited idea of what sustainability means and instruments help to widen their views. Instruments are also used for non-sustainable goals such as for marketing purposes, to improve corporate image, for international recognition, to give a competitive edge over others and to give an example for others.” Table 1 contains a summary of the available tools as reviewed by Neimann (2012, p. 21).
Table 1. Summary of tools used to assess sustainability of construction projects.

<table>
<thead>
<tr>
<th>Tool</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BREEAM-NL</td>
<td>Short for Building Research Establishment Environmental Assessment Method. This certification tool from Great Britain has been adapted to Dutch requirements, but also has many variants in other countries. To certify one must meet a host of conditions, including process-related components.</td>
</tr>
<tr>
<td>GPR-gebouw</td>
<td>This tool is widely used by the government and values utility buildings, homes and business buildings for sustainability by grading them on several issues. Although it is not a process tool, it is an extensive tool with 5 different themes, energy performance calculations and life-cycle analysis methodologies.</td>
</tr>
<tr>
<td>Greencalc+</td>
<td>This performance tool is based on calculation methods of life cycle analysis (LCA). This tool calculates how durable a building is and expresses it using an environmental index. Themes that are measured are: energy, water, materials and mobility. The instrument provides accurate measurement based on building data and user data.</td>
</tr>
<tr>
<td>Eco Quantum</td>
<td>This computer program calculates the sustainability of buildings using LCA methods. Comprising 4 themes that can be used to capture environmental ambitions for housing programs. Currently it is no longer used much and is being taken out of the market.</td>
</tr>
<tr>
<td>LEED</td>
<td>Developed by the United States Green Building Council and an acronym for Leadership in Energy and Environmental Design. This certification tool can be considered as the American variant of BREEAM. Many elements are based on US construction policies. It consists mainly of checklists leading to a valuation and an associated certificate: Certified, Silver, Gold or Platinum. This tool has been applied to several Dutch projects.</td>
</tr>
<tr>
<td>DPL</td>
<td>Short for Sustainability Profile (Duurzaamheids-Profiel) of Location. This Excel tool focuses on the sustainability of neighbourhoods and aims to highlight the strengths and weaknesses. It consists of 3 main themes (people, planet, profit) and is further divided into 11 sub-themes and 24 sustainability aspects. Sustainability is displayed by means of a numeric score.</td>
</tr>
<tr>
<td>DuboCalc</td>
<td>This instrument, developed by Rijkswaterstaat (Dutch governmental body for waterways and structures), is intended to assess the sustainability of soil, road and hydraulic engineering. This instrument is based on LCA calculations and is used to make choices between design alternatives. This tool expresses its value in MKI (Milieu Kosten Indicator or Environmental Cost Indicator). The management and maintenance of the tool is supported by DGBC and CROW (CROW was originally an acronym for Center for Regulation and Research in Soil, Water and Road Construction and Traffic Engineering and is now used as name for a knowledge platform emerged from that).</td>
</tr>
<tr>
<td>LOG-model</td>
<td>An instrument developed by Bouwfonds REIM because instruments like GPR-Building were not deemed sufficient. It is based on the GPR-Building method and adds several additional factors that are focused on the location. The instrument can be used for both homes and offices.</td>
</tr>
<tr>
<td>Eco-Install</td>
<td>Developed by TNO (Dutch institute for applied scientific research) on behalf of Uneto-VNI and ISSO (both entrepreneurial organizations for the installation industry and the technical retail industry) It is a method of determining environmental performance of building installations. It can be used on various parts of the installation. The instrument is still under development.</td>
</tr>
<tr>
<td>Green Up</td>
<td>This tool developed by BAM Utiliteitsbouw and BAM Techniek makes sustainable features measurable, insightful and achievable. It also provides information regarding the technical feature packages and financial aspects.</td>
</tr>
</tbody>
</table>

Certification tool BREEAM-NL

BREEAM-NL Newly Built and Renovation certificates can be acquired for two phases:
For the design phase: a certificate for design that will expire after completion of the building.
For the delivery phase: the final certificate –without expiry date- for the completed building.
The score is compiled from partial scores on different sustainability categories. These categories each have their own weighting: management (12%), health (15%), energy (19%), transport (8%), water (6%), materials (12,5%), waste (7,5%), land use & ecology.
(10%), pollution (10%). This leads to an aggregate score expressed by stars as shown in figure 3.

<table>
<thead>
<tr>
<th>Score</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pass</td>
<td>≥ 30%</td>
</tr>
<tr>
<td>Good</td>
<td>≥ 45%</td>
</tr>
<tr>
<td>Very Good</td>
<td>≥ 55%</td>
</tr>
<tr>
<td>Excellent</td>
<td>≥ 70%</td>
</tr>
<tr>
<td>Outstanding</td>
<td>≥ 85%</td>
</tr>
</tbody>
</table>

Figure 3: BREEAM scores, source: [https://www.breeam.nl/keurmerken/nieuwbouw-en-renovatie](https://www.breeam.nl/keurmerken/nieuwbouw-en-renovatie)

The figure below gives an overview of the number of certifications to-date per scoring class in the Netherlands. The underlying data is derived from the website of the DBGC using the total number of registered projects as of June 2017. Source [https://www.breeam.nl/projecten/projecten-geregistreerd - filter](https://www.breeam.nl/projecten/projecten-geregistreerd - filter)

![BREEAM certifications in the Netherlands](https://www.breeam.nl/projecten/projecten-geregistreerd - filter)

Figure 4. number of BREEAM certifications to date per scoring class. Source based on data from [https://www.breeam.nl/projecten/projecten-geregistreerd - filter](https://www.breeam.nl/projecten/projecten-geregistreerd - filter)

Review of published scientific articles specifically addressing the application of BREEAM or other certification tools are limited or focusing their research questions in a different direction. The publication by Schweber and Haroglu (2014) is an example where the use of BREEAM in divergently informed settings is discussed and Lu and Zhang (2016) have looked at different existing assessment methods to define a framework of corporate sustainability rating system (CSRS). This indicates there is ground to be covered on the applicability and recognition of individual sustainability competences in construction sector.
Link to research on Competences

Fien and Winfree (2014) argue that successful implementation of reform towards sustainable construction requires continuous development of the workforce’s basic skills and competences but also conclude that these green skills are not mutually exclusive with soft skills such as communication, coordination and collaboration needed for contemporary workplace employability. “Both are necessary and, indeed, complementary and mutually supportive.”

Research by Tabassi et al. (2016) looks into field of sustainable construction from the angle of leadership competences. Their study shows that leadership competences, as well as the transformational leadership qualities experience a direct impact on success criteria for sustainable buildings. Listing of their leadership competences, with definitions derived from attributes extracted by Dulewicz and Higgs (2005) and shown below in order of most to least significant show us that there is a highly recognizable overlap with the 6 individual sustainability competences as defined by Lans et al. (2014) and Ploum et al. (2017).

Table 2: Leadership competences in order of significance by Tabassi et al. (2016)

<table>
<thead>
<tr>
<th>Strategic Perspective</th>
<th>Critical Analysis</th>
<th>Engaging Communication</th>
<th>Achieving</th>
<th>Developing</th>
<th>Resource management</th>
<th>Vision and imagination</th>
<th>Empowering</th>
</tr>
</thead>
</table>

Expanding on the above is the view of O’Rafferty, Curtis, and O’Connor (2014) on the ‘need for design education to situate itself away from the traditional art or engineering setting to facilitate greater interdisciplinary learning’. They propose a conceptual framework of key competences with the intention to initiate a dialogue between design education and education for SD thereby allowing for multidisciplinary relationships. The competences included in their framework show sufficient overlap with the competences as defined for SD although worded differently.
2.4 Conceptual model and propositions

Conceptual Model
The review of theoretical background brings us to the following general conceptual model.

![Conceptual Model Diagram]

Based on the results of reviewing existing literature as summarized in this chapter and re-orienting on our hypotheses we can formulate the following main proposition.

- Embracing individual competences for sustainable development positively supports eco-oriented design and build in corporate infrastructural initiatives.

This main proposition can be broken down into the following three underlying propositions:

- Individual sustainability competences are readily recognized and applied by project managers, line managers and other SCM staff in their effort to comply with sustainable guidelines during infrastructural projects.

- Specific individual sustainability competences are linked to critical incidents in sustainable SCM infrastructure projects.

- Application of individual sustainability competences promote integration of sustainability in SCM infrastructure projects.
3. Methodology

Research will be carried out by conducting semi-structured interviews with project managers, line managers and other key personnel actively involved in managing sustainable construction projects. A selection of respondents will be made based on infrastructure projects submitted into sustainability assessment by the BREEAM certification agency, the Dutch Green Building Council in the Netherlands. Specific focus will be on projects executed by SME’s in Noord-Brabant.

The choice to use a qualitative method is partly based on points made concerning the reliability and validity of research done on acquisition and application of competences. Frequently literature on this subject is based on quantitative research methods including self-rated questionnaires. Braun, Woodley, Richardson, and Leidner (2012) have contrasted several self-rated competence questionnaires based on principles of good questionnaire design derived from literature research and they document several useful criteria to evaluate the questionnaires. These criteria include:

- social desirability: related to demographic information and the need for anonymity
- wording of questions: which means avoiding vague terms, retrospective estimation and double-barreled questions.
- response alternatives: preferably using agreement scales, numbering response alternatives and using only positive numbers
- and psychometric properties: concerning reliability and content/theory-based and criterion- or construct-based validity.

These arguments lead to considering the advantages of qualitative methods versus quantitative methods where data collection from individuals is applied.

3.1 Developing interview protocol

An interview protocol will be developed to aid data gathering through interviews within the selected companies. The aim of the protocol is to identify recognition and application of ISC’s in infrastructure project management. This protocol is modeled on the methodology applied by Dekoninck et al. (2016) and combined with the Critical Incident Technique. This technique, CIT, is originally described by Flanagan (1954, p. 1) as an interview technique outlining ‘procedures for collecting observed incidents having special significance and meeting systematically defined criteria’ and has been widely applied and researched over the past five decades. Sharoff (2008, p. 301) adequately summarizes its benefits as a ‘qualitative, systematic, open-ended technique for reducing descriptive data from participants as well as being an effective naturalistic tool for focusing participants on a specific event’. In a review by Butterfield, Borgen, Amundson, and Maglio (2005) on origin, description and evolution of CIT the flexibility of the method is positively referred to but concern on
maintaining accuracy while summarizing and describing data is also expressed. Bott and Tourish (2016) have recently reappraised CIT using a case study to explore various leadership behaviours. They suggest that classification of incidents based on frequency of occurrence and salience to organizational actors are ways to enhance validity and usefulness of the CIT. In the field of Supply Chain Management this technique has recently been applied in research concerning global procurement strategy by Gelderman, Semeijn, and Plugge (2016). They find that key arguments in choosing for CIT is the way it solicits unprompted information found important to the respondents themselves and the fact that it can be successfully adapted to different research demands.

Interviews will be starting with general open questions concerning context, thus characterizing company, respondent(s) and identifying main drivers. Also, defining whether the respondent is linked to/ or working for either the investor/owner or occupant/leaseholder of the project, as this affects short-term and long-term goal setting. Research by Wessels (2014) on segmentation has shown that end users and their potential in terms of improving the sustainability performance of the built environment can be instructive and add relevance to this information. It is shown that segmentation along three axes: (1) willing to invest (or not); (2) investment goal is cost saving vs. strategic value; (3) active or passive in looking for information, leads to four out of 8 possible segments - all including a participant to be willing to invest- that are promising target groups.

An important following question would be: when was chosen to build according to or comply with BREEAM guidelines? Was that decision/idea made upfront or did it come into focus during or even after the realization of the project? Timing of this decision is relevant as has been shown by research by de Nie (2011) who states that not formulating a clear ambition for sustainability in the early stages of the building process is a missed opportunity as the influence of these decisions on the project outcome will strongly decrease when deferred until later in the process. This is also in line with the need for distinction being made between a deliberate strategy and an emergent strategy. In their study into drivers for global sourcing Gelderman et al. (2016, p. 215) question the ‘deliberate nature of decision-making concerning global sourcing strategies’ by ‘SME’s who’s attitude is generally reactive and need-driven’.

In the next stage of the interview the Critical Incident Technique (CIT) will be applied to gain insight in thought processes occurring in this line of questioning. This method would infer more ‘open’ questions with corresponding data-rich answers and is more suitable to the qualitative research we aim to undertake. It would also consider the criticism self-rating questionnaires incur.
The following question modelled after Curtis et al. (2015) is deemed suitable for repeated use with insertion of various competences: ‘Can you give an example of a situation where strategic insight (e.g. systems thinking/normative beliefs/foresighted thinking/interdisciplinary communication) was determinative for the next step in the project’ (Dutch translation: ‘Kun je een voorbeeld geven van een situatie waarin strategisch inzicht bepalend is geweest voor de voortgang van het project?’) The overarching theme of the interview protocol concerns the question “what individual sustainability competences are recognizably used to address critical incidents occurring during this building project?”

A general build-up of the Questionnaire is as follows:

**Starting with general questions characterizing respondent and case company:**
- What is your role with the project?
- Are you working with investor or with occupant?
- Number of years’ experience?
- Familiarity with competences in general?
- Were Competences part of your education?
- Are Competences used in your current work?
- At what moment was decided that the infrastructure project concerned would be a sustainable development?
- Was that decision/idea made upfront or did it come into focus during or even after the realization of the project?

**Recurring questions in different variations:**
- Do you recall any critical incidents occurred during the project?
- Can you recall certain significant events which were determinative for the progress of the project?
- Can you give an example of a specific situation where strategic insight (e.g. systems thinking/normative beliefs/foresighted thinking/interdisciplinary communication) was determinative for the next step in the project?

Different wording for ‘critical incidents’ as illustrated in the questions above is used in accordance with findings by Bott and Tourish (2016) who argue that critical incidents could have both positive or negative effects and by using different wording we will avoid influencing the respondent in their recall of events.

**3.2 Consolidation and analysis of the results**

A variety of complementary techniques is employed to analyze the results from each of the interview blocks. Qualitative analysis using validated labels is used to contextualize the results and provide for the respondents’ description. All the while paying special attention to summarizing and describing the data in a useful manner, while at the same time ‘sacrificing
as little as possible of their comprehensiveness, specificity and validity’ as Butterfield et al. (2005) quoted Flanagan (1954) on the steps of processing and classifying data from derived with the Critical Incident Technique.

An overview of competences is listed in Appendix A, where different definitions of competences as formulated by Tabassi et al. (2016), O’Rafferty et al. (2014), Martens et al. (2010) and WEF (2016) are set off against the six-competence model by Ploum et al. (2017). Labels used for coding are derived from Wesselink et al. (2015) and Martens et al. (2010) and listed in table 3. These two overviews are used to categorise responses using the more detailed behavioural description of the labels to match responses to the overarching competencies.

The benefit of using validated labels –and their match to according competences- from different studies in processing the interview data is that it enhances the reliability of the categorization if overlapping labels can be applied and used to strengthen the recognition of the match to a competency. A factor influencing validity is the frequency of occurrence of specific critical incidents. As suggested by Bott and Tourish (2016) capturing such recurring incidents as typical-, prototypical-, archetypical- or even rare events can enhance validity of the categorization.

Table 3. Individual Sustainability Competences and accompanying labels

<table>
<thead>
<tr>
<th>ISC’s from Lans et al and Ploum et al.</th>
<th>Labels from Wesselink et al. 2015</th>
<th>Labels from Martens, Roorda en Corvers (2010)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategic management competence &amp; and Action competence:</td>
<td>1. Proactive in decision making</td>
<td>Make a stakeholder analysis</td>
</tr>
<tr>
<td></td>
<td>2. Taking responsibility</td>
<td>Take personal responsibility</td>
</tr>
<tr>
<td></td>
<td>3. Perseverance of goals</td>
<td>Render personal account to society</td>
</tr>
<tr>
<td></td>
<td>4. Decision initiative</td>
<td>Critically evaluate own actions</td>
</tr>
<tr>
<td></td>
<td>5. Active involvement</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Evaluation of policies</td>
<td>Weigh un-weighable aspects and make choice</td>
</tr>
<tr>
<td></td>
<td>2. Controlling</td>
<td>Act when time is ripe</td>
</tr>
<tr>
<td></td>
<td>3. Collectively design interventions</td>
<td>Not against the flow: “do without doing”</td>
</tr>
<tr>
<td></td>
<td>4. Leading</td>
<td>Deal with uncertainties</td>
</tr>
<tr>
<td></td>
<td>5. Planning skills</td>
<td>Take decisions</td>
</tr>
<tr>
<td></td>
<td>6. Taking action</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7. Inspiring</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8. Organize</td>
<td></td>
</tr>
<tr>
<td></td>
<td>9. Implementing strategies</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10. Measuring performance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>11. Collectively implementing interventions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>12. Evaluation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>13. Arranging tasks</td>
<td></td>
</tr>
<tr>
<td></td>
<td>14. Motivating</td>
<td></td>
</tr>
<tr>
<td></td>
<td>15. Arranging resources</td>
<td></td>
</tr>
<tr>
<td></td>
<td>16. Arranging people</td>
<td></td>
</tr>
<tr>
<td></td>
<td>17. Designing transitions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>18. Evaluation of programs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>19. Evaluation of action plans</td>
<td></td>
</tr>
</tbody>
</table>
Embracing diversity and interdisciplinary competence:

| 1. Structure relations | Respect and recognize values & action perspectives of him/herself and or other peoples and cultures |
| 2. Facilitating dialogue |

The ability to structure relationships, spot issues, and recognize the legitimacy of other viewpoints in business decision making processes; be it about environmental, social, and/or economic issues.

| 3. Stimulating exchange of ideas |
| 4. Proactivity in information exchange |
| 5. Openness to other viewpoints |
| 6. Recognition of legitimacy of different viewpoints |
| 7. Involving stakeholders |

Systems thinking competence:

| 1. Analysing sub systems | Cooperate in an inter-and transdisciplinary way |
| 2. Analysing systems |
| 3. Cascading effects |

The ability to identify and analyse all relevant (sub) systems across different domains (people, planet, profit) and disciplines, including their boundaries.

| 4. Causing effect relations |
| 5. Reflecting on elements of interdependency |
| 6. Identifying sub-systems |
| 7. Identifying scale |
| 8. Understanding aspects of interdependency |
| 9. Identifying systems |
| 10. Feedback loops |

Normative competence:

| 1. Ethics | Consistently involve SD in own work as professional |
| 2. Equity |

The ability to map, apply, and reconcile sustainability values, principles, and targets with internal and external stakeholders, without embracing any given norm but based on the good character of the one who is involved in sustainability issues.

| 3. Inter and intra generational equity |
| 4. Principles |
| 5. Accountable for decision-making |
| 6. Values |
| 7. Sustainability values |
| 8. Justice |
| 9. Socio-ecological integrity |

Foresighted thinking –or anticipatory- competence:

| 1. Crafting pictures of the future | Recognize and understand non-linear processes |
| 2. Assessing effects on intergenerational equity |
| 3. Balancing locally global |
| 4. Opportunities recognition |
| 5. Balancing long-term vs short-term |
| 6. Innovation |
| 7. Collectively evaluating pictures of the future |
| 8. Asssessing unintended harmful consequences |
| 9. Collectively analysing pictures of the future |
| 10. Creativity |

Interpersonal competence:

| 1. Enabling collaboration |
| 2. Communicating |
| 3. Facilitating collaboration |
| 4. Empathy |

The ability to motivate, enable, and facilitate collaborative and participatory sustainability activities and research.

| 5. Ability to motivate collaboration |
| 6. Collaborating |
| 7. Compassion |
| 8. Negotiating |
3.3 Selection of case companies

Selection of the case companies is based on the registration of BREEAM certified projects with the Dutch Green Building Council. (https://www.breeam.nl/projecten/projecten-gecertificeerd#filter). From the total of 822 projects listed on their website as of May 2017 a sub-selection on achieved certification scores was used, filtering out only cases with 4- or 5-star certification results. Subsequently a selection was made based on the geographic location of the projects in the province of Noord-Brabant and the building function being either Industrial or Office. This brought down the number of applicable projects to 19. Next a filter on whether certification was acquired for both the design- and the building-phase gave us a list of 7 companies. Of these seven companies three are distribution-centers and one is a bank office, all being part of a larger –multinational- company.

The remaining companies are in the small- to medium-size enterprise range (SME’s) and are all privately-owned which makes the design- and building process they encounter -and the management methods they apply- more comparable. Also, the higher probability that willing and suitable respondents could be determined and contacted made these cases more suitable for this study. Those considerations brought us to a shortlist of the following companies: Vencomatic Group BV in Eersel, Holmatro BV in Raamsdonksveer, Datacon BV, NweFAXX building in Tilburg.

Additionally, interviews were conducted with three colleagues from Orangeworks BV in Mill, also a privately-owned SME, currently in the design phase of a new corporate construction project.

3.4 Selection of respondents

To triangulate data preference was expressed to select two to three respondents per project, each having their own take on the process of designing and building a BREEAM certified construction project. This was achieved by extending the circle of possible respondents representing the case companies with the external professionals they enlisted for these projects. Per project the details of the architect, contractor, building expert and assessor are registered with the DGBC and a selection was made based on availability and willingness of the intended respondents to cooperate with the interviews.

Each respondent was then approached by phone to outline the purpose of the interview and ask for their collaboration. This resulted in six appointments for in-person interviews and five appointments for phone interviews. In this first enlistment call a brief explanation on competences and their relation to sustainability was also included. A more detailed briefing on Individual Sustainability Competences was made available upon request in the form of a printed or emailed overview with the description of the competences as outlined in column 1 of table 3.
4. Results

In this section, we first present the case companies, their respondents and a short description of the construction project they undertook. Subsequently the respondents’ input on competences is coupled with critical incidents distilled from their description of the chronological project timeline. Both open and axial coding is performed and quotes from the interviews are labelled according to the related competence using the labels derived from (Wesselink et al., 2015) and Martens et al. (2010) as listed in Table 3.

4.1 The case companies and their respondents

In this paragraph, we describe the four different case companies by outlining their business type, overviewing the construction project and introducing the respondents.

Vencomatic Group BV

Vencomatic, established in 1983, is a supplier of breeder-, housing- and egg-handling equipment for the poultry sector. They offer a range of innovative systems for equipping modern poultry farms worldwide. Vencomatic has over 350 employees working in sales, design, production, distribution and installation of equipment. In 2009, the decision to build a new headquarters was made when the growth of the company and the scattering of different disciplines over five different locations began to take its toll on internal communications and other aspects. The company was already based on the industrial area Meerheide in Eersel with four of its five entities and the preference for a new to-be-developed plot in that same area was expressed by Vencomatics’ management, DGA (Director/Shareholder) Mr. Cor van de Ven and his spouse Mrs. Han van de Ven as investors for the Vencocampus construction project. Design started in 2009 and was certified with a four star Excellent BREEAM rating and 71.8% score in January 2013. The building was commissioned in September 2012 and received a five-star Outstanding certification with an 85.3% score in August 2013.

Data gathering on this case started with an in-person interview with Ad van de Ven (AvdV). Mr. van de Ven is a self-employed architect and consultant on sustainability. He was hired by Mr. Cor van de Ven to be involved in the Vencocampus project as sustainability expert. A second in-person interview was scheduled with Mr. Koen Boot (KB), currently COO (Chief Operations Officer) of Vencomatic Group BV. Mr. Boot is employed by Vencomatic since 1996 and as member of the project-team he was responsible for ICT matters as he was CIO (Chief Information Officer) at the time of project. Additionally, the BREEAM Assessor for this project, Mr. Paul Zonneveld (PZ) was questioned on his insights in a phone-interview. Mr. Zonneveld is a self-employed consultant and coach on sustainability and was involved as independent counsel to assess BREEAM certification efforts.
Holmatro BV

For nearly half a century, Holmatro has been developing, producing and testing high-pressure hydraulic equipment for rescue, industrial and tactical applications. Based on the needs of users, products are known for their high quality and innovative technology. Holmatro sells and services these products through offices in various countries (Netherlands, USA, China, UK, Poland) and an extensive dealer network. Holmatro employs around 200 persons and is eager to expand its building to facilitate conference and meeting activities. A new staff restaurant and meeting area are to be integrated in the development. In February 2015, the design of the extension of the current headquarter facilities on industrial area Dombosch in Raamsdonksveer was BREEAM certified with a four-star Excellent rating and a 73,3% score and construction was started. In November 2015, the new wing was opened and in July 2016 a BREEAM four-star Excellent rating with 74,2% score was awarded for the commissioned building.

As respondents for the Holmatro case Mr. Ydo Schuuring (YS) and Mr. Jeroen van Haarlem (JvH) were first approached. Mr Ydo Schuuring is Senior Specialist Building Physics and Sustainability with DGMR, an engineering and consultancy agency specialized in providing socially relevant and high-quality services and products for improving living and working environments. Mr. Schuuring was involved in the Holmatro construction project as sustainability and building expert. Mr. Jeroen van Haarlem is building coordinator and facility services manager for Holmatro BV. As such he is responsible for all construction and renovation activities concerning Holmatro real estate. Although his employment with Holmatro is relatively recent he was involved in the building and certification phase of the extension project. His recommendation to also interview the architect for the Holmatro project, Mr. Toine van Baalen, was taken to heart and subsequently acted upon.

Datacon BV/FAXX gebouw

Datacon Information Technology and Services is the number one integration specialist of the Benelux offering light weight integration, API enablement and connected portal solutions. Employing over 60 personnel and being primary tenant of the FAXX building since its establishment in 1996 the managementteam of Datacon was planning to revitalize its working environment by building a new sustainable office building to replace the current outdated construction. This development, the NweFAXX building, was consistent with the local municipal strategy to develop the Veemarktkwartier area where they are located into a more encompassing cluster of creative business activity. The design of the NweFAXX building was certified in October 2014 with a BREEAM four-star Excellent rating and a 76,9% score and the new building was commissioned in October 2015. The commissioning was consequently awarded a BREEAM four-star Excellent rating with a 77,6% score in December 2015.

The first interviewee for this case was Mr. Meindert van Duijvenbode (MvD), CEO (Chief Executive Officer) of Datacon and user and co-owner of the NweFAXX building. Secondly
Mr. Paul Zonneveld (PZ) was interviewed. Mr Zonneveld is a self-employed consultant and coach on sustainability and was involved with the NweFAXX development as sustainability assessor for the BREEAM certification.

Orangeworks BV
Established in 1970 and steadily growing to an organisation with over 100 employees in 2017, Orangeworks BV develops and builds production lines for the food processing industry. They invent, design and build custom processing installations, for both Dutch and international clients. In addressing the call for a new integrated production- and office-building to meet the needs of a growing company spread over three locations a start was made in 2016 with a sketch design. Plans are to finalize design in 2017 and commission the new building beginning of 2019.

In relation to insights acquired during the design phase at Orangeworks three respondents were approached and interviewed. Both Mr. Herbert Aalbers (HA), COO of Orangeworks and Mr. Barry van Bakel (BvB), manager engineering at Orangeworks are part of the project-team and they are mainly concerned with the user-aspects of the premises. Thirdly, Mr. Jan de Wringer, (JW) Director/Shareholder of Orangeworks is enlisted as respondent as his insights come both from an investor viewpoint and from a user/tenant viewpoint.

Further details of the respondents and their function are listed in table 4 below.

Table 4: Participating companies and respondents

<table>
<thead>
<tr>
<th>Company and sector</th>
<th>Size and location</th>
<th>BREEAM score</th>
<th>Respondents; work-experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vencomatic Equipment poultry</td>
<td>350, Eersel</td>
<td>4 &amp; 5</td>
<td>Ad van de Ven, Architect (self-employed), &gt;20 years</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Koen Boot, COO Vencomatic Groep BV, &lt;10 years</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Paul Zonneveld, BREEAM Assessor, &gt;20 years</td>
</tr>
<tr>
<td>Holmatro Hydraulic equipment</td>
<td>200, Raams donksveer</td>
<td>4 &amp; 4</td>
<td>Jeroen van Haarlem, Facility manager Holmatro, &lt; 20 years</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ydo Schuuring, Building expert DGMR, &lt;10 years</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Toine van Baalen, Architect, &lt;20 years</td>
</tr>
<tr>
<td>NweFAXX / Datacon Data integration</td>
<td>60, Tilburg</td>
<td>4 &amp; 4</td>
<td>Meindert van Duijvenbode, CEO Datacon, &gt;20 years</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Paul Zonneveld, BREEAM Assessor, &gt;20 years</td>
</tr>
<tr>
<td>Orangeworks Process technology</td>
<td>100, Mill</td>
<td>n.a.</td>
<td>Herbert Aalbers, COO Orangeworks, &gt; 20 years</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Barry van Bakel, manager Engineering Orangeworks, &lt; 20 years</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Jan de Wringer, DGA Orangeworks, &gt; 20 years</td>
</tr>
</tbody>
</table>
4.2 Critical Incidents and the application of Individual Sustainability Competences

In Appendix B the answers of respondents are consolidated in two pages per case company. Interviews are an organic process where answers and questions not always stay aligned, when called upon a specific memory of an incident, respondents will frequently bring up other (un)related thoughts. To accommodate contextual registration of all items a matrix form was chosen where thoughts, memories and quotes connected to specific incidents were documented per connected ISC.

In Appendix B the interview data is documented in a table format where phases are outlined in rows with detailing incidents in sub-rows and ICS’s are outlined in columns.

Open and axial coding performed while processing the interviews led to three broadly defined phases or categories in which critical incidents from the different cases could be grouped. This grouping is used to aggregate insights from these incidents and connect them to the respective competences. An overview of all critical incidents per case company is listed in the table 5 below and added is the phase and the recognized labels as documented by Wesselink et al. (2015) and Martens et al. (2010) in table 3.

Table 5: Critical Incidents per case company

<table>
<thead>
<tr>
<th>Case Company</th>
<th>Critical Incident</th>
<th>Resp.</th>
<th>Phase</th>
<th>Labels applied</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>Recurring use of long-term vision</td>
<td>PZ, AvdV</td>
<td>1. Initial inspiration</td>
<td>long-term vision, opportunities recognition, creativity</td>
</tr>
<tr>
<td>FAXX datacon</td>
<td>Role of entrepreneurs in initial stage</td>
<td>PZ</td>
<td>1. Initial inspiration</td>
<td>risk, opportunistic, anticipatory, pro-active</td>
</tr>
<tr>
<td>FAXX-Datacon</td>
<td>Finding investors in un-agreeable investment climate</td>
<td>MvD</td>
<td>1. Initial inspiration</td>
<td>long-term vision, opportunities recognition, creativity</td>
</tr>
<tr>
<td>FAXX-Datacon</td>
<td>Consultation effort on heat/cold storage</td>
<td>MvD</td>
<td>2. Out of the box thinking</td>
<td>stimulate exchange of ideas, proactivity to information exchange</td>
</tr>
<tr>
<td>FAXX-Datacon</td>
<td>Perseverance in attaining SD goals</td>
<td>PZ</td>
<td>2. Out of the box thinking</td>
<td>perseverance, taking responsibility, proactive</td>
</tr>
<tr>
<td>FAXX-Datacon</td>
<td>Addition of ‘green’ public meeting-spaces</td>
<td>MvD</td>
<td>3. engaging stakeholders</td>
<td>identifying sub-systems, understanding interdependency, scale effects,</td>
</tr>
<tr>
<td>Holmatro</td>
<td>Winning CSR design by architect</td>
<td>TvB</td>
<td>1. Initial inspiration</td>
<td>communicating, motivational</td>
</tr>
<tr>
<td>Holmatro</td>
<td>Starting with interdisciplinary teams a must</td>
<td>YS</td>
<td>2. Out of the box thinking</td>
<td>stimulate exchange of ideas, proactivity to information exchange</td>
</tr>
<tr>
<td>Holmatro</td>
<td>Ecological integration more thought through,</td>
<td>JvH</td>
<td>3. engaging stakeholders</td>
<td>identifying sub-systems, understanding interdependency, scale effects,</td>
</tr>
<tr>
<td>Holmatro</td>
<td>Better buildings positive influence</td>
<td>YS</td>
<td>3. engaging stakeholders</td>
<td>understanding interdependency, scale effects, cause &amp; effect relations</td>
</tr>
<tr>
<td>Orangeworks</td>
<td>Inspiring first presentation by architect</td>
<td>BB</td>
<td>1. Initial inspiration</td>
<td>communicating, motivational, empathy</td>
</tr>
<tr>
<td>Orangeworks</td>
<td>Reference visit to Vencocampus</td>
<td>JW</td>
<td>1. Initial inspiration</td>
<td>communicating, motivational, collaborative</td>
</tr>
</tbody>
</table>
### Vencomatic

- **Role of entrepreneurs in initial stage**
  - AvdV, PZ
  - 1. Initial inspiration
  - Risk, opportunistic, anticipatory, proactive

- **Book on Smart Building by Jos Lichtenberg**
  - AvdV
  - 1. Initial inspiration
  - Communicating, motivational, collaborative

- **Design open plan office spaces**
  - KB
  - 2. Out of the box thinking
  - Stimulate exchange of ideas, proactivity to information exchange

- **Building under own management**
  - AvdV
  - 2. Out of the box thinking
  - Structure relations, involving stakeholders

- **Internal (un)loading dock**
  - KB
  - 2. Out of the box thinking
  - Stimulate exchange of ideas, proactivity to information exchange

- **Four-block approach/direct costing**
  - AvdV
  - 2. Out of the box thinking
  - Identifying sub-systems, understanding interdependency, scale effects,

- **Perseverance in attaining SD goals**
  - PZ
  - 2. Out of the box thinking
  - Perseverance, taking responsibility, proactive

- **Fish pond integration, Information evenings surrounding residents, Odour nuisance neighbour farm**
  - KB
  - 3. Engaging stakeholders
  - Understanding interdependency, scale effects, cause & effect relations, involving stakeholders

- **Building site excursions for employees**
  - AvdV
  - 3. Engaging stakeholders
  - Communicating, motivational, empathy

### Phase 1. Initial inspiration for sustainability in building

One of the first subjects in the interviews –after contextual data was taken care of- was a short chronological narrative of how the building project had come about and why the choice for sustainable building was made. Most interviewees clearly recalled the inspiration responsible for making the initial choice for adhering to sustainable standards as a critical incident in this phase. In the Orangeworks case for example a reference visit made by the Orangeworks project-team (JW, HA and architect) to the Vencocampus and a very motivational talk at that point with Vencomatic’s Director/Shareholder Mr. van de Ven about sustainable building and the methods applied, profoundly shaped the Orangeworks project-team member’s intentions to start on the path to sustainable building. Here the motivational aspect of facilitating collaboration played an important role in conveying the inescapability of this choice. In that same aspect of interpersonal competence, Orangeworks’ architect also added to the enthusiasm for SD by creating an inspiring picture of what the new building could mean for the organisation more than just a structure

“A new building is not a goal in itself, it is the process of creating a shell around who we are” (Quote BvB).
In the Vencomatic case an inspirational source was the “Smart Building” theory developed by TU Professor Jos Lichtenberg. Architect Ad van de Ven remembers lending out his copy of Lichtenberg’s book on Smart Building to Vencomatic’s DS Cor van de Ven and getting it back tattered and dog-eared, full of comments in the sidelines. For Holmatro the choice for sustainability was brought upon them by means of a design competition. After reviewing three contesting offers for the design of their new wing, the sustainability aspects included in the winning proposal inspired Holmatro’s management to steer towards sustainable building. The architect concerned recalls that

“by choosing this design Holmatro’s management felt like taking an important step forward toward fulfilling their Corporate Social Responsibility goals”.

Another competence clearly coming into focus in this phase is the foresighted thinking—or anticipatory competence. For Datacon’s management the main challenge was to find investors for a new office real-estate development in a very saturated office real-estate market. Their recognition of the opportunity that an energy-neutral building, including ergonomic aspects, would allow them to maintain competitiveness on both the office rental market and the recruitment market helped to assure that operating revenue and residual value were more interesting for investing financial institutions in comparison to other –less sustainable- developments. As Datacon’s CEO states

“the real-estate market had ground to a halt and getting a conventional building financed was close to impossible”

This same foresighted consideration played a recurring role in the other three cases where in each case interviewees stated that long-term vision played an important part in off-setting higher initial investment costs against lower exploitation expenditure. In this respect, also Corporate Social Responsibility (in Dutch MVO, or Maatschappelijk Verantwoord Ondernemen) was mentioned several times as a consideration in the initial phase. Holmatro Consultant Ydo Schuuring mentions

“Corporate Social Responsibility objectives were set beforehand and a complementary design was sought”

Long-term vision is a trait often recognized in building projects with privately-owned companies and often also coupled with a short chain of command and a management team that is pro-active in decision making and action-taking. Recognition of this aspect of the strategic management competence is repeatedly noted in the interviews, specifically by the consultants and experts looking at the process from the outside and comparing methods with those applied by their larger corporate/multinational clients. As Vencomatic’s architect quotes and The BREEAM assessor adds

31
“Entrepreneurs are more opportunistic and risk-taking, thinking highly anticipatory”

“the personal commitment of the owner/manager is an important driver in the choice for sustainable building”

One of the project team members for Vencocampus links the long-term vision professed by his superior in his belief that the longer payback period an investment in a BREEAM certificate entails is essential to the cause, also as symbolic for the strategic competence playing a part.

Phase 2. Out-of-the-box thinking

The building phase highlights a notably similar approach among the cases. Grouping comments from this phase showed that in several cases critical incidents were recognized that centred on how to stick to sustainability goals defined in the design phase. The need to ensure that those sustainability ambitions were adhered to even necessitated the choice for building under own management and keep comprehensive control of the project. This approach is most fully implemented by Vencomatic where the actual building process was not tendered in the construction market as a complete project -and awarded to the best-bidding contractor- but instead outsourced to a large diversity of suppliers where each supplier was chosen for being the specialist in their specific line of work. This led to a list of 44 construction partners associated with the Vencocampus project. The management of this project and all its logistics was the responsibility of a building manager operating in service of the client as opposed to the contractor’s office handling all the underlying choices and tasks. This way of working, with different suppliers cooperating, relies on embracing diversity and interdisciplinarity by the project team and assures more transparency and control for the client. As a result, as is recognized in several interviews, working with multidisciplinary teams under own management is an important tool to be able to hold on to choices made in line with sustainability ambitions. Vencocampus’ project team member Mr. Koen Boot relates that for example

“in designing the office spaces, we had the technical installations supplier repeatedly calculate various plans using different models and this way forced them to think out-of-the-box on the necessary technology for climate control”.

Building under own management is a clear application of a multidisciplinary approach according to this respondent. Another example of out-of-the-box thinking and applying interdisciplinary competence Mr. Boot mentioned was the interaction with the municipal government on Vencomatic’s proposal for loading and unloading from cargo trucks inside the premises and the consequences that would have for the emission standards and air quality. They succeeded in convincing the supervisory officers by offering to set up an
electronic air-quality measurement system and sharing the day-to-day results with the municipality.

With regard to the Holmatro case Mr. Ydo Schuuring stressed the importance of interdisciplinarity and quoted “involving all different disciplines from the start of the design phase” and “obtaining a clear and integral overview of all disciplines involved from the start”. In response to the FAXX case Mr. Meindert van Duijvenbode had to add that “broadly consulted experts from different disciplines on heat/cold storage and heat pumps brought essential information to the table necessary to design a stable solution for the sustainable climate control system we wanted”.

All the interviewees agree that perseverance and tenacity play an important role in successfully completing these interdisciplinary negotiations and partnerships. Mr. Paul Zonneveld also observed that

“working in these interdisciplinary teams leads to building-contractors and -suppliers becoming increasingly involved and interested in sustainability, picking up on more improvements and ways to profit”

Working with interdisciplinary teams also helps to foster systems thinking with the individual team members. As Ad van de Ven, architect for the Vencocampus case, teaches that

“applying an integral approach where the building is explicated in four blocks –casco, shell, installations and finish- and base your design- and build-process on this structure of systems”.

This interdisciplinary way of looking at a building project as four separate systems, each with its own lifespan, different specialist suppliers and a divergent timeline will add enormous flexibility. “Add working with direct costing to that and it will bring more transparency on costs, will help you keep control of cost and reduce cost of failure” (Quote AvdV).

**Phase 3. Engaging stakeholders**

A third category is compiled by critical incidents related to engaging internal and external stakeholders. Apart from suppliers and contractors participating in the building project itself, the project teams had to deal with issues brought up by employees, clients, local government and surrounding residents. These incidents concerned ecological and ergonomical aspects and the way they were resolved points to application of systems thinking competence as an important factor in creating stakeholders’ commitment for the newly build premises.
In the Vencocampus case information evenings for the residents of nearby village Duizel were organized to keep them informed on the impact of the project, this because their positive commitment was instrumental in obtaining municipal permittances. An extraordinary collaboration between Vencomatic and the local fishing club was undertaken by integrating the Vencocampus construction in the direct surrounding of the existing fish pond exploited by the local fishing club. This way ecological integration of the building was achieved and in exchange for the fishing club's cooperation a matching clubhouse was added to the campus and technical facilities were provided to retain and re-use rainwater for repletion of the pond. Nuisance odour to prospective employees from a nearby farm was discussed and solved agreeably by supporting the farmer in moving his stables. A critical incident noted in the Vencocampus case was the discussion on the layout of the office space and the ergonomical advantages of choosing for open-plan offices in combination with meeting rooms and concentration-pods. While open-plan offices seemingly bring flexibility and reduction of office-space this choice ultimately led to creating more nett workspaces than personnel employed and thus incurred more surface use and costs.

Holmatro facility manager Jeroen van Haarlem noted that

“the ecological integration of the new wing is lot more thought through than people assume”

and an important factor in recruitment on a competing labour market of technical personnel. Consultant Ydo Schuurung adds

“that the importance of a flora and fauna investigation in advance must not be underestimated”.

These preliminary investigations in existing local plant and animal-life give ideas and suggestions for ecological integration. Holmatro added nesting cages for bats in their façade and included patio gardens containing wild flowers. This leads to

“better buildings with a positive influence on productivity and absenteeism” (quote YS).

At the NweFAXX building the addition of public work- and meeting-spaces inside and outside on rooftop and ground terraces are an example of facilitating employees, visitors and surrounding businesses. Ecological integration is a part of that ergonomic setting by adding water-efficient vegetation, bat cages, bird nesting cages and a beehive. For Meindert van Duijvenbode sustainability
“is primarily dealing with how the building is used and how it facilitates a pleasant work-environment”, and secondary is “the positive appearance it will have on potential employees and customers”.

In the design phase at Orangeworks the issue of how to achieve more cohesion between workshop and office is seen as a critical incident. Both COO and manager Engineering reflect on the extensive discussion on how to improve communication between respective departments in the new environment. As Barry van Bakel remembers

“it was not until we discussed the layout of the new office space that I realised that we currently do not facilitate regular cross-departmental meetings. “

Solutions are suggested varying from routing employees entering and exiting their office-workspace and crossing the workshop-floor, placement of canteen- and changing facilities and creating ‘scrum’ spaces in open-plan offices. Orangeworks’ respondents all distinctly recognize application of systems thinking in the collaboration on this issue.

Other critical incidents relating to engaging stakeholders point to the application of interpersonal competence. Vencomatic for example has organised several excursions to the building location for their personnel. These visits and the fact that the construction site was open for public access are an effort to motivate and facilitate collaborative and participatory sustainability activities for employees and external stakeholders.

Another example of a critical incident in that respect was mentioned by Jan de Wringer and concerned his disappointment at the lukewarm receipt of the announcement of the new business location and the resulting action. The announcement did not generate either the positive or critical response he had expected. This lack of commitment led him to propose a companywide team-building effort. As he stated

“we must now take the time and opportunity pending the commissioning of the new premises to start working on improving the team spirit”

The application of interpersonal competence in relation to this incident is seen in the fact that responsibility for the implementation of that team-building project was given to the employee’s council (Ondernemingsraad or OR) so that they could communicate that as a point scored in the negotiations with management. This strengthened the council’s position towards the employees they represent while at the same time consolidating the cooperation with the management-team.
In table 6 the critical incidents are grouped by the phase they belong to and the Individual Sustainability Competences connected with the recognized labels is included.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Critical Incident</th>
<th>Company</th>
<th>Linked to ISC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial inspiration</td>
<td>Role of entrepreneurs in initial stage</td>
<td>FAXX datacon</td>
<td>1. Strategic Management and Action Competence</td>
</tr>
<tr>
<td></td>
<td>Role of entrepreneurs in initial stage</td>
<td>Vencomatic</td>
<td>1. Strategic Management and Action Competence</td>
</tr>
<tr>
<td></td>
<td>Recurring use of longterm vision, Concrete CIT’s beschrijven</td>
<td>All</td>
<td>5. Foresighted Thinking Competence</td>
</tr>
<tr>
<td></td>
<td>Finding investors in unagreeable investment climate</td>
<td>FAXX-Datacon</td>
<td>5. Foresighted Thinking Competence</td>
</tr>
<tr>
<td></td>
<td>Winning CSR design by architect</td>
<td>Holmatro</td>
<td>6. Interpersonal Competence</td>
</tr>
<tr>
<td></td>
<td>Inspiring first presentation by architect</td>
<td>Orangeworks</td>
<td>6. Interpersonal Competence</td>
</tr>
<tr>
<td></td>
<td>Reference visit to Vencocampus</td>
<td>Orangeworks</td>
<td>6. Interpersonal Competence</td>
</tr>
<tr>
<td></td>
<td>Book on Smart Building by Jos Lichtenberg</td>
<td>Vencomatic</td>
<td>6. Interpersonal Competence</td>
</tr>
<tr>
<td></td>
<td>Perseverance in attaining SD goals</td>
<td>FAXX-Datacon</td>
<td>1. Strategic Management and Action Competence</td>
</tr>
<tr>
<td></td>
<td>Consultation effort on heat/cold storage</td>
<td>Vencomatic</td>
<td>2. Embracing Diversity &amp; Interdisciplinary Competence</td>
</tr>
<tr>
<td></td>
<td>Starting with interdisciplinary teams a must</td>
<td>Holmatro</td>
<td>2. Embracing Diversity &amp; Interdisciplinary Competence</td>
</tr>
<tr>
<td></td>
<td>Design open plan office spaces</td>
<td>Vencomatic</td>
<td>2. Embracing Diversity &amp; Interdisciplinary Competence</td>
</tr>
<tr>
<td></td>
<td>Building under own management</td>
<td>Vencomatic</td>
<td>2. Embracing Diversity &amp; Interdisciplinary Competence</td>
</tr>
<tr>
<td></td>
<td>Internal (un)loading dock</td>
<td>Vencomatic</td>
<td>2. Embracing Diversity &amp; Interdisciplinary Competence</td>
</tr>
<tr>
<td></td>
<td>Four-block approach/direct costing</td>
<td>Vencomatic</td>
<td>3. Systems Thinking Competence</td>
</tr>
<tr>
<td></td>
<td>Addition of ‘green’ public meeting-spaces</td>
<td>FAXX-Datacon</td>
<td>Both 3. Systems Thinking Competence and 2. Embracing Diversity &amp; Interdisciplinary Competence</td>
</tr>
<tr>
<td></td>
<td>Ecological integration more thought through,</td>
<td>Holmatro</td>
<td>Both 3. Systems Thinking Competence and 2. Embracing Diversity &amp; Interdisciplinary Competence</td>
</tr>
<tr>
<td></td>
<td>Fish pond integration, Information evenings surrounding residents, Odour nuisance neighbour farm</td>
<td>Vencomatic</td>
<td>Both 3. Systems Thinking Competence and 2. Embracing Diversity &amp; Interdisciplinary Competence</td>
</tr>
<tr>
<td></td>
<td>Better buildings positive influence</td>
<td>Holmatro</td>
<td>3. Systems Thinking Competence</td>
</tr>
<tr>
<td></td>
<td>Achieve cohesion</td>
<td>Orangeworks</td>
<td>3. Systems Thinking Competence</td>
</tr>
<tr>
<td></td>
<td>Lukewarm receipt of announcement, teambuilding plan</td>
<td>Orangeworks</td>
<td>Both 6. Interpersonal Competence and 5. Foresighted Thinking Competence</td>
</tr>
<tr>
<td></td>
<td>Building site excursions for employees</td>
<td>Vencomatic</td>
<td>6. Interpersonal Competence</td>
</tr>
</tbody>
</table>

Processing the results from these interviews leads to the preliminary conclusion that the propositions formulated in paragraph 2.4 are supported, substantiation and discussion on this conclusion is documented in Chapter 5.
5. Discussion, conclusion and recommendations

5.1 Discussion

This study contributes to the field of application of individual competences for sustainable development by researching the use of ISC’s in corporate infrastructure projects. In interviews using the Critical Incident Technique events from four sustainable infrastructural developments are gathered and linked to labels associated with the individual sustainability competences validated by Ploum et al. (2017). In table 5 a comprehensive list of the incidents is documented and the connection to the applied ISC, based on labelling derived from Wesselink et al. (2015) and Martens et al. (2010), is included.

While individual competences and sustainable development are well defined and conceptualized as concluded by W. Lambrechts and Van Petegem (2016), the majority of research has focused on data gathered from higher education environments. This study investigates ISC in corporate environments, and shows that respondents apply certain ISC’s in their professional context. Below we will discuss the findings per proposition as formulated in line with our conceptual model outlined in paragraph 2.4

Regarding proposition: “ISC’s are readily recognized and applied by SCM staff in their effort to comply with sustainable guidelines during infrastructural projects”, it can be surmised that nine out of ten respondents easily recognize the concept of competences in general and acknowledge using them in their daily work either in performance appraisals or in the review of achievements in Balance Scorecard models. Here we also recognize that the number of years of work experience plays a role in enhancing familiarity with competences, which is similar to findings by Ploum et al. (2017, p. 15) who conclude that “having prior experience seems to have a positive influence on the scores on the competences”. It is also evident from the response that the educational level of the interviewees positively influences their familiarity with competences and their readiness to consciously employ them. Where sustainability was still just a separate –low priority- subject during the master study of Architecture in the 70’s of one of the participants, another respondent clearly recognizes the, more theoretical, understanding recent graduates have of the concept of competences. This would support findings by Verhulst and Lambrechts (2015) that competence-based education plays an important role in fostering sustainable integration.

Regarding proposition: “Specific individual sustainability competences are linked to critical incidents in sustainable SCM infrastructure projects”, the connection between specific ISC’s and the critical incidents –as summarized in table 6- points to several similarities between cases. When categorizing the incidents according to developmental phase of the projects the recurring use of specific competences is striking. As argued by Bott and Tourish (2016) documenting recurring incidents can enhance validity of the categorization.
In the initial phase of the building projects the application of the interpersonal competence, the strategic management competence and the foresighted competence are repeatedly seen as playing a central role in inspiring team-members to aim for sustainable goals. Research by Jansson, Nilsson, Modig, and Hed Vall (2017) corroborates the relation of strategic management competences -such as pro-activeness and coordination and planning- to sustainability commitment in SME’s to be significant.

Research by Sternad and Kennelly (2017, p. 179) is cited as it concentrates on aspects of the anticipatory –or foresighted thinking- competence and concludes that “it is expected that managerial long-term orientation has an influence on sustainability-related managerial behaviour”. They argue that a defining characteristic of sustainability is that it encompasses multiple time periods –incorporating past, present and future sufficiently distant to be unimaginable- and that managements’ “capability to ‘juxtapose’ consideration of both long-term and short-term consequences of their actions permits … a better firm sustainability performance” (Sternad & Kennelly, 2017, p. 189) and (Slawinski & Bansal, 2012).

During the building phase, the diversity and interdisciplinary competency is particularly often recognized while the systems thinking competence comes into play at the diverse moments when engaging stakeholders is a major concern. The conceptual framework proposed by O’Rafferty et al. (2014) aims for exactly these multidisciplinary relationships.

Regarding proposition: “Application of individual sustainability competences promote integration of sustainability in SCM infrastructure projects” it is shown that in realizing the sustainable goals set beforehand, the application of ISC’s in the line of handling the critical incidents recorded has been evidently instrumental. The effort to gather diverse disciplines in teams and broadly source knowledge is shown to be an indispensable method these project-teams have successfully applied to increase the sustainability of the design and execution of their infrastructure project.

Sustainable development benefits from the long-term vision demonstrated by entrepreneurs willing to invest more upfront to gain in long-term exploitation costs. These results are in line with findings by Dean and McMullen (2007) who concluded that sustainable entrepreneurship will become a more profit-driven conception. Another finding in line with this proposition is that the introduction of internationally standardized certification tools such as BREEAM enables those entrepreneurs to make sustainability measurable as a triple bottom line conception. This supports findings by Ahi and Searcy (2013) and Beske and Seuring (2014) who agree on the fact that a more encompassing -people, planet & profit-definition will help increase sustainability in the SCM field.
This is also in line with the conceptualization by Carter and Rogers (2008) and their contention that maximizing on all three PPP dimensions will help sustainability and competitive performance.

Sustainable development also benefits from personal knowledge transfer and collaborative behavior encouraged within the project-teams responsible for implementation of the infrastructural projects. One focus area in multidisciplinary teams is the extent to which application of competences is ingrained. Here, the attention of more experienced team members should be focused on the conscious transfer of SD values, attitudes and the associated competences to their colleagues newer to the field. This is line with the social implications brought forward by W. Lambrechts and Van Petegem (2016, p. 2) who state that “framing research competences within the concept of sustainable development enables a thorough and “conscious”, rather than coincidental, acquisition of competences for sustainable development.”

Sustainable development also benefits from the interdisciplinary teamwork where legitimacy of other viewpoints is recognized and acted upon and stakeholders are involved from the start. This is in line with findings by Fien and Winfree (2014) who state that soft skills and green skills are not mutually exclusive. It also concurs with the leadership competences Tabassi et al. (2016) found to have impact on success criteria for sustainable buildings.

The positive rewards of integrating abovementioned teamwork skills and knowledge transfer in higher education curriculum are also confirmed by research conducted by Heiskanen, Thidell, and Rodhe (2016, p. 225) who “highlight the diverse competencies that practicing sustainability professionals derive and retain from a real-world consultancy course even a decade after having graduated”. They show that this kind of education -apart from increasing knowledge integration, interpersonal competences and management skills- will also serve as a source of confidence and encouragement for sustainability change agents.

A competence relatively sparsely mentioned is the normative competence. When asked directly if respondents feel that with their handling of the projects they have done the ‘right’ thing and made the responsible decisions regarding sustainability, most will shrug off this suggestion and instead use economic aspects to explain their behaviour. The respondents will label their actions as foresighted, strategic or in line with Corporate Social Responsibility policies rather than take a compliment and pride themselves on exemplary normative behaviour. This way they combine both competences to their advantage. This would contradict findings about sustainability as a ‘wicked’ problem, meaning that decision makers would feel torn in this process. It seems that instead of the tension between the normative competence and the action competence Blok et al. (2016) describe, the decision makers we interviewed actually feel emancipated by the inherent approbation the application of universal norms gives their economic behavior.
Presumed is that this behaviour is also exemplary for the decision makers of the companies approached for this study. All four case companies are privately-owned Small to Medium-size Enterprises (SME’s or MKB’s in Dutch) in the process of expansion and building or extending new corporate structures to accommodate that growth. It can therefore be inferred that the involved executives have already distinguished themselves as successful entrepreneurs and that they are the kind of risk-taking, pro-active, responsible, involved team players fully incorporating the behaviour as defined by the strategic management competence (Osagie, Wesselink, Blok, & Mulder, 2016). They would not be where they are otherwise and it is important to realise for the sake of respondent bias that this makes it a rather homogenous group of interviewees. Results found are therefore not necessarily duplicable with line management of multinationals as multiple constraints concerning communication, budget and accountability of the involved professionals differ greatly.

On a critical note, it can be surmised that the extent to which competences found in our research are applied are not always fully in line with the conceptualizations of these competences as they are derived from research in HE environments.

With competences such as systems thinking and foresighted thinking it is noticeable that the higher the educational level of the respondent the broader the interpretation of such a competence will be understood and applied. Respondents are relatively prone to translating the concept of the competences to their direct working environment and they choose to relate examples and critical incidents within this scope. This sometimes leads to a narrower interpretation of for example systems thinking where not all relevant subsystems across all domains and disciplines are easily identified. These findings corroborate conclusions by Lozano et al. (2013, p. 10) who write that in order to “effectively educate students of ‘all ages’ to help make the transition to ‘sustainable societal patterns’ university leaders and staff must be empowered to catalyse and implement new paradigms, and ensure that SD is the ‘Golden Thread’ throughout the entire university system”.

Another effect is seen with foresighted thinking where respondents’ ‘pictures’ of the future are not always envisioned on a global and long-term scale but more adjusted to their immediate reality and surroundings. These viewpoints are of course not only dependant on educational level but also on the work-experience gained and the capacity (function/job) fulfilled by the respondent and therefore this behaviour is more frequently recognizable with team-members from an operational background. These findings on a more narrowly interpretation of competences is in line with concerns expressed by W. Lambrechts and Van Petegem (2016) when arguing for a more holistic framing of competences within the concept of SD and similar findings by El-Zein and Hedemann (2016) who argue that the focus on problem solving affects the professionals attempt to properly embed sustainable thinking.
5.2 Conclusion

The purpose of this study was to investigate whether “embracing individual competences for sustainable development positively supports eco-oriented design and build in corporate infrastructural initiatives”.

This is a valid question in a world where governments are bound to implement stricter energy goals in building regulations as directed by the Energy Performance of Buildings Directive. This directive requires all new buildings to be nearly zero-energy by the end of 2020 (Pettersen, Verhulst, Kinloch, Junghans, & Berker, 2017).

Based on critical incidents distilled from interviews with SCM project-team members from four companies involved in a sustainable infrastructural initiative, this study finds that realizing sustainability goals in infrastructure projects benefits from the application of individual sustainability competences.

The results in the form of recognized individual sustainability competences -as first defined by Wiek et al. (2011) and elaborated upon by Wesselink et al. (2015), Hesselbarth and Schaltegger (2014), Osagie et al. (2016), Lans et al. (2014) and Ploum et al. (2017)- are linked to the corresponding Critical Incidents and listed in table 6.

In line with the expectations formulated in the research problem outlined in paragraph 1.1 where we sought to bridge the more separately evolved lines of research concerning sustainable development and Supply Chain Integration, it can be concluded that this research shows that sustainability competences are playing a major role in successfully undertaking SCM projects.

Results suggest that all the propositions formulated in this study are positively supported. During the eleven interviews twenty-five separate incidents were recalled where specific individual sustainability competences were recognizably applied in to improve sustainability of the outcome. In application of the specific ISC’s three distinct phases are distinguished: initial inspiration, out-of-the-box thinking and engaging stakeholders.

In the data gathered from our interviews which were subsequently coded and cross-analyzed, we found that 5 out of 6 ISC’s could be connected to the critical incidents in 3 to 8 occurrences per ISC. The five recognized ISC’s occur rather equally distributed over the documented incidents with the exception of the normative competence which is not linked to any of the documented CIT’s using the applied set of labels.

We argue that this absence of recognition of the normative competence partly refers to modesty on the part of the entrepreneurs concerned who do not want to be complimented on outstanding moral behavior and rather use economic arguments to explain their actions.
It can also be concluded that the extent to which competences found in our research are applied are not always fully in line with the conceptualizations of these competences as they are derived from research in HE environments. This sometimes narrower or more short-term view seems to be associated with the educational level and work-experience of the respondent. These divergent interpretations of competences by team members are recognized by the management concerned in these projects and they are the reason for expressing objectives in the field of training and education on acquiring these attitudes and skills.

5.3 Recommendations for practitioners

Recommendations for practitioners are targeted towards two areas of expertise. The first recommendation would be toward the area of SCM professionals and the corporations who employ them. This research shows that familiarity or rather affinity with competences makes it easier for professionals to view their deliberative and decision-making processes with a certain retraction. When asked most respondents profess to recognize the concept of competences and the use of competences in performance reviews or management tools. For any team of professionals working on sustainable building projects, a more in-depth knowledge of competences related to integration of sustainability will improve sustainability of the outcome of their work. It is therefore advisable for such a team to measure the level of awareness of all team-members of the role those specific individual sustainability competences can play in group processes.

Construction is often a long-term project requiring intensive collaboration of professionals from diverse backgrounds. A shared knowledge of competences and how to put them to good use will enable a team to improve on the process and the result. Judgement of this awareness upfront and knowledge transfer through consultancy or in-house training on the subject would be a practical recommendation. Implementing the use of performance review tools based on competences as a companywide strategy will also better equip all employees to begin with. This is in line with the integrated perspective on Green HRM and Green SCM that Jabbour and de Sousa Jabbour (2016, p. 1830) present when stating that ‘the more intangible GHRM factors, such as culture, teamwork, and empowerment, form the basis of GSCM’. They argue that HR practices, skills and factors can help an organizational change in favour of sustainability.

The second area targeted for recommendation would be the Higher Education institutes that educate these professionals and their managers. Although the fact that the term competence-based education does not raise any eyebrows with the respondents in this study it is still mostly a theoretical concept for them as they finish their education. Or as one respondent stated: “at the university sustainability is only a subject” (quote AvdA). Lifting the level of awareness on competences with students to a more ingrained belief or attitude would be a formidable goal for HEI’s, but it seems an unavoidable one if we want
corporations to be infused with those values and norms through those new generations of professionals. The same notion is emphasized by Verhulst and Lambrechts (2015, p. 200) in their presentation of the conceptual model aiming to improve the sustainable development integration process. Their insights on the importance of ambassadors ‘ensuring a two-directional flow of information, initiatives, ideas and enthusiasm’ clearly shows similarities with our findings in the first phase of initial inspiration where several respondents described the key role of such ambassadors as critical incidents to their process.

5.4 Recommendations for future research

In this study only a limited number of cases was reviewed and while homogeneity of the focus group is helpful in comparing the resulting data it is also a limitation as gained insight cannot be extrapolated to business settings in general. Our case companies are all small- to medium-sized (SME’s) privately-owned businesses and the owner/shareholders were all actively involved in the decision-making processes regarding the infrastructural projects. This signifies a marked difference with larger multinational –listed- companies where the chain-of-command is longer and more complex and short-term goals are given more priority. This difference was commented upon as such by the interviewees with consulting roles as they could compare different clientele and their respective behaviour. This limitation would call for further research to be conducted in different contexts and concerning other corporate structures and settings.

Another limitation is the fact that the Critical Incident Technique is a retrospective research method, which implies that the findings might be flawed by recall bias. This aspect of CIT is also signalled by Gelderman et al. (2016, p. 222) who refers to Gremler (2004) when he states that “the method relies on events being remembered by respondents who might have misinterpreted or reinterpreted the incidents”. This limitation is acknowledged and an attempt is made to control this respondent bias by triangulating the data by interviewing two or more respondents per case company and comparing critical incidents on their recurrence. Furthermore, this limitation would lead to a recommendation for future research where additional –written- resources could be included in the review of data and a focus on more current projects would benefit the reliability of the respondents’ recollection.

A third limitation concerns the impact of certain aspects of behavioural economics having affected the respondents in their decision-making processes. Research on biases by Kahneman, Lovallo, and Sibony (2011) teaches us the importance of challenging decision makers to check for confirmation bias, anchoring bias, availability bias and the halo effect. Aspects of bias can be discerned from the different responses gleaned but the actual recognition of these biases in the context of behavioural psychology has not been a subject of the interviews for this research and therefore would be a valuable recommendation for inclusion in future research.
Apart from discussing limitations in the current research as indicative for recommendations we can also look at concepts emerged but only touched upon that would merit further research.

One such topic is the lack of recognition of the normative competence and the way respondents choose to merge normative aspects of their behaviour with the Strategic/action competence. This issue is illuminated by a recent quote from Grant Reid, CEO of Mars in an interview in Fortune (Bach, 2017) on committing one-billion US dollar to fight climate change, when he explains the rationale behind the investment by stating “Mars isn’t just doing this because it’s the right thing to do but also because it’s good business”. Research into the misappropriation of this competence might lead to challenging the conceptualisation of the normative competence in further research.

Another interesting subject for future research would be into barriers or thresholds perceived with sustainable building. Our research focussed on companies already committed to sustainable building but what aspects played a role in current infrastructure projects not (or on a lesser scale) adhering to sustainable standards? The effects of rewards could be studied for example, on how bonuses on application of individual sustainability competences influences outcome of building projects. Or as suggested by Gualtherie van Weezel (2017), in the Dutch newspaper Volkskrant, by rewarding housing corporations to make their homes more sustainable. These effects would be interesting research material with results that could help spur the increase of sustainability in future infrastructure projects.
References


