Jarno Einolander

Strategic Assessment of Organizational Commitment

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Tiivistelmä

Organisaatiositoutumisen käsitettä on tutkittu laajasti kuluneiden vuosikymmenten aikana, kuitenkin se on edelleen yksi organisaatiotutkimuksen haastavimmista käsitteistä. Sitoutuminen on laajalti ymmärretty erittäin tärkeäksi tämän päivän liiketoimintaympäristössä mutta sen moniulotteista luonnetta ei yrityksissä ole välttämättä ymmärretty riittävästi.

Tämän tutkimuksen tavoitteena oli tarkastella organisatorisen sitoutumisen käsitettä ja sen mittaamisen ongelmallisuutta sekä kehittää aikaisempaan tieteelliseen tutkimukseen perustuva käytännön sovellus sitoutumisen tason määrittämiseksi.

Tutkimuksen ensimmäisessä osassa laadittiin organisaatioon sitoutumista käsittelevä teoreettinen viitekehys, jonka perusteella kehitettiin kolme ontologiaa. Ontologiat käsittelevät organisaation sitoutumista eri näkökulmista sekä opiskelijoiden akateemista sitoutumista. Ontologioiden sekä laaditun arviointijärjestelmän avulla on mahdollista ymmärtää sitoutumiseen liittyviä käsitteitä, saada yhteinen näkemys organisaation nykytilasta ja tulevaisuuden näkemyksestä sekä löytää mahdollisia kehityskohteita. Empiiristen case-tutkimusten tuloksia on esitetty tämän työn loppuosassa sekä liitteenä olevissa tutkimusartikkeleissa. Tulokset osoittavat, että laadittujen sovellusten avulla on mahdollista saada tietoa vastaajien tuntemuksista ja pyrkimyksistä. Tätä tietoa voidaan hyödyntää päätöksenteon tukena sekä perustana kehitystoimien luomiselle.

Asiasanat

Organisaatio, Sitoutuminen, Johtaminen, Henkilöstöjohtaminen, Ontologia, Akateeminen sitoutuminen

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Abstract

The concept of organizational commitment has been widely studied over recent decades, yet it remains one of the most challenging concepts in organizational research. While commitment is understood to be highly valuable in today's dynamic business environment, its multifaceted nature is not necessarily understood adequately. The purpose of this study was to examine the concept of organizational commitment and its measurement issues within organizations, and to develop a practical evaluation tool for management, which is based on previous scientific research.

First, a theoretical framework discussing organizational commitment and engagement was established. Based on the literature research, three ontologies were developed addressing organizational commitment and engagement, as well as academic engagement. The ontologies were constructed as a synthesis of existing theories. With the help of the ontologies and the created evaluation system, it is possible to better understand these concepts, gain a collective view of the organization's current state and vision for the future, and to open a dialogue between members of the organization regarding their development.

The results of the empirical case studies are presented at the end of this thesis, as well as in the attached research papers. The empirical results indicate that, by using these applications, it is possible to gain insights about the respondents' feelings and aspirations, which can be used to support effective decision-making and as the basis for creating development actions within the organization.

Keywords

Organizational commitment, Engagement, Management, Leadership, Ontology, SHRM, Academic engagement

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Hammerfest, April 23, 2018

Jarno Einolander.

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Definitions

Attrition	Attrition refers to students who do not re-enroll at an institution in consecutive semesters (Berger, Ramirez & Lyons, 2005).
Co-Evolute methodology	The Co-Evolute methodology presents a co-evolutionary management principle. This principle has its basis in systems sciences and emphasizes the need for a fundamental understanding of the natural processes of the co-evolution of individuals and the organizations in which they work (Kantola, Vanharanta & Karwowski, 2006).
Creative tension	Creative tension is the difference between one's personal vision and current state. Creative tension is the force that brings the current state closer to the vision for the future (Senge, 1990).
Disengagement	Disengagement refers to uncoupling oneself from work roles. If disengaged, employees withdraw and defend themselves physically, cognitively or emotionally, while performing their work roles (Kahn, 1990).
Dropout	Dropout refers to a student whose initial educational goal was to complete a degree, but did not (Berger et al., 2005). Dropout rates refer to the number of students who leave the study program/higher education system (European Commission, 2015).
Employee engagement	Engagement can be described as harnessing one's self to his or her roles at work. Engaged people express themselves cognitively, physically and emotionally, while performing their work roles (Kahn, 1990). This can be defined as "the level of an employee's psychological investment in their organization" (Aon Hewitt, 2017).
Evolute	Evolute technology is an online soft computing platform utilizing indicative statements, which allows management object ontologies to be used for management purposes. The platform supports simultaneous development and the use of numerous management object ontologies (Kantola, 2009).
Fuzzy logic	This is the capability to reason precisely with imperfect information or abstract things. Imperfect information is information, which, in one or more respects, is imprecise,

	uncertain, incomplete, unreliable, vague or partially true (Zadeh, 2009).
Helix	An ontology-based system, which, in this dissertation, describes the evaluation of organizational commitment and engagement.
Helix Academic	An ontology-based system, which, in this dissertation, describes the evaluation of students' commitment and engagement regarding educational institutes.
Management object	Organizational resources can be considered as a bundle of management objects. They include physical objects, mental objects, constructs and abstract objects (concepts), which are being managed and developed by the management of an organization (Kantola, 2005).
Management object ontology	A management object (concept), which is constructed (explicitly specified) as an ontology (Kantola, 2005).
Ontology	An ontology is an explicit specification of the conceptualization of a domain (Gruber, 1993). Ontologies define common words and concepts (meanings) that describe and represent an area of knowledge (Obrst, 2003).
Organizational commitment	This can be defined as "the relative strength of an individual's identification with and involvement in a particular organization" (Mowday, Porter & Steers, 1982).
Persistence	Persistence refers to the desire and action of a student to stay within the higher education system from the start of the first year until degree completion (Berger et al., 2005).
Proactive vision	The same as creative tension, but applied to the business process discipline (Paajanen, 2012).
Proactive visioning	Proactive visioning refers to the method of comprehending and perceiving the uncertainties beforehand (Aramo-Immonen, Kantola, Vanharanta & Karwowski, 2005).
Retention	Retention means the extent to which the employer retains employees (CIPD, 2015). It defines the employer's effort to retain desirable workers in order to meet business objectives (Frank, Finnegan & Taylor, 2004).
Student retention	Retention refers to the ability of an institution to retain a student from admission to the university until graduation (Berger et al., 2005).

Turnover	Employee turnover refers to the proportion of employees who leave an organization over a set period of time, expressed as a percentage of total workforce numbers (CIPD, 2015). In the broadest sense, the term can express all leavers, both voluntary and involuntary. It is also possible to calculate more specific turnover data, such as, resignation levels (CIPD, 2015).
Withdrawal	Withdrawal refers to the departure of a student from a college or university campus. Withdrawal can be voluntary or involuntary (Berger et al., 2005).

Publications

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1 INTRODUCTION

Organizational commitment has been at the center of studies into individual and organizational performance for several decades (Mathieu & Zajac, 1990; Meyer, Allen & Smith, 1993; Meyer & Allen, 1991; Mowday et al., 1982). One of the main reasons for this continued research interest is that organizational commitment has many positive effects on employees and organizations. Today, the increased focus on employee commitment is due, in part, to the turbulent and continuous changes in the business environment, higher employee turnover and cost-cutting efforts in organizations. Major trends, such as globalization, lead to increases in knowledge work, while fast technological advancements make it necessary for organizations to acquire and retain human capital (Holtom, Mitchell, Lee & Eberly, 2008).

According to Meyer and Parfyonova (2010), there is an interesting paradox within the modern workplace. Nowadays, when organizations are increasingly reliant on a committed workforce to gain competitive advantage, many of the changes that organizations make in the name of efficiency (e.g., downsizing, reengineering, merger and acquisition) have the potential to weaken that commitment (Meyer & Parfyonova, 2010). Therefore, it is now extremely important to understand the nature, development and implications of employee commitment (Meyer & Parfyonova, 2010). Now, when organizations need to ask even more of their employees than in the past, it has become worrisome for organizations to be able to retain the commitment of their top talent and get them to work harder to help the business succeed (Richman, 2006). Therefore, from a management viewpoint, the attracting and retaining high-quality employees is more vital today than ever before.

As organizations become leaner and jobs become more flexible, organizations must retain a core group of people whose work input is increasingly important. Therefore, organizations must be able to trust their employees to do what is right (Meyer & Allen, 1997), and depend on them to use their skills and energies wisely so that contributions are maximized. In other words, organizations need employees who work not only harder but smarter (McAllister, 1995).

Europe has faced major challenges regarding its competitiveness, for example, resulting from the changes in the population's age structure and in methods of production (Työelämä 2020, 2012). In this day and age, European countries have to rely upon a skilled, engaged and healthy workforce, capable of adjusting to technological changes and new patterns of work organization (European Commission, 2010). Although there are differences between countries, studies analyzing the costs of turnover (Hinkin & Tracey, 2000) and the shortage of qualified employees in critical industries emphasize the importance of retaining key employees for the organization to succeed in future.

Many countries have launched development projects to advance the quality of working life, employment rates and well-being at work. Finland has set a goal to make working life in Finland the best in Europe by 2020 (Ramstad & Mähönen, 2017). This requires organizations to successfully renew and improve their activities to respond to continuously changing operating environments. By improving the quality of working life and well-being at work, productivity and profitability can be increased in a sustainable way (Työelämä 2020, 2012). To succeed, organizations need to invest in strengthening engagement at work, management and supervisory work, new practices, as well as cooperation (Työelämä 2020, 2012). According to Ramstad and Mähönen (2017), internationally, Finland's particular strengths are employees' skills, high job autonomy, motivation to perform well, good opportunities to balance work and family life, and supporting innovative practices. All of these issues are connected and related to commitment and employee engagement.

It has also been continually noticed that a committed workforce is critical to a company's performance and therefore sustaining its competitive advantage. This is because employees who identify with and are involved in their organization (in other words, those who are committed) probably want to stay with their organization and exert effort on its behalf (Mowday et al., 1982; Mowday & McDade, 1979). The link between organizational commitment being an important factor in determining turnover intentions and the claim that strongly committed employees are least likely to leave an organization is very well documented (e.g., Allen & Meyer, 1990; Elangovan, 2001; Mowday, Steers & Porter, 1979; Porter, Steers, Mowday & Boulian, 1974).

Organizational commitment is not only related to increased employee retention, but also to several other positive outcomes. According to many extensive meta-analytical studies, organizational commitment, especially affective commitment, is related to employees' higher job performance, positive organizational citizenship behaviors (OCBs), health and well-being, as well as lower absenteeism from work, turnover intentions and actual turnover (e.g., Cooper-Hakim & Viswesvaran, 2005; Mathieu & Zajac, 1990; Meyer, Stanley, Herscovitch & Topolnytsky, 2002). Furthermore, a committed workforce has been found to be more dedicated to their jobs, more inclined to innovate, and more motivated to use their time and effort to fulfill the required tasks, in addition to being more active in developing their organizationally relevant skills, and showing more support and acceptance for organizational changes (De Clercq & Rius, 2007; Meyer, Srinivas, Lal & Topolnytsky, 2007; Ng, Feldman & Lam, 2010). Eventually, organizational commitment has been found to have a positive effect on operational performance and effectiveness, resulting in improved productivity, quality, profitability and customer satisfaction (e.g., Harter, Schmidt & Hayes, 2002; Wright, Gardner, Moynihan & Allen, 2005).

The notion of employee engagement is newer than organizational commitment, although it was previously used in the main by human resources (HR) consulting companies to give advice on how engagement can be achieved and influenced in organizations (Macey & Schneider, 2008). The construct has mostly been used by practitioners to describe positive organizational behaviors and high levels of affective organizational commitment. During the period of its usage, the term has been defined in various ways, which often resemble better-known and more proven constructs, such as organizational commitment and OCB (Robinson, Perryman & Hayday, 2004).

Although engagement and organizational commitment share some aspects, Macey and Schneider (2008) argue that organizational commitment can be seen as a facet or part of engagement, but not equivalent to it. Job engagement can be regarded as being conceptually distinct from organizational commitment because the focus is on work rather than the organization (Macey & Schneider, 2008). Saks (2006) also argues that organizational commitment differs from engagement because it refers to a person's attitude and attachment to their organization, whereas engagement is not an attitude but the level to which an individual is attentive and involved in the performance of their roles. Meanwhile, Meyer and Gagne (2008) found that engagement is distinguishable from general work motivation, commitment, job involvement, job satisfaction and other key concepts in the organizational behavior literature.

According to Robinson et al. (2004), engagement can be considered as being 'one step up' from commitment. It is not simply about job satisfaction or high retention rates. It is a multifaceted concept influenced by many factors, such as organizational culture and communication, and management and leadership styles, trust and respect, and the reputation of the company (Lockwood, 2007).

Usually, definitions of engagement or characteristics of an engaged workforce emphasize satisfaction, motivation, commitment, passion and finding meaning at work, pride, awareness of business context, and discretionary effort exhibited by employees for the benefit of the organization. According to Saks (2006), employee engagement has been mostly defined as emotional and intellectual commitment to the organization (Richman, 2006; Shaw, 2005), or the amount of discretionary effort exhibited by employees in their jobs in the form of extra time, brainpower and energy (Frank et al., 2004).

Richman (2006) states that there is clear evidence that employee commitment and engagement have powerful effects on business outcomes. Research suggests that the benefits of a highly engaged workforce include higher efficiency, delivery of higher levels of customer satisfaction, attainment of higher productivity levels and lower turnover rates (Buhler, 2006). In addition, high levels of engagement have been found to foster retention of talent, improve customer loyalty, and enhance organizational performance and stakeholder value (Lockwood, 2007).

It may be harder for employees to stay committed to their employer or for organizations to make long-term commitments to their employees in this new working life with new business and economic realities riddled, for example, with efficiency improvements by downsizing or outsourcing, international competition, fast-paced market economy, technological changes, and changes in consumer demands. However, considering the numerous positive consequences associated with organizational commitment and an engaged workforce, it is clear that organizations should place high value on committed employees and try to nurture it as effectively as possible.

This dissertation presents a novel methodology for strategic HR management and leadership purposes. The aim of this research is to provide the organizations with a holistic picture of their HR environment regarding these two previously discussed important management concepts. The research method utilizes management and leadership ontologies to capture the current and future views of personnel in terms of their engagement and reasons for being a part of their respective organization. This research presents three management object ontologies (MOOs): Helix for evaluating organizational commitment and engagement (Helix A and B), and Helix Academic for evaluating academic student engagement. Based on the ontologies, this research introduces a new types of qualitative decision support system (DSS). The creation and revelation of ontologies are based on the literature and follow the teachings of Heidegger (Heidegger, 1996) by trying to first uncover the content of the concepts as widely as possible, and then progress to narrowing them down to a more condensed form in order to create the structure for the DSS instrument.

This research presents qualitative DSSs that differ from normal measurement methods. Ordinarily measurement methods of organizational commitment focus on the analysis of the organization’s current state. If the measurement method does not attempt to analyze the aspirations of the members of the organization, i.e., what they are thinking should be developed or how they see them change in the future, an important development aspect is left out. If intervention and change within the organization are the goals, this type of information is very important for the management.

The systems presented in this study evaluate the organization's current state, as well as the target or future state based on the opinions of the members of the organization. The target state indicates where the respondent would like to see improvement. The current state shows how the organization has been managed. In the target state evaluation, respondents express their own desires and feelings, according to their own situation and knowledge. This type of evaluation enables the analysis of creative tension (Senge, 1990), which is also known as proactive vision. Creative tension or proactive vision is the difference between the target state and the current reality, and describes the aspirations and creative force for change. Proactive visioning is a method of comprehending and observing uncertainties in advance. The gap simulates the potential development in each feature of the ontology. In this study, the proactive visioning is directed to the development of the organization's HR environment.

The presented ontologies use a generic fuzzy logic-based Internet application environment, which supports the evaluation of different concepts and constructs in an interactive manner. By using the created ontologies through this system, a collective understanding of the organization's current state and target state concerning the state of employees' organizational commitment and engagement can be modeled. The applications use linguistic statements, describing unique features of the organization's HR environment. Respondents are asked to evaluate each statement by the current state and target state (the target state can also be viewed as a future vision). In the application, the statements are presented randomly to the respondents. Therefore, the respondents cannot know to which concept or feature in the ontology the statements are connected. As a result of the evaluation, the system visualizes results based on the current state, the target state and the creative tension or proactive vision.

Using ontology-based computer applications, managers and leaders can get a holistic view of the current and prediction of future levels of the factors affecting the different dimensions of organizational commitment. This type of collective view and understanding of commitment is important for leading and managing organizations to thrive in the face of today's intense competition. By utilizing these applications, the goal is to prepare for and respond to the changes in the dynamic organizational environment by developing organizations' HR environment proactively, based on the collective view and knowledge based on facts. The applications are used as DSSs to find out how employees are feeling, identify development areas, plan for development activities, and follow up the changes within the workforce and the organization. By using evaluation results gathered directly from employees, the people who work in the organizations can feel part of the development efforts and therefore commit to possible changes.

These applications and the ontologies behind them can also be used to study or teach these concepts. Understanding these concepts is important since, for example, according to Hinkin and Tracey (2000), managers who understand the value of employee retention and management practices in its reinforcement will outperform the competition. Therefore, the development of employees' organizational commitment and engagement should be a strategic goal for today's organizations.

This research deals with issues belonging to the field of strategic HR management (SHRM). The developed ontologies are based on literature research and discussions with academic experts. The theoretical framework is built on the organizational commitment and engagement literature, as well as literature related to student engagement. In addition, DSSs and MOOs are discussed. Although this research focuses on evaluating organizational commitment, it is analyzed in relation to concepts closely related to it, such as organizational engagement, career commitment, work commitment, organizational identification, motivation and turnover intention.

1.1 Problem formulation and research objectives

In organizations, the concept of commitment is frequently understood too simplistically. The term has become a part of management jargon, with many using it without understanding its true nature, meaning, and the related norms and parameters. Management often only use the term *commitment* without specifying or understanding what that includes. It is also understood many times in too static and straightforward a way. Commitment is often referred to as a single concept, although it is very broad and complex when its entirety is revealed. Since the concept after revealing its characteristics is very complex and fuzzy, just to use the word "commitment" is not enough in management and leadership practice to describe all its aspects and dimensions. Without proper knowledge and understanding of the meaning, the management of the organization is less powerful in affecting the development of organizational commitment.

If the nature of the commitment to an organization is not understood, this results in a lack of understanding about employee attachment, which could in turn lead to defective leadership strategies that fail to achieve their goals. The features inside commitment should be revealed to management, so that the true meaning and content can be understood. Ontologies are effective ways to present such complex concepts, which can also help to reveal their dynamic nature.

In this research, the research objectives address management and leadership problems. This research attempts to increase the managerial understanding of organizational commitment and engagement by trying to answer the following research questions:

- What is employee commitment and engagement, and what are the sub-constructs that influence them?
- How can the influencing factors be modeled in a usable way for organizational management and management support system (software) development?
- How can the states of employees commitment and engagement at distinct levels be assessed and presented in an effective way for management and leadership?

In addition to above, as the basic survey strategy and instruments do not reveal the entity, they can be used effectively in organizational management and leadership. Effective management requires insights or predictions concerning where the organization is going. The assessment of current states, future aspirations, problem identification and the determination of development needs requires the development of suitable systems to support managerial decision-making.

Visual and easy-to-understand fuzzy logic-based tools can support management and leadership decisions more effectively than detailed statistical and numerical presentations of assessment results, especially in complex and fuzzy organizational concepts.

The goal of this research is to develop and test a new type of assessment system to assist organizational management and leadership in the creation of a responsive and engaging HR environment. By utilizing these systems in organizations, it will then be possible to better understand, internalize and learn about these concepts related to organizational commitment and engagement, acquire a collective understanding of the organization’s current and future state, plan development activities, and open up a dialogue between members of the organization, as well as follow the progress of these activities.

The objective of the research can be divided into four parts. The first part of this research studied the concepts of organizational commitment and engagement in order to reveal their true meaning according to the literature. Theories regarding student engagement were also explored. These theories, related to the research topics, were combined in the theoretical framework.

The second part was to construct MOOs in order to reveal the concepts inside the research topics based on the theoretical framework. The development of ontologies is important, if the true meaning and content of commitment is to be understood and internalized. The ontologies are constructed from statements, features and categories/classes.

The third part sought to transform these ontologies for use with a fuzzy logic-based query application platform. The platform enabled the evaluation of the statements within the ontologies on the Internet through a graphical user interface. The platform also enabled the collective reporting and examination of the results.

The fourth part was to test these ontology-based applications in different practical case studies.

1.2 Research strategy

The present work is situated at the intersection of industrial engineering and management disciplines. According to Eloranta, industrial engineering and management belong to business economics sciences, particularly design sciences. These sciences have a natural tendency to aim for both practical and epistemic utility. A research contribution made in the industrial engineering and management discipline should represent new information for the scientific community and, at least potentially, usable practical knowledge that benefits the real business and industrial community. Research in industrial engineering and management often attempts to answer the question about how the world should be. It also emphasizes more the relevance of the research problem than the research methods. Therefore, in different research themes, various approaches, research methods and explaining mechanisms are used (Olkkonen, 1994).

A research methodology consists of the combination of the process, methods and tools that are used in conducting research in a research domain (Nunamaker, Chen & Purdin, 1990). Figure 1 presents research philosophies in the form of a research onion. The image describes different research methods, philosophies, approaches, strategies and research techniques. The methodology of the theoretical framework is based on the conceptual research method, while the constructive research method is used to create a managerial construct to be used in empirical research. In the beginning of this research exploratory research was used through a literature review to examine the research object to gain better understanding of the characteristics and to surface the key issues for the creation of ontology. In the empirical case studies, the research type was descriptive as the purpose was to describe and comprehend case groups and their unique feelings and opinions using structured questionnaires as the data collection method. The empirical part and the analysis of the research use both quantitative and qualitative methods in the analyzing of case studies, and inductive reasoning. The time horizon of the research was cross-sectional.

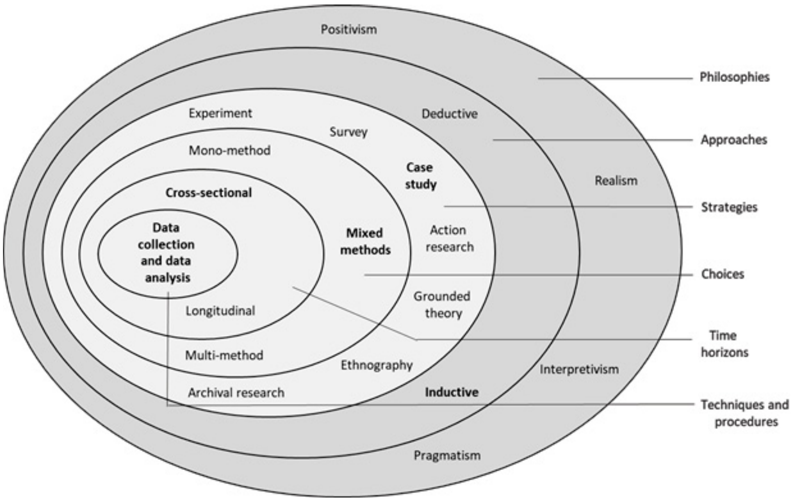

Figure 1. The research 'onion' (Saunders, 2009)

Typically, research approaches in the field of business economics can be connected to positivism or hermeneutics. Some research problems also require using both types of research approaches within one research project. According to the main criteria of positivistic research philosophy, the gathering of knowledge can only be based on identified and verifiable observations. Likewise, in the processing of observations, only objective methods, independent of the researcher's subjective interpretations, are used. Ideally, positivistic research includes the research done with the exact sciences.

In contrast, in hermeneutic research philosophy, the gathering of knowledge includes the researcher's own understanding of the phenomenon under study. Understanding especially includes contexts, reasons for the phenomenon and processes that are hard to measure. Observations are mainly qualitative, and their processing is based on the researcher's own interpretations. The basis for hermeneutic research comes from human sciences, for example, from behavioral sciences.

In research work, it is rare to find research that is only either positivistic or hermeneutic in its every step and part. In business economics research, it is common to combine different research philosophies within one research project. These types of philosophy are, for example, concept analytic and constructive approaches (Olkkonen, 1994).

In Finland, the discussion in the context of research methodology broadly begins with a classification defined by Neilimo and Näsi (1980). It is based on the division into four approaches: nomothetical (natural scientific), decision-oriented (management science-oriented), action-oriented (hermeneutic) and conceptual (Kasanen, Lukka & Siitonen, 1993). Later on, Kasanen, Lukka and Siitonen (1991) added the constructive approach to this classification. Figure 2 shows these approaches according to their main emphases on two axes: theoretical-empirical and descriptive-normative.

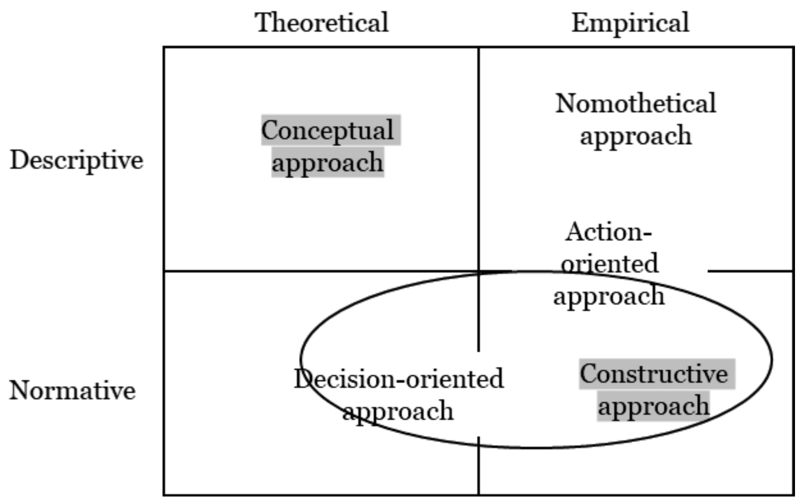

Figure 2. Research approaches, adapted from Kasanen et al. (1993)

The nomothetical approach is closely related to the modernist (positivist) research tradition. The underlying explanatory model is causal, and it attempts to state the findings in the form of general laws. The decision-oriented approach is typically based on assumptions similar to the nomothetical one. However, there is a difference in the essential nature of the research, which, in the decision-oriented approach, is normative and meant to help management in running the company. The action-oriented approach can be considered as a kind of alternative to the nomothetical approach by way of bringing the human being into the focus of analysis. The emphasis in the action-oriented approach is usually placed on gaining a thorough understanding of the subjects in question through hermeneutic philosophy, although the purpose may also include active participation in change processes. The conceptual approach is distinguished by its a priori basic nature because it produces new knowledge primarily through the method of reasoning (Kasanen et al., 1993). The conceptual approach is a non-empiric research method, which can be used as the foundation for empirical research or as a research approach independently (Puusa, 2008).

The constructive approach is normative and, for the most part, empirical, and has much in common with the decision-oriented and action-oriented approaches. The difference is that the decision-oriented approach normally uses the deduction method, while constructive approach is characterized by heuristic innovations. The main difference is that the constructive approach always attempts to explicitly demonstrate the practical usability of the constructed solution. When comparing the constructive approach and action-oriented approach, in both cases, the direct and pragmatic empirical connections play a significant role. The common features of action research and the constructive approach emerge in the empirical part of the research which usually utilizes the case method. Both types of research presuppose a thorough understanding of organizational processes in order that the planned changes can be accomplished in practice. Both types of research also assume that the researcher acts as a person who supports the participants of the organization in their learning processes. An important difference between the constructs is the fact that action research does not to aim to create any explicit managerial constructs (Kasanen et al., 1993).

It is typical for business economics research to use several research methods within one study. At the beginning of the research, a conceptual analysis is used to create a theoretical framework or conceptual system for the research, which is used for gathering and processing the subsequent empirical data. Later, a constructive approach or decision-oriented approach is used to create concrete theoretical constructs and the systems for organizational management.

This research uses conceptual and constructive research approaches highlighted in the Figure 2. Concept analysis identifies the critical characteristics of the concept under consideration, recognizing the features that make the concept unique and distinguish it from concepts close to it (Puusa, 2008). The conceptual research approach is used to develop conceptual systems. New conceptual systems are needed, for example, to describe and identify phenomena, to make a typology, to organize knowledge and to form a basis for design systems (Olkkonen, 1994). Concept analysis can help in understanding what kinds of meanings are related to the researched concept, how the concept differs from related concepts, and what features are critical characteristics of the concept (Puusa, 2008). The analysis follows the principle of the hermeneutic circle, such that information obtained at a later stage of the process often leads to a reassessment of the facts presented in the earlier stage and, possibly, to corrections, resulting in a desired outcome (Puusa, 2008). The justification of a concept resulting from the conceptual research approach, is usually done by testing. Testing determines the suitability of the result for different uses and determines the needs of further research (Olkkonen, 1994).

In this research, the conceptual research method is used to create the theoretical framework and define concepts within the created ontologies. The purpose of creating a theoretical framework is to develop a conceptual system that identifies, describes, types and analyzes the phenomenon under the research. This is done based on previous theories and conceptual analyses through the method of analysis and synthesis. The developed concepts are tested through multiple case studies.

Constructive research is normative in nature. It aims to develop problem-solving methods for organizational management. Constructive research combines target-oriented, innovative processing of the problem, empirical testing of the created solution on a practical level, and an assessment of the scope of the solution's application (Olkkonen, 1994). According to Kasanen et al. (1993), the constructive research process may be divided into following phases:

1. Finding a practically relevant problem, which also has research potential.

2. Obtaining a general and comprehensive understanding of the topic.

3. Innovating, i.e., constructing a solution idea.

4. Demonstrating that the solution works.

5. Showing the theoretical connections and the research contribution of the solution concept.

6. Examining the scope of applicability of the solution.

This research uses the constructive research approach to create a theoretical and concrete construct to build a managerial DSS to assess the organization's HR environment regarding employees' organizational commitment and engagement. It is expected that the developed constructs and application can reveal the state of the organization's HR and be used to direct the environment in a more responsive direction (cf. Kivelä, 2011; Paajanen, 2012). Various case studies are used to evaluate how the constructs work in practice in running business (and educational) organizations. According to Eisenhardt and Graebner (2007), the multiple-case method provides rich qualitative evidence for supporting research conclusions.

Multiple cases also enable the broader exploration of research questions and theoretical elaboration.

According to Kasanen et al. (1993), case studies are characterized by the use of small samples. The distinctive feature of case studies is the smaller distance between the researcher and the research object, while the aim is usually to gain a more profound and comprehensive understanding of the studied subjects than what is possible by collecting large samples through surveys. However, from the positivist viewpoint, the central problem of this type of case study is the lack of any possibility to make statistical generalizations (Kasanen et al., 1993). However, multiple-case research typically yields more robust, generalizable and testable theories than single-case research (Eisenhardt & Graebner, 2007). Several cases also enable comparisons, which clarify whether an emergent finding is simply idiosyncratic in relation to a single case or consistently replicated by multiple cases (Eisenhardt & Graebner, 2007).

In the analysis of the results, the interpretations based on the researcher's own understanding are central. The research problem in question is fuzzy and dynamic in nature, which is why the built-up research instrument is very extensive and in-depth. The purpose of the research is to develop a conceptual system and theoretical construction for helping the business community. Due to the limited number of cases and their respondents, further research is needed to make any possible generalizations.

The analytical part of this research combines both qualitative and quantitative analyses for the purpose of increasing the breadth and depth of the analysis. First, an analysis was made using a linguistic and visual qualitative method with regard to organizations and universities. Next, the data were used for quantitative analysis purposes in the form of relevant statistical calculations. Thirdly, the synthesis of the research was made by combining these analyses in a form that was relevant from the management perspective. This type of research paradigm, which combines elements of qualitative and quantitative methods, is called mixed method research. Tashakkori and Creswell (2007) defined mixed method research as "research in which the investigator collects and analyzes data, integrates the findings, and draws inferences using both qualitative and quantitative approaches or methods in a single study or program of inquiry".

1.3 Dissertation outline

This dissertation contains a monographic summary of the research, consisting of five chapters, with nine research papers as the Appendix. Chapter 1 presents an introduction and background to the research. In Chapter 2, the theoretical framework of the thesis is presented. Chapter 3 presents the results of a theoretical study in the form of the construction of the ontologies and DSS applications. Chapter 4 presents the results of the empirical research, as well as summaries of the research papers and different analyses of the results. Chapter 5 offers a discussion and conclusions of the research. The Appendix consists of the original papers (1-9). All the research papers describe the development of the ontologies and their application in the conducted case studies.

2 THEORETICAL FRAMEWORK

The focus of this research is to find out how to gather information on organizational commitment and engagement from employees in companies, and how to utilize this information for leading the HR function. By rapidly making evaluations of employees' commitment in a collective manner, leaders of the organization can develop strategies in order to encourage individuals and teams to become more attached to and satisfied with their job and their organization.

In this chapter, organizational commitment and engagement are studied in the form of a literature review, followed by the presentation of a method for their evaluation. Some of the theoretical framework presented in this chapter is also described in the attached articles (cf. Einolander, 2016; Einolander & Vanharanta, 2011, 2013, 2017; Einolander et al., 2016). The theoretical framework outlined here is extended from the attached research articles to comprise the theoretical framework for this whole research. In this work, the terms *affective commitment* and *engagement* are partly used interchangeably.

2.1 Commitment and engagement in an organizational context

The concept of organizational commitment has been at the focus of research on the performance of individuals and organizations for several decades (Mathieu & Zajac, 1990; Meyer et al., 1993; Meyer & Allen, 1991; Mowday et al., 1982). One of the main reasons why the concept of organizational commitment has attracted considerable interest in research is because it tries to understand the strength and stability of employee dedication to work organizations (Eisenberger, Fasolo & Davis-LaMastro, 1990). Organizational commitment has been considered as a mediator variable in several causal models of employee behavior, often focusing on predicting employee reactions or behaviors (Mathieu & Zajac, 1990). Consequently, organizational commitment has been connected to several personal variables, role states and aspects of the work environment, such as job characteristics or organizational structures.

Originally, organizational commitment research emerged as an alternative explanation for certain workplace behaviors, such as turnover and absenteeism, when previous explanatory models had led to disappointing findings (Steyrer, Schiffinger & Lang, 2008). Interest in organizational commitment research for business organizations stems from the sign that organizational commitment has many positive effects, both for workers and for their organization. Organizations have continually been able to sustain their competitive advantage through committed employees and therefore found organization commitment to be critical to their performance. This is because employees who identify with and are involved in their organization (in other words, those who are committed) are likely to want to stay in their organization and exert effort on its behalf (Mowday et al., 1982; Mowday, Steers & Porter, 1979). Many extensive meta-analytical studies support this prediction (cf. Cohen, 2000; Mathieu & Zajac, 1990).

For example, Meyer et al. (2002) concluded, in their meta-analysis, that commitment negatively relates to turnover and several other types of withdrawal cognitions. In addition, Meyer and Allen (1997) found a positive correlation between affective commitment and work attendance. A committed workforce will be more devoted to their jobs, more inclined to innovate, and more motivated to give their time and effort to perform the required tasks, in addition to being more active in developing their organizationally relevant skills, and showing more support and acceptance for organizational changes (De Clercq & Rius, 2007; Meyer et al., 2007; Ng et al., 2010). Consequently, commitment has been found to have an effect on operational performance and effectiveness, leading to improved productivity, quality, profitability and customer satisfaction (e.g., Harter et al., 2002; Wright et al., 2005).

In short, people who are committed to their organization do not change the organization in the same way as those with weak commitment (Allen & Meyer, 1996; Porter, Crampon & Smith, 1976), and have lower absenteeism from work, turnover intentions and actual turnover (Angle & Perry, 1981; Bateman & Strasser, 1984; Porter et al., 1976). According to Ruokolainen (2011), committed employees perform better than others and remain in the organization for longer, thereby improving the efficiency and productivity of the organization, as well as reducing the costs associated with employee turnover. In addition, commitment has been found to have a positive impact on motivation, OCBs, performance, and wellbeing at work (Meyer et al., 2002; Mowday et al., 1982). However, there are contradictory views among researchers regarding the relation between commitment and well-being. Some researchers argue that commitment acts as a buffer, which prevents against work stressors (Begley & Czajka, 1993), while the opposite view is that committed employees are more exposed to stressors than less committed employees (Reilly, 1994).

In the course of extensive organizational commitment research conducted over a number of decades, the term has been defined in various ways. However, during this time, much has happened to the ways in which organizations behave, including the emerging of new forms of employee relations and new psychological contracts (Swailes, 2002). Next, the terms *organizational commitment* and *engagement* are defined more specifically.

2.1.1 Defining organizational commitment and engagement

Organizational commitment describes the link between employee and organization. It refers to the extent to which an individual regard him/herself as an organizational person. Organizational commitment can be defined as a psychological state that binds an individual to an organization (Meyer & Herscovitch, 2001) and influences individuals to act in ways that are consistent with the interests of the organization (Mowday, Steers & Porter, 1979; Porter et al., 1974). In particular, a frequently used definition of organizational commitment refers it as "the relative strength of an individual's identification with and involvement in a particular organization" (Porter et al., 1974).

Reichers (1985) defines organizational commitment as a process of identification with the goals of an organization's multiple constituencies, such as organization, occupation, job, supervisor, workgroup or organizational goals. Later, Meyer and Herscovitch (2001) proposed that commitment is "a force that binds an individual to a course of action of relevance to one or more targets". Rusbult and Farrell (1983) used a similar definition of organizational commitment described as the willingness to put in extra effort, the desire to remain, and the acceptance of the goals and values of the organization.

Wiener (1982), in turn, considered commitment as "the totality of internalized normative pressures, to act in a way that meets organizational interests". Vance (2006) argues that there are emotional and rational components in organizational commitment. The emotional component describes a positive feeling toward an entity or an individual, and the rational component a conscious and thoughtful planning and carrying out necessary actions to fulfill commitments (Vance, 2006).

O'Reilly and Chatman (1986) argue, following Kelman's (1958) work, that commitment can have three stages which they called compliance, identification, and internalization. According to O'Reilly and Chatman (1986), compliance can be said to occur when an individual act in the hope of achieving a favorable reaction from another person or group or to avoid punishment or disapproval. Individual adopts the behavior only in order to satisfy external constraints such as acquiring rewards or approval or because of trying to avoid punishment not because of shared beliefs. This stage and the type of behavior is closely associated with continuance commitment where the employee stay their current organization because it delivers them desirable personal outcomes (Meyer & Allen, 1997).

The second stage, named identification, occurs when an individual accepts the influence of others in order to establish or maintain a satisfying, self-defining relationship with another person or social group, respecting its values but not adopting them to their own (O'Reilly and Chatman, 1986). This relationship may take the form of classical identification or a reciprocal role relationship. The third stage, internalization, arises when attitudes and behavior are adopted because the content of the attitude or behavior is congruent with the individual's own values. In this stage, the employee feels the values of the organization to be intrinsically rewarding and want to stay with the organization. Identification and internalization lead to commitment based on a desire to affiliate with others, and to adopt their values and goals, and the desire to contribute to their success. Therefore, these two types characterize affective commitment (Johnson, Chang, & Yang, 2010). Even though identification and internalization are separate constructs, they are highly correlated because of their self-determined nature (Johnson et al., 2010).

According to Robinson et al. (2004), engagement is believed to be "one step up" from commitment. The construct of organizational engagement is based on earlier concepts concerning organization-employee linkages, such as job satisfaction, organizational commitment and OCBs. Therefore, employee engagement is broader in scope than each of these separately. Engagement has been shown to influence business outcomes, as well as being related to an increased intention to stay with the organization: as engagement increases, employee turnover decreases (Robinson et al., 2004). According to Saks (2006), many researches have indicated that employee engagement predicts employee outcomes, organizational success and financial performance, for example, total shareholder return.

Definitions of engagement usually show the two-way relationship between employer and employee more clearly than job satisfaction, employee commitment or OCBs. Engagement encompasses several positive behaviors for organizations and is a stronger predictor of positive organizational performance. These include the extent to which employees involve themselves in their work, and the strength of their commitment to the employer and their role. Usually, themes such as job satisfaction, recognition, pride in the employer, organizational supportiveness, effort to go the extra mile, and understanding the linkage between one's job and the mission of the organization can be found in the definitions of engagement (Vance, 2006). Furthermore, engagement is seen to go beyond job satisfaction, referring to an employee's personal state of involvement, contribution and ownership (Robinson, Perryman & Hayday, 2004).

For example, Kahn (1990) defined personal engagement as "the harnessing of organization members' selves to their work roles; in engagement, people employ and express themselves physically, cognitively, and emotionally during role performances". Harter et al. (2002) defined employee engagement as "the individual's involvement and satisfaction with as well as enthusiasm for work". More broadly, Robinson et al. (2004) defined engagement as "a positive attitude held by the employee toward the organization and its values. An engaged employee is aware of business context and works with colleagues to improve performance within the job for the benefit of the organization. The organization must work to develop and nurture engagement, which requires a two-way relationship between employer and employee". Klein (2004), meanwhile, defined employee engagement as the "the extent to which employees commit to something or someone in their organization, how hard they work, and how long they stay as a result of that commitment".

According to Kahn (1990), engagement focuses on how people commit themselves while performing the job. Employees express themselves cognitively, physically and emotionally, while performing their work roles. He argues that, in order for the work environment to be engaging, three conditions must be met: 1) meaningfulness (when people feel worthwhile, useful and valuable); 2) safety (when people feel that they can show and employ themselves without fear of negative consequences to self-image, status, or career, in other words, an environment with trust and supportiveness); and 3) availability (people feel a sense of having the physical, emotional or psychological means to engage in their job tasks at any moment) (Kahn, 1990).

Two major views of employee commitment have focused on affective attachment and calculative involvement, which are usually considered to be conceptually and empirically distinct (Eisenberger et al., 1990). The affective emotion-based view emphasizes the employee's sense of unity and shared values with the organization, while the calculative aspect of the employee-organization relationship envisions that economic factors are of primary importance in employee absenteeism, work effort and turnover (Eisenberger et al., 1990). Table 1 describes different definitions of commitment, including views from various researchers and decades. Even if there are many varying definitions, most include one or more of the following three elements as a vital part of their definition: affective orientation, cost-based approach and moral obligation toward the organization. The table is classified according to these three elements.

Table 1. Definitions of commitment (Meyer & Allen, 1997)

Affective Orientation
The attachment of an individual's fund of affectivity and emotion to the group (Kanter, 1968, p. 507).
An attitude or an orientation toward the organization which links or attaches the identity of the person to the organization (Sheldon, 1971, p. 143).
The process by which the goals of the organization and those of the individual become increasingly integrated and congruent (Hall, Schneider & Nygren, 1970, pp. 176-177).
A partisan, affective attachment to the goals and values of the organization, to one's role in relation to goals and values, and to the organization for its own sake, apart from its purely instrumental worth (Buchanan, 1974, p. 533).
The relative strength of an individual's identification with and involvement in a particular organization (Mowday, Porter & Steers, 1982, p.27).

Cost-based
Profit associated with continued participation and a "cost" associated with leaving (Kanter, 1968, p. 504).
Commitment comes into being when a person, by making a side bet, links extraneous interests with a consistent line of activity (Becker, 1960, p. 32).
A structural phenomenon which occurs as a result of individual-organizational transactions and alterations in side bets or investments over time (Hrebiniak & Alutto, 1972, p. 556).

Obligation and Moral Responsibility
Commitment behaviors are socially accepted behaviors that exceed formal and/or normative expectations relevant to the object of commitment (Wiener & Gechman, 1977, p. 48).
The totality of internalized normative pressures to act in a way which meets organizational goals and interests (Wiener, 1982, p. 421).
The committed employees considers it morally right to stay in the company, regardless of how much status enhancement or satisfaction the firm gives him or her over the years (March & Mannari, 1977, p. 59).

According to Meyer and Allen (1991, 1997), commitment to an organization is a psychological state, which employees experience in three simultaneous mindsets. Their (Meyer & Allen, 1991, 1997) widely recognized three-component model (TCM) of organizational commitment divide the construct into three distinct components. The authors denominate the components as follows: 1) affective commitment, 2) normative commitment and 3) continuance commitment. Each one of these three components differently affects how employees feel about the organization for which they work (Meyer et al., 2002). Each type of commitment binds the individual to the organization in different ways and will have different effects to his/her behavior in the workplace. According to Meyer and Allen, employees can experience each of these psychological states to varying degrees.

According to Solinger, Van Olffen and Roe (2008), Meyer and Allen's three-component conceptualization ties together three separate views of earlier commitment research (Becker, 1960; Buchanan, 1974; Kanter, 1968; Mathieu & Zajac, 1990; Mowday et al., 1982; Salancik, 1977; Wiener & Vardi, 1980; Wiener, 1982), and is affected by their strengths and weaknesses. This model of organizational commitment has been a focus of the greatest amount of empirical analysis and has received the greatest support (e.g., Meyer & Allen, 1997).

Based on this model, the affective component refers to employees' emotional attachment to, identification with, and involvement in the organization. It refers to how strongly the employee identifies with, is involved in, and enjoys being a member of an organization. In other words, this is the degree to which the employee internalizes the values of the organization. This dimension is closely similar to the definition of Porter et al. (1974), i.e., "the relative strength of an individual's identification with and involvement in a particular organization".

Secondly, continuance commitment (Allen & Meyer, 1990; Meyer & Allen, 1991) relates to the switching costs of maintaining the membership or leaving the organization. This refers to the commitment accumulated based on the sacrifices and investments made by an employee, which would be lost if the activity were discontinued (e.g., pay, pension, seniority). This cost-related aspect of commitment draws upon Becker's (1960) early thoughts about the reasons leading to organizational commitment.

Lastly, the normative component refers to employees' abiding by established organizational values and thus having a feeling of obligation to remain with the organization (Meyer & Allen, 1997). Normative commitment sees commitment developing based on internalized loyalty norms, i.e., the feeling of obligation to remain with an organization (Allen & Meyer, 1990; Meyer & Allen, 1991).

In short, according to Meyer and Allen's model, employees are inclined to remain with the organization because they want to (affective commitment), need to (continuance commitment), or ought to (normative commitment) do so. They argued that each type of commitment binds the individual to the organization in different ways and will affect his/her behavior in the workplace differently. According to Allen and Meyer (1990), a person's total commitment should be the combined value of these three psychological states. Table 2 summarizes the three components.

Table 2. Summary of the three dimensions of commitment

Dimension	Definition	Motive for permanence	Psychological state
Affective	The degree to which employees feel emotionally attached to, and identified and involved with the organization.	Want to stay	Desire
Continuance	The degree to which employees feels to remain in the organization due to the recognition of the costs associated with resigning, the lack of alternative jobs, or the feeling that personal sacrifices of quitting will be too high.	Need to stay	Need
Normative	The degree to which employees feel they have a moral duty to remain in the organization.	Must stay	Obligation

Figure 3 illustrates the TCM of organizational commitment. This figure highlights the process by which the antecedent variables (on the left side of the figure) produce psychological states, known as commitments, and how these commitments convert to behavior (on the right-hand side).

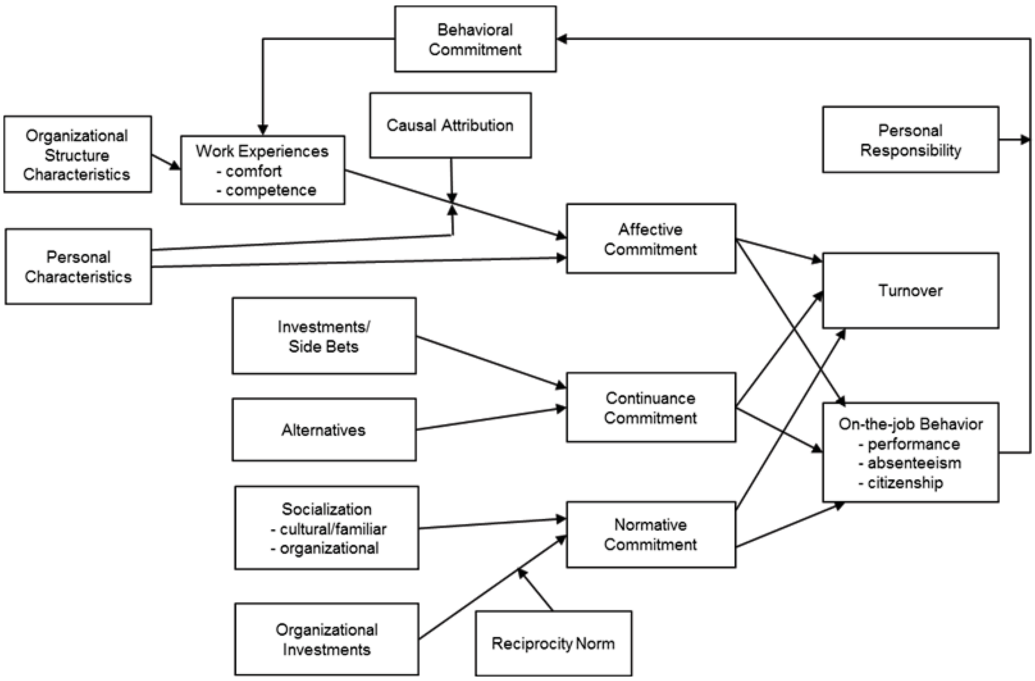

Figure 3. The three-component model of organizational commitment (Meyer & Allen, 1991)

Meyer and Herscovitch (2001) emphasized the importance of looking at the joint effects of the three commitment components. They argued that employees can have varying degrees and different forms of commitment, which will create distinct commitment profiles for each employee, and that the different profiles will have different consequences for job-related outcomes. Stanley, Vandenberghe, Vandenberg and Bentein (2013) also argued the importance of analyzing the role of commitment profiles, rather than analyzing the role of each commitment dimension separately.

Meyer and Herscovitch (2001) suggested that the probability of an employee showing desirable behaviors would be highest in the case of the "pure" affective commitment profile, followed by the "pure" normative commitment profile and then the "pure" continuance commitment profile. This is because, if employees are committed mainly out of desire, they might be more inclined to follow through on their commitment than employees who are committed out of obligation or to avoid costs (Meyer and Herscovitch, 2001). Wasti (2005) emphasized that the latter type of group who feel somewhat "trapped" could be expected to try to find ways to get out of their commitment.

When looking at profiles with different levels of each type of commitment, Meyer and Herscovitch (2001) theorized that a profile with a high affective commitment, complemented by high levels of normative commitment or, especially, continuance commitment, could be less favorable than a profile with "pure" affective commitment in terms of predicting desirable behaviors. They also argued that a profile with high affective commitment, regardless of the supplementary levels of normative and/or continuance commitment, could be better at predicting desirable behaviors than profiles with "pure" high levels of normative or continuance commitment. They continued to speculate that, for profiles with low levels of affective commitment, a "pure" normative commitment profile would be more favorable than a profile with high levels of normative commitment and continuance commitment or "pure" continuance commitment profile. Lastly, the lowest possibility of positive organizational behavior was linked to a profile showing low levels of all three types of commitment (Meyer & Herscovitch, 2001; Wasti, 2005).

Stanley et al. (2013) stressed the importance of analyzing employee groups or particular profiles, rather than examining average responses to commitment surveys. They argue that, when doing an intervention, targeting specific profiles, instead of all employees, could generally enable management to treat high-risk groups more efficiently. For example, employees in the non-committed profile may be at the highest risk of leaving the organization and could find the retention-increasing interventions most useful (Stanley et al., 2013). Employees in the continuance commitment dominant profile may also be another high-risk group because they stay in the organization, but are likely to show lower levels of productivity and overall well-being (Meyer, Stanley & Parfyonova, 2012; Somers, 2009; Stanley et al., 2013; Wasti, 2005).

Meyer and Allen's model of commitment has been extensively used to predict employee outcomes, such as turnover, extra citizenship behaviors, job performance, absenteeism and tardiness (Meyer & Allen, 1991; Meyer et al., 2002). An important rationale for their model is that all three forms of commitment are negatively related to turnover; however, they relate differently to measures of other work-related behaviors (e.g., attendance, in-role performance and OCBs). More specifically, affective commitment is predicted to have the strongest positive relation, followed by normative commitment. Continuance commitment is assumed to be unrelated or have a negative effect on these desirable work behaviors (Meyer et al., 2002).

However, some studies have criticized continuance commitment as being conceptually ambiguous, and that there is redundancy between concepts of normative and affective commitment (Cohen, 2007). Addressing the controversy about the contribution of TCM and some of its dimensions, Cohen (2007) attempted to clarify and better represent the concept of organizational commitment. First, Cohen presented the concept of the timing of commitment, which differentiates commitment propensity, developed before one joins the organization, and organizational commitment, developing after entry into the organization. Accordingly, Cohen (2007) reasoned that normative commitment should be rather viewed as pre-entry commitment propensity than actual commitment, which develops after one's entry into the organization.

Cohen argued that normative commitment is most probably shaped by early socialization and cultural factors, while measuring normative commitment after entry into the organization does not provide much information about the commitment of current employees (Cohen, 2007). Secondly, Cohen introduced dimensions (he called these the bases of commitment), which made a distinction between commitment based on instrumental considerations and commitment based on psychological attachment. Based on this new conceptualization, Cohen (2007) suggested a theory concerning four forms of organizational commitment, two of which develop before entry into the organization and two of which develop after. Figure 4 illustrates this model.

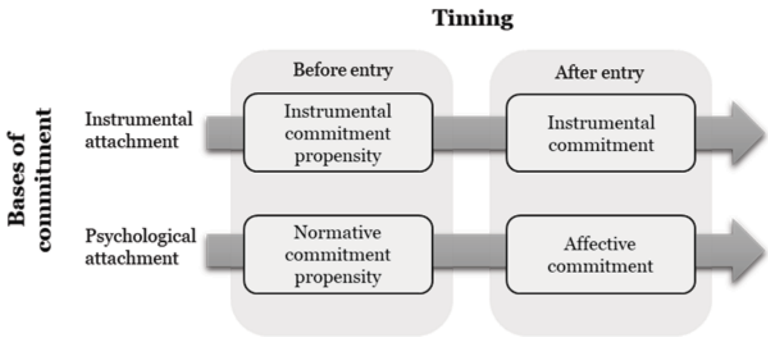

Figure 4. Four-component model of commitment (adapted from Cohen, 2007)

Cohen (2007) described the first two forms of commitment that form before entry as commitment propensities: the first is resulting from one's general expectations about the quality of the exchange (expected benefits and rewards) with the organization, which he called instrumental commitment propensity; and the second is referred to as normative commitment propensity, which describes the general moral obligation toward the organization. Meanwhile, he called the two post-entry forms of commitment instrumental commitment and affective commitment. Instrumental commitment is the outcome of how employees see the quality of the exchange between their contributions and the rewards that they are receiving. On the other hand, Cohen (2007) defined affective commitment as a psychological attachment to the organization, demonstrated by identification, emotional involvement and a sense of belonging to the organization. Cohen (2007) also argued that the two forms of pre-entry commitment are important for determining the two post-entry commitments.

By creating the new four-component conceptualization, Cohen (2007) tried to make several advances in relation to the prevalent conceptualization of commitment. First, by making a distinction between the timing of commitment to pre- and post-entry commitment, Cohen (2007) shifted Meyer and Allen's (1997) conceptualization of normative commitment as a situational attitude, that is, commitment propensity that reflects individual differences. Second, by making the distinction between instrumental and affective commitment, Cohen tried to avoid a possible overlap between continuance commitment and outcomes, such as turnover intentions and some problems with the former's construct and predictive validity by moving the emphasis from the costs of leaving the organization to the instrumental exchange regarding perceptions about the benefits of staying, i.e., instrumental commitment.

These distinctions were meant to solve two problems that commitment researchers had faced. First, it has been argued that affective commitment and normative commitment have a high correlation with one another, leading to questions about the contribution of normative commitment to the conceptualization of commitment. Cohen (2007) argued that high correlations occur because normative commitment is, as a matter of fact, a propensity to be committed before entry to the organization, and not a form of organizational commitment. Second, he suggested that the concept of instrumental commitment could solve the ambiguities that have been linked to the definition and measurement of the continuance commitment (Cohen, 2007).

Additionally, Solinger et al. (2008) questioned the correctness of Allen and Meyer's TCM as a general model of organizational commitment, arguing that it represents a specific model for predicting turnover. They further argued that, as only affective commitment represents a general attitude toward an organization, it describes organizational commitment. In contrast, continuance and normative commitment highlights the antecedents of attitudes toward specific forms of behavior (i.e., the act of staying or leaving), and hence do not represent organizational commitment.

2.1.2 Antecedents of organizational commitment and engagement

Antecedents of organizational commitment are the factors that are believed to contribute to the development of organizational commitment. There have been several comprehensive studies regarding these antecedents; however, antecedents of affective commitment have gained the most research attention (e.g., Allen & Meyer, 1990; Mathieu & Zajac, 1990; Meyer & Allen, 1997; Mowday et al., 1982).

Additionally to the organizational antecedent factors, employees have been influenced by many cultural institutions before joining the organization, for example, family, community, nation, state, church, education systems and other work organizations (Hatch, 1997). These pre-employment associations influence their attitudes, behavior and identity, which in turn affect their propensity, i.e., a predisposition to become committed while working in the organization.

Affective commitment

Antecedents of affective commitment have generally been categorized into three main groups: organizational characteristics, person characteristics and work experiences (Meyer & Allen, 1997). Further, person characteristics have generally been categorized into two types of variables, i.e., demographic variables (e.g., gender, age, tenure) and dispositional variables (e.g., personality, values). According to Mathieu and Zajac's (1990) meta-analysis, personal characteristics of age and tenure tend to have a low positive association with commitment, although it may be nonlinear. Cohen's study showed that correlations were higher for younger employees and for those with high tenure. This may be because employees may need to obtain a certain amount of experience for them to become strongly attached to the organization, or because only employees who develop affective attachment will remain in the organization in the long run (Meyer & Allen, 1997). Level of education was found to have a non-significant or low negative association. Gender did not seem to have an impact on organizational commitment. Additionally, Allen and Meyer (1990) found that perceived personal competence had a strong correlation with commitment (Swailes, 2002).

Meyer and Allen (1997) conclude that the relations between affective commitment and demographic variables have not been found to be strong or consistent. Consequently, in common with many other studies, Meyer and Allen (1997) argue that it is probable that personal characteristics affect the development of affective commitment through certain work experiences. A vast amount of research concerning the importance of work experiences emphasizes the organization's supportiveness toward its employees, fair treatment and enhancement of employees' senses of personal importance and competence (Meyer & Allen, 1997).

Organizational policies and fairness behind organizational acts have been found to have a positive correlation with affective commitment. Also, the way in which new policies are communicated to employees has an influence on the development of commitment (Meyer & Allen, 1997). In addition, several studies have showed high correlations between job scope characteristics and affective commitment. Especially, affective commitment has been positively correlated with job challenge, the degree of autonomy and the variety of skills used by employees (Meyer & Allen, 1997).

Continuance commitment

Conceptually, the development of continuance commitment is fairly direct. Continuance commitment can develop because of any action or event that increases the costs of leaving the organization, as long as employees recognize that these costs have been incurred. In Meyer and Allen's (1991) TCM, these actions and events are categorized as two sets of antecedent variables: investments and alternatives (Meyer & Allen, 1997). Employees can make investments in organizations in a number of ways, for example, by incurring the expense and human cost of relocating a family from another city or by spending time acquiring organization-specific skills. Leaving the organization could mean that an employee would lose or have wasted the time, money or effort that was invested (Meyer & Allen, 1997).

The other hypothesized antecedent of continuance commitment is the employee's perception of employment alternatives. Employees who think they have several other alternatives will have lower continuance commitment than those who believe their alternatives are limited (Meyer & Allen, 1997). It is important to notice that neither investments nor alternatives will have an impact on continuance commitment unless or until the employee realizes them and their implications (Meyer & Allen, 1997).

Normative commitment

Normative commitment develops based on a collection of pressures that individuals feel during their early socialization (from family and culture) and during their socialization as new employee to the organization. Socialization experiences can be very rich and varied, and carry with them all sorts of messages about the appropriateness of particular attitudes and behaviors (Meyer & Allen, 1997). Normative commitment has also been suggested to develop on the basis of a particular kind of investment, which the organization makes in the employee – specifically, an investment that seems difficult for employees to reciprocate. These investments can include for example such things as organization-sponsored tuition payments or "nepotistic" hiring policies. Given the norms of reciprocity, it has been argued that employees could feel this sort of imbalance or indebtedness uncomfortable and, to correct this imbalance, feel a sense of obligation (normative commitment) to the organization. However, cultural differences may exist in the extent to which people have internalized the reciprocity norms and, therefore, the degree to which organizational investments will cause feelings of indebtedness (Meyer & Allen, 1997).

Normative commitment can also develop on the basis of the "psychological contract" between an employee and the organization (Meyer & Allen, 1997). Psychological contracts refer to the perceived exchange agreement between the organization and the employee, i.e., things offered by one of the parties, which are conditional on something the other party does in return (Conway & Briner, 2005). In other words, psychological contracts consist of the beliefs of the parties involved in an exchange relationship regarding their reciprocal obligations (Meyer & Allen, 1997).

2.1.3 Commitment processes

It is believed that there are several intervening, complementary processes that influence the development of organizational commitment. Each of these processes is related to different components (i.e., affective, normative, continuance) of commitment. Figure 5 shows nine processes, which have been identified by previous studies on employee commitment as having a possible effect on the development of organizational commitment. Next, these processes are briefly discussed.

Organizational commitment	Affective commitment	Attribution	Antecedent variables (e.g., personal characteristics, role states, work experiences, idiosyncratic variables, socialization experiences)
		Rationalization	
		Met expectations	
		Person-environment fit	
		Need satisfaction	
	Normative commitment	Expectations	
		Obligations	
	Continuance commitment	Alternatives	
		Investments	

Figure 5. Commitment processes

There are five different processes that have been identified as influencing the development of affective commitment:

1) The attribution process addresses the perceived cause of others' behaviors (e.g., compliance with the law, out of habit, genuine concern for employees). It is believed that employees' perceptions of the motives behind HRM practices moderates their effect on commitment (e.g., Koys, 1988, 1991).

2) Retrospective rationality or justification processes can develop affective commitment to an entity through behavioral commitment. Retrospective rationality occurs very quickly and without the person's awareness (Meyer & Allen, 1997). Meyer and Allen (1997) proposed that employees will be more likely to stay with the organization if they joined the organization based on their own volition decision and made their choice public, and if the decision could not be reversed easily. After being "tied" to the organization, employees will attempt to rationalize their actions, retrospectively, by developing an emotional attachment to the organization.

3) Employees have different expectations about the job when they enter the organization. Employees develop positive attitudes toward the organization when their expectations are met by the experiences within the organization. These expectations influence the degree to which actual experiences within the organization will turn into affective commitment.

However, negative attitudes will develop if those expectations are disconfirmed.

4) Person-environment fit is the process that evaluates how individuals and organizations fit with each other, highlighting the extent to which a person and the organization share similar characteristics and/or meet each other's needs (Kristof, 1996). It includes several other conceptually distinct forms of fit, e.g., person-job fit and person-organization fit (Sekiguchi, 2004).

5) The fulfillment of personal needs, i.e., the needs satisfaction process, has long been assumed to be related to affective commitment (Meyer & Allen, 1997). It is believed that employees will develop affective commitment to an organization if it satisfies their needs, meets their expectations and allows them to achieve their goals. In other words, affective commitment may develop, based on psychologically rewarding experiences (Meyer & Allen, 1997).

Two processes affecting the development of normative commitment have been identified:

1) Grounded on the expectation process, commitment develops on the basis of pressures felt by individuals in their early socialization (from family and culture) and during their socialization in the organization as a new employee. Through the socialization processes, of conditioning (rewards and punishments) and modeling (observation and imitation of others), individuals learn what is expected of them, e.g., the appropriateness of particular attitudes and behaviors. The assumed process here is the process of internalizing the appropriateness of being loyal to one's organization (Meyer & Allen, 1997). Dunham, Grube and Castaneda's (1994) study supports the conclusion that expectations could affect the development of normative commitment.

2) Obligation-related processes and antecedents of the normative commitment are associated with the psychological contract (Rousseau, 1990). Rousseau (1990) argued that the psychological contract is implicit, rather than explicit, in agreements between the organization and its employees. Psychological contracts can also change over time when one or both parties experience obligations to have been fulfilled or violated and can take different forms (i.e., transactional and relational). Relational contracts (social exchange) seem to be more relevant to normative commitment, while, transactional contracts (economic exchange) can influence the development of continuance commitment (Conway & Briner,

2005). Meyer and Allen (1997) argue that normative commitment could also develop, on the basis of investments (e.g., paid tuition) that the organization makes in its employees, which are hard to reciprocate. Employees could feel uncomfortable about the imbalance or indebtedness; to rectify this, they will feel a sense of obligation to the organization (Meyer & Allen, 1997).

Continuance commitment is believed to be affected by two processes:

1) The process of realization of employment alternatives suggests that the employees' need to remain in the organization is affected by the perceptions of the availability of alternative employments. Employees who have many possible alternatives will have lower continuance commitment than those who think their alternatives are limited (Meyer & Allen, 1997).

2) The investment process draws on Becker's (1960) side-bet theory. According to Becker (1960), commitment can be an outcome of the accumulation of side bets that a person makes. These side bets are the investments (e.g., time, effort, money) that an employee would lose if he or she left the organization (Meyer & Allen, 1997). The potential costs can develop with full knowledge by the employee (e.g., special skills training) or they can accumulate over time without the employee being aware of them (e.g., the employee's skills become useless elsewhere). However, unless they are recognized, they have no impact on continuance commitment.

To conclude the discussion about the processes, it must be noted that, although the processes that are believed to be involved in the development of different components have been described separately, they occur, to a large extent, alongside. There is also some criticism concerning some of the processes because of the lack of support there is for their ability to explain the process of commitment formation. Nevertheless, they have all been discussed here since there have been of diverse results in the different studies. In addition, the above-mentioned antecedents and processes have some similarities and are closely related to promote the development of commitment.

2.2 Affecting commitment through human resource management

The term *HRM* is used to describe formal systems created for the management of people within an organization. In its essence, organizations use HRM practices to manage and lead their workforce to meet the organization's growth in the short term and its mission and vision in the long term. Effective HRM uses systems and tools to figure out how to bring together the right amount of people, with the right attitude and skills, in the right place at the right time. Achieving this requires many managerial decisions in three major areas: staffing, employee compensation and benefits, and defining/designing work. Essentially, the goal of HRM is to maximize the productivity of an organization by optimizing the effectiveness of its employees.

It is widely acknowledged that organizational policies and HRM practices can have a significant influence on employee commitment and engagement. Managers should aim to find out how to keep their employees engaged on their job. However, if the management does not understand what is mean by commitment and engagement, they cannot apply it effectively, at least in the long term. According to Shahnawaz and Juyal (2006), commitment is one of the key factors of HRM policy in an effective organization, and that it should be central to organizational strategy. Therefore, according to McElroy (2001), management needs to understand the concept of organizational commitment: what it is, how it operates and, most importantly, the behavior exhibited by committed employees. Addressing relevant issues requires organization-wide HR policies and practices that help to meet or exceed expectations at each level.

According to Wimalasiri (1995), HRM practices promote, reinforce and influence commitment through selection, placement, development, rewards and retention. HRM practices, such as training, recruiting and compensation, are organizational activities directed at ensuring that human capital is working toward the fulfillment of organizational goals (Wright, McMahan & McWilliams, 1994). HR provides the architecture that helps to manage and foster commitment, and thus creates an environment where the highest level of commitment and retention can be attained.

The impact of HRM practices on commitment is believed to be moderated by employees' perceptions of the motives behind these practices (e.g., Koys, 1988, 1991). According to Gaertner and Nollen (1989), the perceptions of HRM practices in addition to context factors (supervisor relations, participation in decision-making and communication) can explain differences in commitment (Meyer & Allen, 1997). According to Meyer and Allen (1997), in order to manage employees' commitment, organizations need to influence their perceptions. Employees' perception of the action specifies which component of commitment is affected. The understanding and application of policies and attributes can either support or prevent higher retention and commitment (Stum, 2001).

Wellins, Bernthal and Phelps (2005) argued that, in order to create an engaged workforce, management must concentrate on five key elements of the work environment:

1. Align efforts with strategy—Effective performance management is the foundation of employee engagement. Employees must have a clear understanding of their work description and a clear set of performance expectations. It is critical to have an understanding of how individual goals are connected to the organization's goals. This drives accountability (Wellins et al., 2005).

2. Empower—Management should try to empower their employees. Empowerment is a feeling of ownership and commitment to the job resulting from employees' making their own decisions, being responsible, being measured by results and being given recognition. Management should design tasks with a specific goal or purpose, which is of value to the individual and gives employees the feeling that their actions are self-determined, rather than controlled by others (Wellins et al., 2005).

3. Encourage teamwork and collaboration—In order to engage through teamwork and collaboration, good relationships are required within the work group and across different work groups. In addition, it requires a clear understanding that everyone is working toward a common goal, rather than competing with each other. The key to developing and fostering high levels of collaboration and teamwork is a work environment built on trust between employees and management. The level of teamwork and supportiveness plays a vital part in influencing whether employees decide to stay with or leave an organization in the long term (Wellins et al., 2005).

4. Support employees' growth and development—Organizations can engage their workforce by promoting a learning culture and making individual development strategies. Management needs to understand employees' strengths and development needs, and offer opportunities to influence or build skills and knowledge. Employees feel engaged when their unique strengths are recognized and capitalized (Wellins et al., 2005).

5. Provide support and recognition—Employees are likely to be more engaged if they feel they are listened to, supported, appreciated and recognized for their contributions. In an engaging environment, support and recognition should be given daily in order to build employee self-esteem and create strong partnerships. Employee appreciation is a critical factor in employees' decisions to stay or leave the organizations (Wellins et al., 2005).

2.3 The importance of organizational commitment

Researchers have found many positive attributes, which high levels of commitment and engagement bring to companies. This has led to the realization that, by focusing on employees' engagement, a more efficient and productive workforce can be attained. Based on commitment theory, each type of commitment is hypothesized to be related to employee retention. Each facet of commitment is also thought to influence job performance, absenteeism and citizenship, although their relations are more vague (Somers, 1995).

From a larger perspective, organizational commitment can benefit the whole society in terms of lower rates of job movement and possibly higher national productivity or work quality or both (Mathieu & Zajac, 1990). According to Wasti (2003), organizational commitment has become an important theme for organizational research since it has associations with extra role behaviors (e.g., Niehoff & Moorman, 1993), absenteeism (e.g., Gellatly, 1995) and turnover (e.g., Somers, 1993). According to Meyer and Allen (1997), high levels of commitment have a strong relation with three important characteristics of working life: employee retention, work performance and employee well-being. Next, each of these characteristics is discussed in brief.

2.3.1 Employee retention (turnover)

The most attention given to the concept of organizational commitment results from the relationship it has with turnover (Cohen, 1993). Employee turnover refers to the proportion of employees who leave an organization over a set period of time, expressed as a percentage of total workforce numbers (CIPD, 2015). In the broadest sense, the term can express all leavers, both voluntary and involuntary; it is also possible to calculate more specific turnover data, such as resignation levels. Retention, on the other hand, states the extent to which an employer retains his or her employees and can be measured as the proportion of employees with a specified length of service, expressed as a percentage of overall workforce numbers (CIPD, 2015). The last related term, *intention to leave*, is an employee's conscious and deliberate desire and intention to leave his or her present organization. It is the last part of a withdrawal cognition process (Mobley, Horner & Hollingsworth, 1978).

Employee retention has consistently been seen as a significant consequence of organizational commitment. By definition, highly committed employees want to remain with their employing organizations (Mowday et al., 1982). Hence, one major way to reduce voluntary turnover is to strengthen employee commitment to the organization (Mohamed, Taylor & Hassan, 2006).

There is a vast amount of research that voluntary employee turnover is affected by job satisfaction (Eisenberger, Cummings, Aemeli & Lynch, 1997; Eisenberger, Huntington, Hutchison & Sowa, 1986; Eisenberger, Stinglhamber, Vandenberghe, Sucharski & Rhoades, 2002; Lee & Mitchell, 1994), commitment (Eisenberger et al., 1986) and availability of other job options (Mitchell, Holtom & Lee, 2001). This shows that, if employees are dissatisfied, they are more likely to leave the organization than satisfied employees. Further, if dissatisfied employees feel that they have many other available opportunities, the possibility of their leaving becomes very real. Conversely, if employees are satisfied and committed, they are not that likely to be attracted by other alternatives. The employees' perception of how the organization values and cares about them is likely to increase their satisfaction and commitment, which in turn fosters their desire to remain in the organization and be motivated and productive.

According to Meyer and Allen (1997), the link between organizational commitment and employee retention is well documented, with each type of commitment hypothesized to affect turnover intention (Meyer & Allen, 1991). There are several studies that have found negative correlations between commitment and employees' intention to leave, as well as actual turnover. However, there are differences in correlations between components of commitment (Meyer & Herscovitch, 2001). Most of the research has focused on affective commitment in predicting turnover. Affective commitment has been found to have the strongest correlations with decreased employee turnover, which is inclined to be enhanced by supportive HRM practices, indicating the organization's concern for its employees (Yao & Wang, 2006). The normative commitment was found to have less correlation than affective commitment, but more than continuance commitment (Meyer & Allen, 1997).

Yao and Wang (2006) have criticized the current research's overemphasis of the role of affective commitment on turnover. According to them, normative commitment may be more important in predicting turnover since that type of loyalty-based commitment can be considered as a better predictor of long-tenured employees' behavioral patterns, i.e., they think it is the right thing to stay in the company (Yao & Wang, 2006). There is also evidence that high levels of continuance commitment lead to self-justified affective ties to the organization, as high sunken costs lead to feeling trapped in the organization and consequently perceptual distortions in the levels of affective commitment to justify one's continued organizational membership (Somers, 1995).

According to Cohen (1993), there is a difference in the prediction of the commitment-turnover relationship between tenure groups. This is because changes in commitment occur quite often among new employees and can be very rapid, largely based on reflections triggered by unrealistic and inflated job previews. However, for older employees, the process from the decline of their organizational commitment to their departure decision can be longer because of structural bonds, few employment alternatives and a desire for stability (Cohen, 1993). Mathieu and Zajac (1990) argue that it is impossible to separate the unique influences of age, tenure and job level on commitment. However, it is likely that older workers have higher positions than younger and newly hired employees because of longer tenure and advancement opportunities. They argue that organizational commitment is likely to be enhanced if the individual prefers to have upward mobility, which is complemented by opportunities for advancement within an organization. Therefore, it is probably more appropriate to consider that a general process of career progression within the organization is associated with organizational commitment than any single variable. In addition, possible financial opportunities (e.g., stock options, profit sharing programs) on the basis of job level or organizational tenure may also increase calculative-type commitment (Mathieu & Zajac, 1990).

It is vital to an organization's success to retain a motivated and positive staff, since employee turnover increases expenses and also has a negative effect on company morale. From a financial perspective, turnover can be highly costly for the organization. According to Borysenko (2015), estimated costs for employee turnover vary from 30-50% of the annual salary for entry-level employees to 400% of the annual salary for high-level or highly specialized employees. The actual turnover costs depend on the industry, the type of job and the availability of replacing employees, among other factors (Hinkin & Tracey, 2000). The costs accumulate from recruitment advertising to the selection process and training period, and lost investments in terms of time and money in a previous person's training. Possible lost business/clients and deciding to work for a competitor can also be very costly for the organization, as well as new employees' time to learn and emotional costs, such as lower productivity from the rest of the team.

However, the effect of turnover and the decision to decrease turnover is organization-specific. The negative effect of employee turnover for the employer depends on many factors, such as the industry in which the organization operates. According to Allen, Shore and Griffeth (2003), companies should try to reduce turnover if their organizational practices are perceived and managed as investments in the employees and their professional development (Allen et al., 2003). In conclusion, an organization with less turnover always has advantages compared to those with a higher rate of turnover operating in the same field (Hinkin & Tracey, 2000).

However, it must be noted that not all employee turnover is detrimental to the organization (Torrington, Hall & Taylor, 2005). A certain amount of turnover can revitalize the organization and workforce, and bring in new ideas. Especially at management level, turnover can help to drive changes in the organization. New employees can also contribute new ideas and experiences to the organization. Further, through turnover, organizations can control their employee costs and get rid of unwanted poorly performing employees. In uncertain environments, management can even delay hiring new employees to replace those who are leaving and hence save on labor costs. By doing so, management must make sure that the recruitment process is effective enough to replace leavers with effective employees (Torrington et al., 2005). Therefore, the organization should have strategies in place for retaining good employees in order to reduce employee replacement costs and indirect costs, such as decreased productivity or lost customers.

2.3.2 Work performance

A high-performance organization is the main objective of modern HRM (Creative HRM, 2016). According to organizational commitment theory, an employee's commitment to his or her organization can make him or her remain with the organization, as well as exert effort on its behalf. There have been many studies investigating the linkage between commitment and organizational performance. According to Marchington and Wilkinson (2005), there is no doubt that the correlation between management and business performance is positive, and that it is cumulative. In addition, employee performance and turnover are affected strongly by HRM practices (Huselid, 1995). According to Becker and Huselid (1998), the HR system is an important function that can help an organization become more effective and achieve a competitive advantage.

Most studies have focused on the linkage between the affective type of commitment and performance. Many studies (e.g., Barling, Weber & Kelloway, 1996; Keller, 1992; Meyer & Allen, 1997; Meyer, Paunonen, Gellatly, Goffin & Jackson, 1989) have strengthened the proposition that affective commitment is in a key position to predict performance. According to Kelloway and Barling (2000), employees who display positive affective attitudes (pride in membership, desire to be a part, willingness to retain membership) to the organization are likely to be motivated to help the organization, and one way of doing this is to elevate one's performance. They suggest that affective commitment is a predictor of how much employees invest their knowledge in the organization (Kelloway & Barling, 2000).

Affective commitment is grounded in the reciprocal and exchange-based relationship between the employee and the organization. Based on this, the employee offers his or her talents to the organization in exchange for rewards of organizational membership. Thus, Kelloway and Barling (2000) suggest that employees' willingness to use their knowledge to help the organization is related to their trust and commitment to the organization.

Meyer and Allen (1997) identified that there is a link between different components of commitment (affective, normative and continuance) and employees' work performance. According to them, organizational commitment has relations with (1) attendance at work, (2) in-role job performance and (3) OCB.

Attendance at work

Organizational commitment has most often been used to predict withdrawal behaviors (Mathieu & Zajac, 1990). Several studies have looked at the relationship between organizational commitment and attendance at work. Based on the research, affective commitment has a significant and positive relation to attendance, or its opposite, absenteeism (Meyer & Allen, 1997). According to Mathieu and Zajac's (1990) meta-analyses, organizational commitment correlates positively with attendance, and negatively with lateness and turnover, as well as demonstrating large correlations with two turnover-related intentions: (1) the intention to search for job alternatives, and (2) the intention to leave one's job. Meyer and Allen (1997) state that affective commitment is highly related to voluntary absences from work, which refers to something that employees have control over; however; it is not ordinarily expected to influence involuntary absences, such as those due to illness or family emergency.

In contrast to affective commitment, absenteeism does not have significant relations with continuance commitment or normative commitment, or at least the relation is not clear. However, some studies have found some support for the claim that annexed absences (absences attached to a weekend or holiday) were predicted by an interaction between affective and continuance commitment. One study specifically showed that the relation between annexed absences and affective commitment were found to be lower if there is moderate to high levels of continuance commitment, than if continuance commitment is low. However, if both affective commitment and continuance commitment are low, annexed absences tend to be on a high level.

In-role job performance

Meyer and Allen (1997) refer to in-role job performance as the performance employees give to duties, activities and accomplishments related to the required features of the job, which are considered as “part of the job”. Several studies have suggested that employees with stronger affective commitment are harder working and perform better at their in-role duties than those with weaker affective commitment. According to Cascio (1982; cited in Meyer & Allen, 1997), even small changes in employee performance can have a significant impact on the organization’s net income and either improve or diminish its competitive advantage.

According to Meyer and Allen (1997), affectively committed employees focus their attention to aspects of job performance, which they consider to have value for the organization (Meyer & Allen, 1997). In addition, affectively committed employees are likely to modify their behavior and contribution based on the skills, preferences and activities of their co-workers, which will likely have some impact on overall organizational performance by reducing redundant behavior and filling gaps (Meyer & Allen, 1997).

Further, affective commitment has been found to be positively related with many self-reported measures of work effort and managers’ self-reported adherence to organizational policy. Kim and Mauborgne (1993) found that managers who have strong affective commitment reported higher levels of compliance with strategic decisions made at the corporate level. Nouri (1994) also reported that managers with high affective commitment were more likely to obey to corporate policies by avoiding budgetary slack. Many studies have also correlated affective commitment with self-reported measures of overall job performance, as well as an independent assessment of performance, such as sales figures (Bashaw & Grant, 1994) and the control of operational costs (DeCotiis & Summers, 1987). According to Steyrer et al. (2008), organizational commitment correlates positively with economic measures of company success. They argue that this relation can hardly be unidirectional, as an attachment to, identification with and willingness to work hard for the company are arguably advanced by the feeling of being part of a successful organization (Steyrer et al., 2008).

Based on Angle and Lawson’s (1994) study, aspects of performance that are motivational in nature tend to correlate significantly with commitment. In their study, in particular, employee dependability and initiative were correlated with commitment, whereas those that do not correlate with commitment, such as employee ability, may be more strongly influenced by non-motivational factors.

Relations between different performance measures and continuance and normative commitment are weaker. Several researchers examining continuance commitment have suggested that it has non-significant correlations with performance indicators (Meyer & Allen, 1997). Studies concerning the relation between normative commitment and performance indicators are relatively limited. Relations are similar to those with affective commitment, but weaker. Normative commitment has been found to correlate positively with self-reported measures of work effort and overall performance. However, a study by Hackett, Bycio and Hausdorf (1994) showed that there are no significant relations between normative commitment and independently measured performance indicators.

Organizational citizenship behaviors

According to Organ's (1997) definition, OCBs involve "performance that supports the social and psychological environment in which task performance takes place". One of the key reasons for the interest in OCBs or extra role behaviors is that they are expected to be positively related to measures of organizational effectiveness and performance. Many studies highlight the link between high affective commitment and OCBs (Meyer & Allen, 1997).

OCB encompasses positive things that employees do of their own volition, which supports co-workers and benefits the company. According to Organ and Ryan (1995), OCB refers to individual contributions in the workplace, which go beyond role requirements and contractually rewarded job achievements, as well as organizational policy and one's own job description (Meyer & Allen, 1997). As opposed to in-role job performance, OCB includes such contributions as volunteering for extra job activities, providing help to others, and adhering to workplace rules and procedures regardless of personal inconvenience (Organ & Ryan, 1995). It is about going the "extra mile". Such behavior is not easily governed by individual incentive schemes because it is often too subtle to measure and may contribute more to others' performance than one's own (Smith, Organ & Near, 1983). However, it must be noted that high OCB can have potentially negative consequences, including increased levels of role overload, stress and work-family conflicts (Bolino & Turnley, 2005).

In addition to expected individual-level outcomes, OCBs are expected to have effects on the unit or organizational outcomes as well. It is believed that extra role performance can be a critical factor in creating organizational success (Meyer & Allen, 1997). According to Podsakoff, Whiting, Podsakoff and Blume's (2009) meta-analysis, several researchers (Borman & Motowidlo, 1993; Organ, 1988; P. M. Podsakoff, Ahearne & MacKenzie, 1997; Podsakoff & MacKenzie, 1997) have explored reasons why OCBs could enhance unit- or organization-level effectiveness. Based on their studies, for example, experienced employees who show OCBs can boost the productivity of less experienced peers by teaching them best practices. Similarly, employees exhibiting OCBs may offer their manager useful suggestions that improve unit effectiveness, reduce costs, or free up the manager's time. In addition, OCBs may also enhance team spirit, morale and cohesiveness, and enhance the organization's ability to attract and retain the best employees. Many studies also relate OCBs positively to a variety of unit or organizational effectiveness measures, including production quantity, efficiency, profitability, and the reduction of costs (Podsakoff et al., 2009).

Yen and Niehoff (2004) noted that OCBs can also influence external effectiveness measures, such as customer satisfaction of the organization. This is because altruistic employees encourage teamwork and cooperation among co-workers, which allows them to provide goods or services more effectively, possibly leading to increased customer satisfaction. In addition, such employees are likely to stay informed and up to date about the products and services their company offers, and provide ideas on how to improve customer service, which will lead to increased customer satisfaction.

Many studies using self-reports and the independent assessment of behavior have observed significant relations between affective commitment and OCBs (Meyer & Allen, 1997). According to Organ and Ryan (1995), affective commitment has significant correlations with altruism toward specific members of the organization and general obedience with the rules and norms of the organization. Similar to affective commitment, normative commitment has been found to be positively related to OCBs, although the link is weaker. Research on the possible link between continuance commitment and OCBs has yielded mixed results, as both unrelated and negative results have been reported (Meyer & Allen, 1997).

2.3.3 Employee well-being

Commitment to the organization may also have implications for employee well-being and behavior beyond the workplace (Meyer & Allen, 1997). Researchers suggest that commitment can also benefit employees, making it potentially a win-win situation (Meyer & Maltin, 2010).

While most previous studies have been concerned with affective commitment, the relation between well-being and normative commitment and continuance commitment has also been studied. Although the research has been fragmented and to a certain degree unsystematic, there is a reasonably sized body of evidence linking commitment to employee well-being (Meyer & Maltin, 2010). Meyer and

Maltin (2010) suggest that having a strong affective commitment to one's organization results in the most positive health benefits for individuals, as well as having the most positive consequences for employers.

According to Meyer and Maltin (2010), various studies have consistently found positive relations between affective commitment and indices of employee well-being, including general physical well-being, general health, mental health, positive affect, job-related well-being, self-esteem and life satisfaction. In contrast, studies have consistently found negative relations with measures of strain, including psychosomatic symptoms, physical health complaints, mental health problems such as anxiety and depression, negative affect, burnout, and feelings of stress, distress, general strain and job-related tension.

The relation between continuance commitment and employee well-being or strain is not so well examined. However, studies have found a negative relation with life satisfaction, and positive relations with indices of strain, including work-related tension, time anxiety, and emotional exhaustion. Studies concerning normative commitment are even scarcer with most reporting non-significant correlations with various indices of strain (Meyer & Maltin, 2010).

To conclude, affective commitment seems to be positively related to well-being and negatively to strain, whereas continuance commitment appears to relate positively to strain in many cases. Finally, studies involving normative commitment generally come up with very weak relations. Therefore, one of the most important things for managers to do in order to improve well-being is to decrease the stressors in the workplace and avoid practices that advance the development of pure continuance commitment.

2.4 Student commitment and engagement in educational institutions

This chapter briefly describes the theoretical framework behind the other application whose development came as a spin-off from the organizational commitment/engagement ontology and the application. The construction of the application and its usage are described in Chapter 3.2.

It has been said that students stay in their respective higher education institution for similar reasons to those of employees in organizations, such that student withdrawal can be considered to be similar as employee turnover (Bean, 1979). As with organizational commitment, where an employee is committed to a particular organization, opposed to career commitment, studies have shown that students who are committed to a specific educational institution graduate more likely than those who have the goal of graduating, but feel no commitment to any specific university. According to Blau (1985), career commitment can be defined as “one’s attitude toward one’s profession or vocation”, whereas organizational commitment is said to refer to commitment toward a particular organization. Carmeli and Gefen (2005) suggested that affective organizational commitment will be the key predictor of withdrawal intentions from the organization, and that career commitment will be the key predictor of withdrawal intentions from the occupation.

According to Astin (1984), the term *engagement* in an academic context means “the amount of physical and psychological energy that the student devotes to the academic experience”. More recently, Kuh (2009) defined student engagement as the time and effort that students devote in educational activities, which are empirically linked to desired outcomes and what institutions do to induce students to participate in these activities. Generally, student engagement has been used to describe commitment to and investment in learning, identification and belonging at an educational institution, and, in terms of participation in the school environment and initiation of an activity leading to an accomplishment, associated with desired academic, social, and emotional learning outcomes (Christenson et al., 2008).

Several factors affect student engagement, for example, socioeconomic status, race/ethnic background, academic preparation and intergenerational effect of parents’ education (whether parents have a university education or not) all have implications for the level of student engagement (Pascarella, Pierson, Wolniak & Terenzini, 2004; Pascarella & Terenzini, 2005; Welch & Bonnan-White, 2012). Factors such as investment in the academic experience, interactions with the faculty, involvement in co-curricular activities and interaction with peers are also involved in academic engagement (Kuh, 2009; Pascarella & Terenzini, 2005).

Further, a key factor regarding engagement is the students’ level of motivation. In order for students to be engaged and motivated to learn, underlying psychological variables related to motivation, such as competence and control, beliefs about the value of education, and a sense of belonging must be fulfilled (Youth & Studer, 2004). In short, motivation and engagement are gained by promoting students’ confidence to learn and succeed by providing challenging instructions and support for meeting high standards (National Research Council, Institute of Medicine et al., 2004).

It is widely accepted that engagement and academic achievements are tightly related to each other (Welch & Bonnan-White, 2012). Research has shown that student engagement leads to many positive outcomes, such as student success and achievement, obtaining higher grades, showing better performance during tests, feeling a greater sense of belonging and meeting personal goals, and valuing education, in addition to being a good indicator of institutional quality (Christenson et al., 2008).

Engagement has become a significant consideration as a means of understanding student behavior and performance, and for addressing student needs (Christenson et al., 2008). It has also been identified as a means to understand the gradual process in students' life and influence the final decision to stay or leave (Hart, Stewart & Jimerson, 2011). Alexander, Entwisle and Horsey (1997) argue that academic engagement is the primary key to understand and prevent student dropout. It is suggested that an understanding of student engagement could help educators to prevent harmful outcomes and promote positive ones for at-risk students (Hart et al., 2011).

It is generally acknowledged that student engagement is vital to school success; therefore, making sure that students connect to their school and to their learning is crucial. Such engagement and commitment have many facets, which all need to be addressed to increase the chances of sustaining and developing the overall level of student engagement.

2.4.1 Dimensions of academic engagement

There are different dimensions or elements in academic engagement. Some researchers argue that it is a two-dimensional (i.e., behavioral and emotional) construct (Finn & Voelkl, 1993; Skinner & Belmont, 1993), while others argue that there are three separate dimensions (i.e., behavioral, emotional, and cognitive) (Fredricks, Blumenfeld & Paris, 2004). There are also many conceptualizations of engagement, which include only one or two of the three types (Fredricks et al., 2004).

The emotional element of engagement includes the student's perceptions and attitudes concerning the norms of the institution, and their feelings toward school, learning, teachers and peers, and the emphasis that the academic institution has on scholarly activities, diversity and vocational preparation (Hart et al., 2011; Kuh & Hu, 2001). In the literature, the construct of emotional engagement has also been described using the terms *affective* and *psychological engagement* (Appleton, Christenson & Furlong, 2008; Hart et al., 2011).

The behavioral element of engagement includes student interaction and participation with faculty members and peers, and is investigated through students' positive conduct, such as following rules and norms, effort and persistence, and participation in school-related activities and attendance (Fredricks et al., 2004).

Cognitive engagement focuses on inner psychological investment in an effort directed toward learning, understanding, mastering knowledge, the desire to go beyond requirements, and a preference for challenge, implying more than behavioral engagement. The literature describes cognitive engagement in terms of being strategic or self-regulating (Fredricks et al., 2004).

2.4.2 Theoretical models of student retention

For years, two commonly referenced theories of student persistence and retention have been Tinto's (1975, 1987, 1993) student integration model (also known as Tinto's theory of student departure) and Bean's (1979, 1982) student attrition model. Even though each model has a unique theoretical foundation, i.e., Tinto's model is derived from the theory of suicide, while Bean's model relates to employee turnover, both models emphasize the importance of background characteristics and student experiences.

Berger et al. (2005), in their historical overview of retention, defined the terms *persistence* and *retention* as follows: persistence refers to the desire and action of a student to stay within the system of higher education from the first year through to degree completion, while retention refers to the ability of an institution to retain a student from admission to the university through to graduation (Berger et al., 2005). There are many other models of student retention. For example, Pascarella and Terenzini's (2005) work offers a summary of different theories and model, which have been used in research on student involvement for decades.

Tinto's theory of student departure

Tinto's theory of student departure explains the longitudinal process and forces that affect students' voluntary departure from the academic institution prior to degree completion (Tinto, 1988). According to Tinto (1982), academic retention involves two different types of commitment from students. The first one, goal commitment, describes students' commitment to graduate and obtain a degree, while the second, institutional commitment, concentrates on their decision to obtain that degree at a specific institution. These commitments, combined, characterize what affects students' commitment to a particular institution (DeShields, Kara & Kaynak, 2005).

Based on Tinto, students' background characteristics (family background, individual attributes and experiences from earlier education) influence their initial level of goal commitment and initial commitment to their educational institution. According to Tinto (1975), the key to actual persistence is integration, which occurs when a student succeeds in integrating into the institution academically and socially. Tinto describes integration as the degree to which a person integrates the values and norms of a community to his or her value system (Tinto, 2012). Classmate and faculty interactions, as well as out-of-classroom factors, all contribute to social integration, which influences both goal and institutional commitment (Grosset, 1991).

Similarly, Habley (2004) argued that one of the key factors affecting students' retention is the quality of interaction they have with other people on campus. This increased integration, both academically and socially, leads to higher goal commitment and institutional commitment, resulting in lower dropout rates and higher graduation rates. Thus, successful social and academic integration influences students' commitment to the goal of completing their degree and their commitment to the particular institution, consequently affecting the decision to stay at or leave the institution. According to Tinto, students who fail to successfully integrate academically or socially could also have difficulties in their academic progress, such that they are likely to leave their educational institution.

According to Tinto (2003), there are five vital conditions that support student persistence: expectations, support, feedback, involvement and learning. Tinto argued that students are more likely to remain and graduate in a setting that (1) expects them to succeed, (2) provides academic, social and personal support, (3) provides frequent and early feedback about their performance as they try to learn and persist, (4) involves them as valued members of the institution (e.g., frequent and quality interaction with staff and other students), and (5), most importantly, fosters learning. Students who are actively involved in studying, i.e., who use more time for tasks, especially with others, are more likely to learn and, in turn, more likely to stay and graduate (Tinto, 2003).

Bean's model of student attrition

Bean developed the student attrition model (Bean & Metzner, 1985; Bean, 1979) by referring to the organizational commitment literature, particularly Price's (1977) study of turnover. In his model, student withdrawal is viewed in the same way as employee turnover in work organizations. He argued that, in the process of student attrition, students stay in their higher educational institutions for similar reasons to employees in organizations, and that students and employees leave for similar reasons. Students' interaction with their respective organization plays an important part in the longitudinal attrition process, which influences their decision to stay or drop out (Bean, 1981a). According to Bean (1981a), student attrition (a term used interchangeably with "dropout") can be defined as the cessation of individual student enrollment in a particular institution (Bean, 1981a).

Bean's model was created to identify factors that influence students' intention to leave and effect their decision to drop out from an educational institution from multiple perspectives (Bean, 1981a). Bean (1981a) developed his model of student attrition by identifying and categorizing related factors from psychological, sociological and educational sources. His model contains six sets of variables leading to dropout in causal sequence: (1) background, (2) organizational, (3) personal, (4) environmental and (5) attitudinal variables, which all are expected to influence (6) intent to leave. All these six variables affect students' decision to drop out. In his later revised theoretical model, Bean (1981b) classified personal variables and attitudinal variables in the same category of outcomes and attitudinal variables, on the basis that they did not appear to be conceptually different. According to Bean (1981a), intentions are the result of attitudes, norms and previous behaviors, and these intentions precede subsequent behaviors, in this case, the dropout decision.

Consequently, Bean's (1981b) later synthetic model of student attrition identified four classes of variables: background variables, organizational variables, environmental variables, and attitudinal and outcome variables. All of these variables have direct or indirect effects on intent to leave, which is the immediate precursor of dropping out. Bean (1981b) concluded that any study related to student attrition should include specific variables within these categories for understanding dropout. However, researchers can adapt the model by adding or deleting variables within these categories to adjust it to different contexts and the specific needs of a particular institution.

Later on, Bean and Metzner (1985) advanced their research by attempting to create a conceptual model of the dropout process for non-traditional students. They characterize non-traditional students as students who have lessened intensity and duration of interaction with the primary agents of socialization (e.g., faculty, peers) at the educational institution they are attending (Bean & Metzner, 1985). Typically, non-traditional students have to find a balance between their studies and employment. According to Fleming (2009), they usually are either full-time students, working part-time, or part-time students who have full-time jobs

(Fleming, 2009). Frequently, these types of students live relatively far away from their place of education and, only attend part-time, for example, because of work, and have family responsibilities.

Bean and Metzner (1985) contended that the main difference between the attrition process of traditional and non-traditional students is that external environment conditions affect more non-traditional students than traditional students, who are affected more by social integration variables. The participation of such students in the extracurricular activities is relatively small compared to traditional students, as are the impacts of other social integration variables that are considered to have a significant impact on traditional students. (Bean & Metzner, 1985). This pattern of participation increasingly characterizes higher education students in Europe nowadays (Fleming, 2009).

Research conducted by Cabrera, Castaneda, Nora and Hengstler (1992), comparing Tinto's and Bean's models, attempted to gain a better understanding of the student persistence process. Based on their research, the two models have several similarities, such as both models regard persistence as the result of a complex set of interactions over time, and that the precollege characteristics have an influence on how well students subsequently adjust to their institution. Furthermore, both models say that the successful match between the student and the institution is a key factor for affecting persistence. Contradictory to the student integration model, the student attrition model underscores the external role factors in influencing attitudes and behaviors.

In addition, the student integration model views academic performance as an indicator of academic integration, while the student attrition model regards test scores as an outcome variable resulting from social-psychological processes. The models also have different perspectives in terms of which variables have the strongest effect on persistence. According to the researchers' comparison, the student integration model suggests that academic integration, social integration, institutional commitment and goal commitment, to some extent, have the highest effects on student retention. However, the student attrition model emphasizes the role of intent to persist, attitudes, institutional fit and external factors (e.g., family approval, peer encouragement, financial aspects and perceptions of possibilities to transfer to other institutions) on persisting behavior. They concluded that these two dominant theories of persistence are not mutually exclusive, but a more comprehensive understanding of the persistence process could be achieved by combining them (Cabrera et al., 1992).

2.5 Decision support systems

In the early 1970s, Michael S. Scott Morton articulated the first concepts involved in DSSs under the term *management decision systems* (Sprague, 1980). Before that, the two main areas of research that contributed to the development of research in DSSs were theoretical studies of organizational decision-making at the Carnegie Institute of Technology during the late 1950s and early 1960s, as well as the technical work carried out at the MIT in the 1960s (Shim et al., 2002). With developments in technology, DSSs started to incorporate more sophisticated web-based applications in the mid-1990s (Cohen & Condeluci, 2014). Since the early days, DSSs have evolved significantly and moved from representing a radical movement, which changed the way information systems were perceived in business, to a mainstream commercial systems that all organizations can utilize (Arnott & Pervan, 2005), not only to help support smart enterprise-level decisions but to help their customers make product decisions as well (Cohen & Condeluci, 2014). Over the past three decades, DSSs have delivered substantial success in many areas of business activities such as in logistics and operations management.

DSSs represent an area of the information systems discipline that is focused on supporting and improving managerial decision-making (Arnott & Pervan, 2005). DSS research has typically focused on how to improve the efficiency of making decisions and the effectiveness of those decisions using information technology (Shim et al., 2002). They are different types of information systems whose purpose is to support complex decision-making and problem-solving by providing information and structure needed to make rational decisions. DSSs help to understand the underlying issues and situations, and to make decisions where the activities or outcomes are not initially clear or only a part of the information is available in advance (Sprague, 1980). By extended definition, DSSs can include any system that makes some contribution to decision-making.

These interactive computer-based systems, which draw on transaction processing systems and interact with other parts of the overall information system, help decision makers to utilize data and models to solve unstructured problems (Sprague, 1980). Normally, a DSS is embedded in an information system that acquires and processes input data, then transforms it into usable output data related to complicated or complex problems. The DSS manages the database and provides inputs to quantitative models, manages and integrates the models, and interacts with the user to execute queries and analyses, as well as interpret model outputs (Vanharanta, Magnusson, Ingman, Holmbom & Kantola, 2012). DSSs are used in organizations, usually by mid-level or higher management and other knowledge workers, to help make decisions regarding management, operations and planning.

Sprague (1980) highlights the characteristics of DSSs as follows:

- DSSs are likely to be directed at less well-structured, underspecified problems, which upper-level managers typically face.

- DSSs attempt to combine the use of models or analytic techniques with traditional data access and retrieval functions.

- DSSs explicitly emphasize features, which make them easy to use by non-computer people in an interactive mode.

- DSSs are flexible and adaptable in terms of facilitating changes in the environment and the decision-making approach of the user.

DSSs are tools to facilitate organizational processes, which can be completely computerized or human-powered, or somewhere in the middle. At present, DSSs includes personal DSSs, group support systems, executive information systems, online analytical processing systems, data warehousing and business intelligence systems (Arnott & Pervan, 2005).

According to Sprague (1980), DSSs should involve six requirements in order to utilize the full performance of the DSS concept. However, the required performance criteria for any particular DSS will depend entirely on the task, the organizational environment and the decision maker(s) involved. The six criteria are as follows:

1. DSSs should provide support for decision-making activities, emphasizing semi-structured and unstructured decisions.

2. DSSs should provide support in decision-making to managers at all levels, and assist in integration between levels whenever suitable.

3. DSSs should support interdependent and independent decisions, by having different capabilities to support each type of decision (personal support, organizational support and group support).

4. DSSs should provide support at all stages of the decision-making process. For example, a classic model of rational decision-making by Herbert Simon (originally published in Simon, 1960) suggests that, to make intelligent decisions, people should first search for whether there is something that needs problem-solving

and/or decision-making. Next, they should design, invent, develop and analyze possible courses of action. In this step, the problem is understood, and solutions are generated and tested for feasibility. The last step is to make a choice by selecting a course of action from what is available and implement it.

5. DSSs should support different decision-making processes, and not be dependent on any specific one.

6. The last performance requirement for DSSs is that they should be easy to use.

Figure 6 describes the ordinary process of decision-making in a DSS environment. The emphasis in this process is on model development and problem analysis.

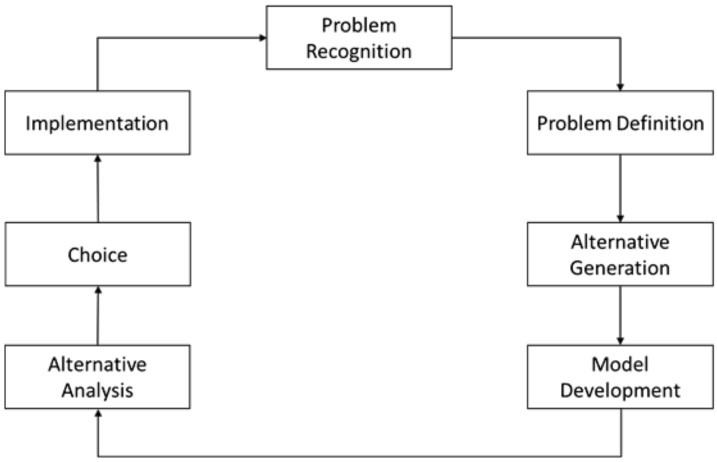

Figure 6. The DSS decision-making process (Shim et al., 2002)

The first step in the process is problem recognition. After the problem is recognized, it is defined in terms that facilitate the creation of the model. In the next step, alternative solutions are created, with the models developed to analyze the alternatives. Lastly, the choice is made and implemented. According to Shim et al. (2002), these phases tend to overlap and blend together, and involve frequent loops back to earlier stages, as more is learned about the problem, or because of solutions fail, and so forth.

Typically, DSSs comprise three components: 1) sophisticated database management capabilities with access to internal and external data, information, and knowledge; 2) powerful modeling functions accessed by a model management system; and 3) capable user interface designs, which enable interactive queries, reporting and graphing functions (Shim et al., 2002).

DSSs can also be categorized into different types. Categorizing and differentiating DSSs can help researchers and managers to understand how information systems impact decisional behavior, and how one should design and construct such systems (Power & Sharda, 2007).

According to Power and Sharda (2007), there are five common types of DSS: 1) communications-driven, 2) data-driven, 3) document-driven, 4) knowledge-driven and 5) model-driven systems. These categories can be recognized by identifying the dominant architectural component that provides the functionality for supporting decision-making.

For a communications-driven DSS, different communication technologies are vital in supporting decision-making. The purpose of this type of DSS is to help conduct a meeting, or for users to collaborate, for example, using instant messaging and online collaboration.

A data-driven DSS is mostly used by managers and staff, but also suppliers of products and services. It is used to deliver access to large data storages and analytics to create information. For example, computer-based databases with a query system for checking are data-driven DSSs.

A document-driven DSS uses documents to make information available for decision-making. This is most common type of DSS, which is targeted at a wide base of users. Document-driven DSSs are usually used when searching web pages and finding documents for some specific keywords.

Knowledge-driven DSSs are also known as expert systems or recommender systems. They cover wide-ranging systems covering users within the organization, but may also include others interacting with the organization, for example, consumers of a business. They are usually used to provide management advice or choose products or services.

Model-driven DSSs are complex systems that are used to analyze decisions or choose between different options. Model-driven DSSs use quantitative models for functionality; they are also called model-oriented DSSs and computationally oriented DSSs. Managers and staff members use such DSSs for various purposes, depending on the set up of the model, for example, for scheduling or decisional analyses.

Knowledge management systems encompass both document- and knowledge-driven DSS (Power, Sharda & Burstein, 2015).

2.5.1 Decision support systems in human resources management

In HRM, there are many activities that involve unstructured processes, such as recruitment, training, motivation and maintenance (Decenzo & Robbins, 2005). Decision-making in these kinds of unstructured processes usually depends on human judgment and preferences. While DSSs have been used for HRM problems, these have generally involved fields such as personnel scheduling (Ernst, Jiang, Krishnamoorthy & Sier, 2004), which does not differ much from scheduling manufacturing processes, such those involving machinery.

Given that most aspects of HRM require “soft” skills, since it involves dealings with people, it has therefore been less suitable for the application of information technology, which has meant that it has been less researched in the past than other business applications (Keenan, McGarraghy, McNamara, Phelan & Schools, 2004). However, advances in research and technology have started a new era in which it is possible to also incorporate “soft” and “unstructured” abstract concepts, such as those encountered in strategic management generally, into computerized working environments (Vanharanta et al., 2012).

For managers, it is essential to have full knowledge of the problem. However, human decisions are subject to limitations because of information overload, forgetting important details of the problem, or making decisions based on personal preference or bias. This can lead to careless, inconsistent or unfair decisions. DSS applications to gather input and processing output data for decision-making (Vanharanta et al., 2012) can be used to provide impartial and consistent decisions, thus increasing the effectiveness of decision-making processes (Palma-dos-Reis & others, 1999). DSS applications can be specifically developed to support various non-structured management problems, and to be flexible, adaptable and interactive. According to Turban, Sharda and Delen (2011), DSSs are used to assist decisions makers in order to extend their capabilities, but not to replace their judgment.

DSSs in HRM try to solve specific problems or give information on specific domains. These DSSs either support personnel in their daily tasks or provide useful conclusions to decision makers. Most of the DSS applications used in HRM involve the expert system or knowledge-based system approach (Mantra & Bhar, 2016). An expert system is a computer application that contains and can apply specialized knowledge to make suggestions to users, who may not have the full range of expertise offered by the system (Shortliffe & Fagan, 1982). Expert systems can capture expert knowledge in the HRM field, and support and educate managers, for instance, engaged in personnel selection (Keenan et al., 2004). According to Hannon, Milkovich and Sturman (1990), expert systems can also be designed to diagnose the reasons behind employee turnover problems through a series of branched questions. The system architecture in these systems must emulate the reality of organizational and individual behavior to allow the strategy makers to have a holistic view of the organization's activities, its operating environment and its external structure (Vanharanta et al., 2012).

However, expert systems in HRM may have limitations, for instance incorrect knowledge resulting from the difficulty in gathering knowledge from appropriate experts, difficulty in representing that knowledge in a computer model, and computers' inability to learn. Further, some people may fear that, when using an expert system, they are no longer the actual decision maker, as they feel that the computer is taking over the decision-making process (Hooper, Galvin, Kilmer & Liebowitz, 1998). In light of these problems with the expert system approach, other techniques, such as hybrid intelligent techniques, can be very effective in HR DSS research. Newer research regarding HR-related DSSs tends to use other intelligent methods, such as data mining and neural network approaches (Mantra & Bhar, 2016). Table 3 describes different techniques used for various HR-related applications.

Table 3. DSS techniques used for the various functions of human resources (Mantra & Bhar, 2016)

Category	DSS technique used
Staffing and personnel selection	Knowledge-based system (Hooper et al, 1998)
	Data mining (Huang et al, 2006)
Training and development	Knowledge-based system (Liao, 2007)
Motivation, performance appraisal	Artificial neural network (Tung et al, 2005)
Administration and scheduling	Software agent (Glenzer, 2003)

This research suggests that, by using the created DSS, a so-called co-expert system, organizations can get insights from their employees to enhance actual HR-related decision-making through visual perception, as well as through textual meanings and meta-knowledge formation. The term *co-expert system* refers to an interactive DSS, which can be used to capture the bottom-up view of the organization's environment (Kantola, Paajanen, Piirto & Vanharanta, 2004). This system is intended to help management in their dynamic business environment by gathering information from the employee level and providing a collective understanding for management and leadership purposes. The system enables the use of real knowledge, instead of presumptive real knowledge, in making decisions concerning development efforts. If used and implemented correctly through HR-related processes, this information can improve the quality of decision-making significantly and maximize the benefits for employees and the organization.

2.6 Management object ontologies

The purpose of this research was to develop ontologies that will help management to assess the organization's HR environment regarding its commitment and engagement factors. The ontological framework can be useful for managers in planning development activities when creating a committed workforce, which is engaged in their work and workplace. The framework provides tools and concepts, which can be utilized to development processes.

Ontologies are not very common in business, apart from applications in the information and communications technology sector, which invented the concept. Next, a definition of ontology is presented and how ontologies are constructed as MOOs.

2.6.1 Definition of ontology

The term *ontology* originates from philosophy, where it means a systematic explanation of being (Corcho, Fernández-López & Gómez-Pérez, 2003) or theory about the nature of being or kinds of existence (Borst, 1997). Ontology has been defined in several ways, and the definitions have changed and evolved over time. Neches et al. (1991) defined ontology "the basic terms and relations comprising the vocabulary of a topic area as well as the rules for combining terms and relations to define extensions to the vocabulary", stating that every knowledge-based system implicitly or explicitly embodies an ontology. Neches et al.'s (1991) definition offers guidelines on how to build an ontology: the definition identifies basic terms and relations between terms, identifies rules to combine terms, and provides the definitions of such terms and relations (Corcho et al., 2003). Nowadays, ontology has grown beyond philosophy, since it has many connections to information technology (Chandrasekaran, Josephson & Benjamins, 1999).

According to Gruber (1993), an ontology is an explicit specification of the conceptualization of a domain. Borst (1997) altered Gruber's definition slightly and defined an ontology as a formal specification of a shared conceptualization. Based on these definitions, Studer, Benjamins and Fensel (1998) argued that conceptualization refers to an abstract model of some phenomenon in the world by having identified the relevant concepts of that phenomenon. According to

Gómez-Pérez (2004), the conceptualization is an idea of (part of) the world that a person or a group of people may hold (Gómez-Pérez, 2004). For Obrst (2003), ontologies define common words and concepts, as well as meanings, which describe and represent an area of knowledge. They thus represent a method of formally expressing a shared understanding of information (Parry, 2004). Ontologies are quintessentially content theories because their main contribution is to identify specific classes of objects, properties of objects, and relations that exist in a specified domain (Chandrasekaran et al., 1999). They provide potential terms for describing knowledge about the domain (Chandrasekaran et al., 1999).

As ontologies are widely used for different purposes, such as natural language processing, knowledge management and intelligent integration information in different communities (i.e., knowledge engineering, databases and software engineering), Jasper and Uschold (1999) sought to present a definition that would suit many disciplines. They defined ontology as follows: "An ontology may take a variety of forms, but it will necessarily include a vocabulary of terms and some specification of their meaning". Their definition includes other definitions and an indication of how concepts are interrelated, which in turn collectively imposes a structure on the domain and constrains the possible interpretations of terms.

By definition, ontologies are well suited to explicitly describing concepts that belong to the organizational domain. According to Corcho et al. (2003), the different definitions provide diverse and complementary points of view of the same reality. Some definitions are independent of the processes followed in order to build the ontology, and also independent of its use in applications, whereas others are influenced by the ontology development process. It is also characteristic of ontologies that they can be reused and shared across applications and by different groups of people.

A well-designed domain ontology makes ground for representing the domain knowledge. In addition, the ontology of a domain helps to identify the semantic categories that are involved in understanding discourse in that domain (Chandrasekaran et al., 1999). In this research, ontologies are used to describe related to concepts and their relations affecting organizations' HR environment and their employees' togetherness, i.e., commitment and engagement. In addition to these ontologies, a spin-off ontology for evaluating engagement with and the responsiveness of the learning environment in the domain of educational institutions is presented. These ontologies are called organizational resource ontologies.

2.6.2 Ontology building for organizational resources

Ontologies have several benefits, including interoperability, browsing and searching, and reusing and structuring knowledge (Menzies, 1999), which enable the computational processing of information (Kantola, 2009). According to Studer et al. (1998), the main motivation behind ontologies is that they allow for sharing and reusing knowledge bodies in computational form. The main components of an ontology are classes (concepts), relations (associations between the concepts in the domain) and instances (elements or individuals in the ontology) (Gómez-Pérez, 2004).

Based on Beck and Pinto (2002), ontology building is a process performed in order to achieve something. Usually, the ontology development life cycle comprises the following main phases: specification, conceptualization, formalization, implementation and maintenance (Beck & Pinto, 2002). Figure 7 presents the activities involved in the ontology development life cycle.

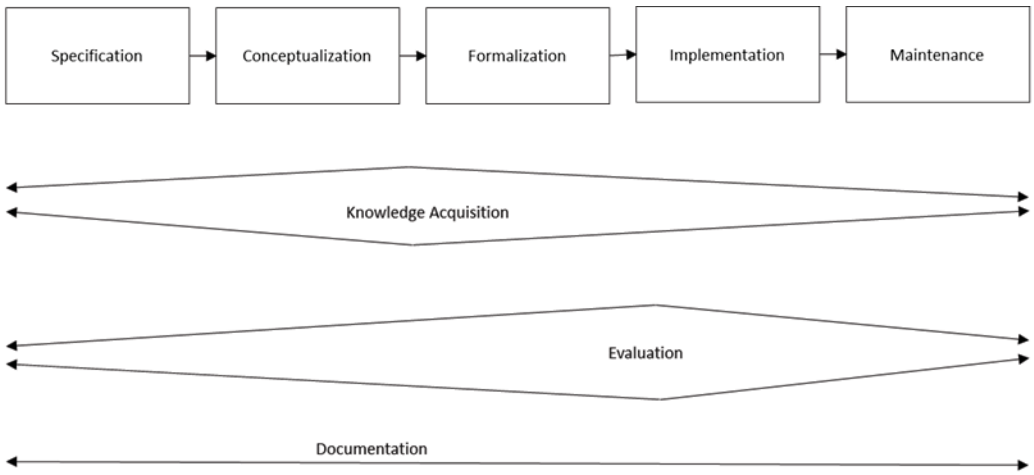

Figure 7. Activities in the ontology development life cycle (Beck & Pinto, 2002)

In the specification phase, the researcher identifies the purpose and scope of the ontology. In the conceptualization, the conceptual model is described, so that the ontology meets its required specifications. In the formalization phase, the conceptual description is transformed into a more formal form. In the implementation phase, the formalized ontology is written in a language, which represents formal knowledge of the ontology. Lastly, in the maintenance phase, the realized ontology is updated and errors are corrected. According to Beck and Pinto (2002), during the whole ontology life cycle, knowledge acquisition, documentation and evaluation of knowledge should be performed, in addition to the main phases. Ontologies should also be reused as much as possible. However, reusability depends on the used methodology (Beck & Pinto, 2002).

The process of ontology development is comparable to application development in terms of the major concepts of design, development, integration, validation, feedback and interaction (Edgington, Choi, Henson, Raghu & Vinze, 2004). Typically, ontology development follows an evolving development process, rather than a waterfall or iterative process. Evolving a prototype life cycle is applicable in ontology development because one can go from any stage to any other stage of the development process (Beck & Pinto, 2002). If the ontology does not satisfy the evaluation criteria and does not meet all specified requirements, the ontology prototype is improved. This is also important because ontologies need to be able to be fine-tuned over time, as the domain evolves and as researchers learn more about the domain they are investigating. Gómez-Pérez (2004) refers to this ontology life cycle as ontology engineering. This type of evolving life cycle differs from a waterfall design process, since it may return to a previous stage of the life cycle. The main difference from an iterative process is that there is no a priori planning of the numerous ontology prototypes (Beck & Pinto, 2002). Figure 8 compares the different life cycle models by focusing on how activities are scheduled along the life cycle and how the final product is developed.

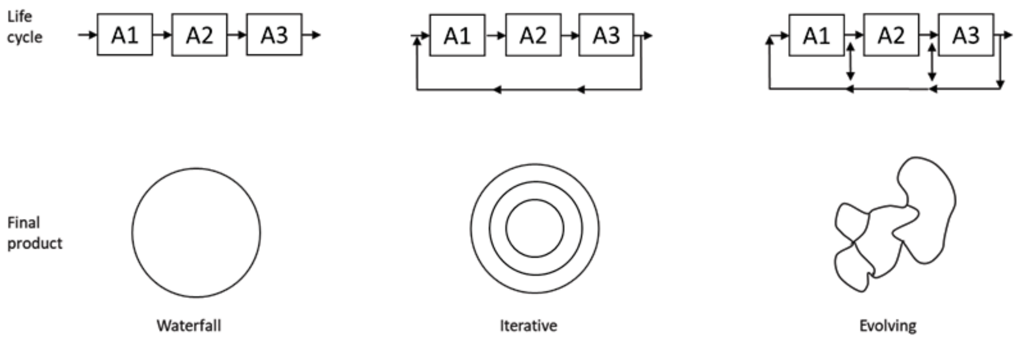

Figure 8. Comparison of life cycle models (Beck & Pinto, 2002)

According to Sure, Staab and Studer (2004), an ontology creation process has five main steps in the knowledge management context: (1) feasibility study, (2) kick-off, (3) refinement, (4) evaluation, and (5) application and evolution. Each of these main steps has many substeps. Typically, the three last steps (refinement, evaluation, and application and evolution) need to be performed in iterative cycles. The main outcome of the ontology development process is usually the decision support for taking future decisions.

According to Kantola (2009), managers face three tasks, regardless of which field or organization they work in: (1) managing work and organizations, (2) managing people, and (3) managing production and operations. In all of these tasks, organizational resources are managed. Management means the coordination of human, material, technological and financial resources as needed by the organization to achieve its goals (Hess & Siciliano, 1995). Evidently, human cognitive capacity is simply not advanced enough to handle large amounts of available data. Thus, humans are compelled to seek techniques to reduce complexity in information, tasks and coordination (Fox, 1981; Kim, 2002). Ontologies could provide the support that management needs to tackle this problem (Kantola, 2009).

Kantola (2005, 2009) defines managed organizational resources as management objects (MOs). Many of the important business constructs, concepts and variables related to MOs are vaguely understood in real business situations. MOs are vague entities with multiple dimensions and layers, combined with varying levels of complexity and abstractness; thus, they pose a great challenge for managers and for decision-making. These objects can be tangible or intangible. Intangible assets cannot be measured directly, but they can be evaluated linguistically by people who have knowledge of them (Kantola, 2005).

In addition to the current perception of MOs, people have their own visions and goals. This makes it difficult to define precise objectives, which all stakeholders can agree to. Multi-objectiveness concerning both the current perception and the perceived goal of MOs means trouble for managers because this information often remains hidden (Kantola, 2009).

Kantola (2009) argues that ontologies provide an approach with which to specify and manage MOs in a holistic way, while constructing MOs as ontologies provides an attractive approach to positioning and managing organizational resources both now and in the future. Kantola refers to these ontologies of MOs as MOOs. By looking at the definition of ontology, it is clear that, without their use, it will be difficult for management to follow the classification and structure of MOs (Kantola, 2009).

Kantola (2005) writes that MOOs follow a normal life cycle: birth, development and death. MOOs can also be divided into separate parts, when they start to live their own lives. Furthermore, different ontologies can be joined together to form new top-level ontologies. The life cycle of MOOs can be influenced by the increased understanding of MOs, which makes it possible to build better ontologies, and by the changes in the environment(s) that ontologies must reflect.

All MOs are either open or closed systems; in most cases, they are open systems. Figure 9 shows that there are two ways of looking at and specifying MOOs

(Kantola, 2005). Type A is the ontology of an MO and Type B is the ontology of an MO and a system.

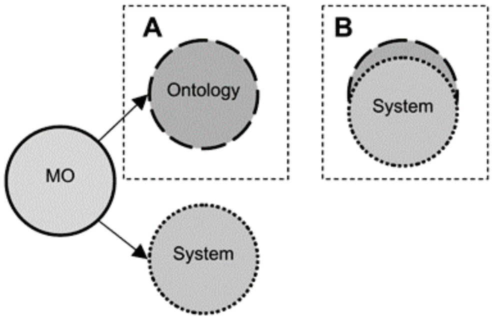

Figure 9. Two ways of constructing management object ontologies (Kantola 2005)

Type A is an ontology that contains one classification of information related to an MO. The content of the ontology is the outcome from the conceptualization of an MO, and the specification of that conceptualization. Type B is both an ontology and a system. This type of ontology contains two classifications of information regarding an MO. Type B also needs a link between these classifications. The content of the ontology results from the conceptualization of an MO, the conceptualization of a system and the specification of those conceptualizations including the link (Kantola, 2005).

In this research, two main ontologies were developed. One of the ontologies focuses on organizational commitment and engagement in an organizational setting, and the other in educational institutions. The first ontology was constructed in two parts (A and B), assessing different characteristics. Both ontologies are Type B ontologies, which include an ontology and a system. The ontologies were named *Helix* and *Helix Academic*, respectively.

The system level of the ontologies produces meta-knowledge related to HR and their inner thoughts. The ontologies are built in order to use the generic Internet-based Evolute system (Kantola, Karwowski & Vanharanta, 2011), which utilizes fuzzy logic in the analysis. The architecture of the Evolute system is described in the next subchapter, while, in Chapter 3, the structure and content of these ontologies are described.

2.6.3 Research architecture – the Evolute system

This research follows the Co-Evolute architecture (Figure 10) proposed by Vanharanta and Kantola (Vanharanta & Kantola, 2017). The overall architecture of this research is based on a wide construct starting from a scientific framework, theoretical framework, methodology and technical approach. Figure 10 explains the whole co-evolutionary theory and methodology. The Co-Evolute theory and methodology enables the creation of MOOs, including human object ontologies as well as business object ontologies. From these ontologies, it is then possible to create computer applications on a fuzzy logic-based evaluation platform, i.e., Evolute.

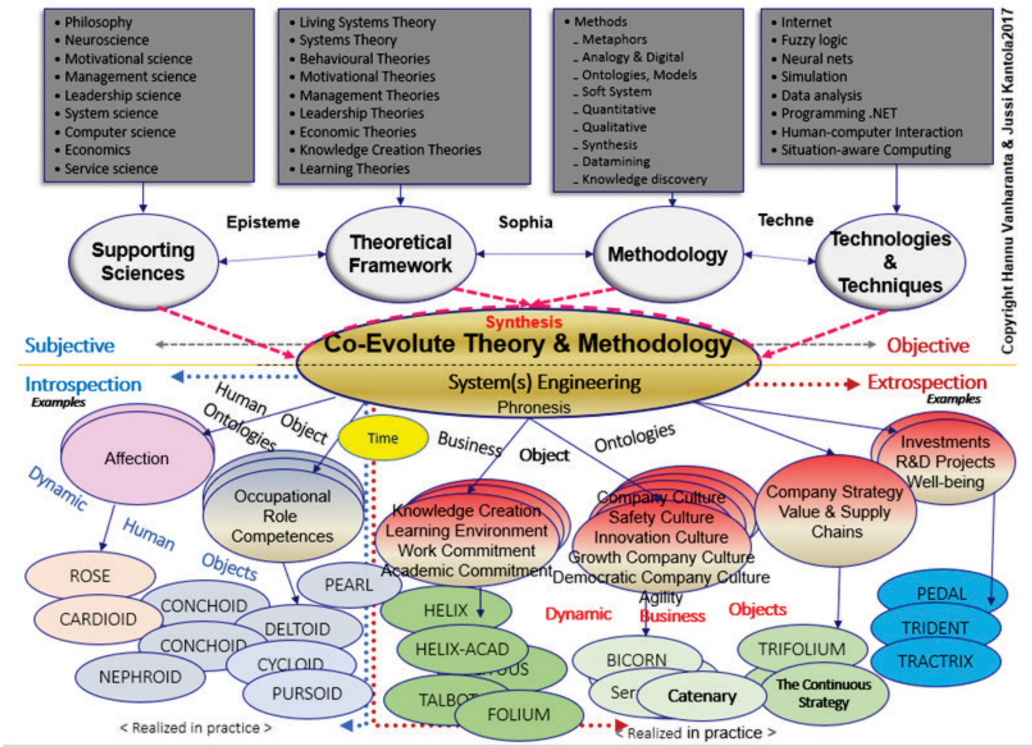

Figure 10. Co-Evolute theory and methodology (Vanharanta & Kantola, 2017)

Evolute architecture is based on a co-evolutionary management paradigm (Kantola et al., 2011, 2006). This management paradigm considers co-evolution in human and business performance and in human-computer interaction. The goal of the paradigm is to shift the traditional focus of management science from management, as a set of activities, to the need for a fundamental understanding of the natural processes of continuously co-evolving individuals and the organizations in which these individuals work (Kantola, 2005). In short, it refers to theory and methodology that support the simultaneous development of systems, such as individuals and organizations.

The research methodology combines a variety of different methods to obtain real situation-aware computing in order to define the degree and sources of organizational commitment. The methodology is focused on covering both past and current data, as well as current information, in order to creating a vision of how people evaluate commitment development both now and in the future within their own company. Figure 11 illustrates the ontology-based situation-aware computing research methodology.

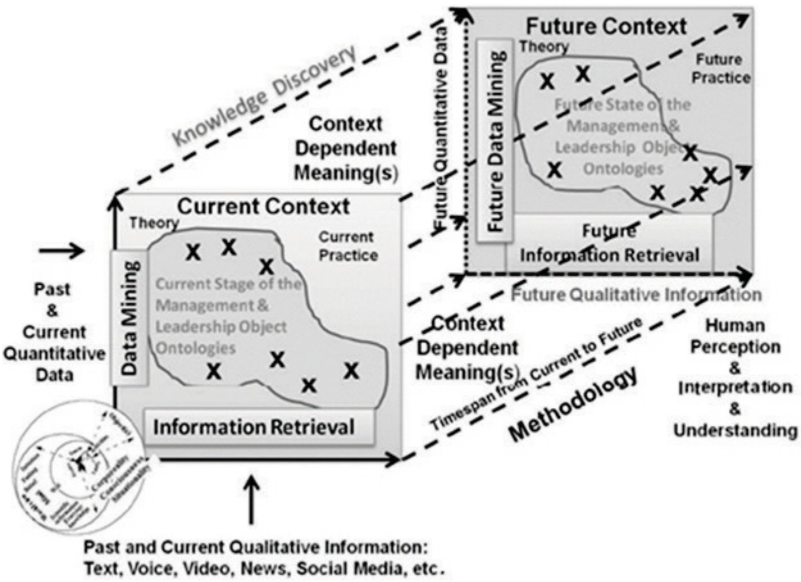

Figure 11. Ontology-based research methodology (situation-aware computing) (Vanharanta, 2015)

The basic principle of situation-aware computing is about trying to find out how people see their company's HR environment in their own mind. By analyzing people's feelings, behavioral patterns in their work, meetings, decisions and other activities, highly important information can be obtained about their past in order to justify their present state and predict the future state of their mind (Vanharanta, 2005).

3 DEVELOPMENT OF APPLICATIONS

The conceptual outcome of this research is the creation of three MOOs. In this context, the concept of an ontology refers to the formal representation of a set of concepts within a domain and the relationships between them. Ontologies are used to reason the properties of specific domains and may be used to define them. According to Gruber (1993), an ontology is a "formal, explicit specification of a shared conceptualization" (Gruber, 1993). An ontology provides a shared vocabulary, which can be used to model a domain, that is, the types of objects and/or concepts that exist, and their properties and relations (Arvidsson & Flycht-Eriksson, 2008).

The aim of the research was to model and define ontologies containing the key features of the HR environment, concerned with the development of commitment and engagement, within an organization. The goal was to create MOOs, along with an assessment system, that could function as a usable DSS for management purposes.

Figure 12 shows the ontology structure and its distinct levels. The main category in the ontology represents the whole construct in question, i.e., organizational and academic commitment and engagement. In the creation of the ontologies, each of the identified main categories/constructs was first divided into smaller separate constructs (in this research, they are called categories or classes), which have an effect on the main components. After classification, the categories were divided into features containing the actual statements by which they are assessed. In this way, the ontology is constructed on four levels, which makes it possible to examine larger wholes or dig into deeper smaller concepts according to the statement-based evaluations. In all the ontology models, because of possible partial overlapping within the features, each statement can be a part of multiple features (represented in the figure by a dotted line). The following chapters present the created MOOs.

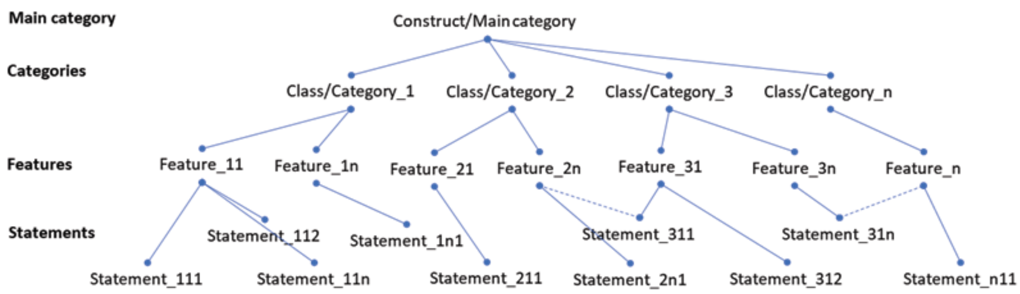

Figure 12. Different levels of ontology

3.1 Organizational commitment and engagement model – Helix

The Helix assessment system was created to support business organizations in their decision-making and leadership. Helix was developed over many years of research and its construction has evolved many times based on testing. The testing of Helix in a university setting has resulted in the creation of an application named Helix Academic, a spin-off application created to assess university students' engagement and commitment to their studies and their university. The construction of Helix Academic is described in the following chapter.

In the development part of the research, the aim was to define an ontology containing key features and characteristics, which influence employees' commitment and engagement toward their job and their employing organization. The goal was to create a tool that could be easily administered even to many employees in different locations in order to evaluate the various components of organizational commitment and their primary correlate constructs. The evaluation of different components is important because the various components of organizational commitment will lead to different effects on other variables, such as attitudes and behaviors (Meyer & Herscovitch, 2001).

In the first phase of the development process, an overall ontology was created. However, its usefulness suffered from the sheer size of the ontology and the number of statements. The first version included 18 categories and 59 features, and 237 linguistic statements for assessing them.

The further development work addressed these limitations and resulted in splitting the ontology into two parts and two separate new assessment systems: Helix A and Helix B. The division of the ontology in two parts was intended to ensure that the respondents' concentration persisted while evaluating all the statements. Approximately 20% of the statement scales were also reversed, i.e., the direction of a "positive" value was intentionally changed in order to reduce the response set bias (Hubbard, 2010). By reversing the scale, the respondents were encouraged to read each statement carefully and respond to it accordingly, rather than always answering in terms of a particular direction, regardless of the wording of the statement.

In the latest version of the ontology, Part A contains 32 features in 10 categories/classes in two main categories. Part A is designed to assess employees' intrinsic motivation, motivating potential of the job, job satisfaction, organizational support, attributions of HRM practices, organizational dynamics and person-role congruence, in addition to affective commitment, normative commitment and continuance commitment. Part A was classified this way to represent concepts identified as being closely related to organizational engagement. This part contains overall 123 unique linguistic indicative statements, also known as indicators.

Part B comprises 29 features in 11 categories/classes in four main categories, and assesses person-organization fit, identification with the organization, perceptions of justice and fairness, sense of obligation, psychological contract, work-related investments, employment alternatives and opportunities, and non-work-related investments, as well as affective commitment, normative commitment and continuance commitment. Part B's classification follows stricter concepts related to the continuation to stay with the organization, which are evaluated using 120 unique statements.

In the models, three organizational commitment classes are identically constructed in order to evaluate the most important commitment statements, even if only one application is used within the organization. This was also done in order to validate the results in organizations that use both of the applications. In all the ontology models, because of partial overlapping within the features, each statement can be part of multiple features.

The basis of the created ontology model and its statements lies in the Meyer and Allen (1984, 1997) multidimensional model of organizational commitment. In this research, their model was used as the basis for grouping different components of commitment. In the further classification of the concepts into smaller classes and their features (see Figure 12), earlier research was consulted (e.g., Allen & Meyer, 1990; Cohen, 2007; Mathieu & Zajac, 1990; Meyer & Allen, 1997; Mowday et al., 1982; Swailes, 2002).

For example, the features and their statements assessing organizational commitment were adapted from the scales created by Meyer and Allen (1991), and Porter et al. (1974). Job satisfaction and the motivating potential of job measures were developed, based on measurement tools devised by Hackman and Oldham (1980), and Weiss, Dawis, England and Lofquist (1967), while the statements describing the components of organizational justice were adapted from the Niehoff and Moorman (1993) scale. Scale item adaptations were made in order to modify the scales so as to be suitable for our research content and enable the evaluation of a vision for the future state. In Tables 4 and 5, as well as in the following descriptions, the structures of the ontologies are presented, and their categories/classes are defined. These definitions of the categories have been previously presented and published in Einolander, 2016.

Table 4. Helix A – features, categories and main classes

Construct	Categories	Features
Employee Engagement	Intrinsic Motivation	Sense of Competence
		Sense of Choice
		Sense of Progress
		Sense of Meaningfulness
		Responsibility Taking/Ownership
	Motivating Potential of the Job	Job Challenge
		Task Identity
		Task Significance
		Work Autonomy
		Feedback
		Interaction
	Job Satisfaction	General Satisfaction
		Growth Satisfaction
		Working Conditions and Resources
		Job Security Satisfaction
		Compensation Satisfaction
		Co-worker Satisfaction
		Manager/Supervisor Satisfaction
	Organizational Support	Recognition
		Supportiveness
		Care and Respect
	Attributions of HRM Practices	Causal Attribution
	Organizational Dynamics	Information Sharing
		Strategic Alignment
		Participative Decision-making
	Person-role Congruence	Role Ambiguity
		Role Conflict
		Role Overload
Organizational Commitment	Affective Commitment	Affective Commitment
	Normative Commitment	Normative Commitment
	Continuance Commitment	Continuance Commitment: LoAlt
		Continuance Commitment: HiSac

The category of *Intrinsic motivation* includes features assessing intrinsic or internal rewards, which drive employee engagement. Based on intrinsic motivation, employees do something just because it is enjoyable, or because they believe it is a good or the right thing to do (Thomas, 2000; see Einolander, 2016).

Motivating potential of the job includes features that are believed to intrinsically motivate employees, which will lead to increased satisfaction and motivation. These features assess challenging and motivating work tasks, which have clear outcomes, and tasks that feel significant and may have an impact on others, as well as whether the job provides freedom to use own volition or independence and clear information about the effectiveness and performance (Hackman & Oldham, 1976, 1980; Hackman, 1980; see Einolander, 2016).

Job satisfaction describes a positive emotional feeling, resulting from people's evaluation of their job or job experiences. The category of job satisfaction assess various facets, such as working conditions, co-workers, management, pay and job security (Judge & Klinger, 2008; see Einolander, 2016).

Organizational support includes features that assess the degree to which employees feel that their employer values their contributions and cares about their well-being (Eisenberger et al., 1986; Eisenberger, Jones, Aselage & Sucharski, 2004). According to the norm of reciprocity, the recipient of benefits is morally obligated to recompense the donor (Gouldner, 1960; see Einolander, 2016).

Attributions of HRM practices assess the perceived reasons for others' behaviors (e.g., compliance with the law, acting out of habit, genuine concern for employees). It is supposed that the impact of HRM practices on commitment is influenced by employees' perceptions of the motives behind these practices (Koys, 1988, 1991; see Einolander, 2016).

Organizational dynamics include features assessing open communication, information sharing and participative decision-making in the organization between the employees and employers (Choudhury, 2011), and strategic alignment describing familiarity with the organization's strategy, as well as how employees' actions contribute to their fulfillment and whether they are directing their efforts in the right direction (see Einolander, 2016).

Person-role congruence represents a set of behaviors, which are expected of employees, and how they are congruent with the individual. Features assessing person-role congruence include role ambiguity, role conflict and overload (Rizzo, House & Lirtzman, 1970; see Einolander, 2016).

Table 5. Helix B – features, categories and main classes

Construct	Categories	Features
Affect-related	Person-organization Fit	Needs/Supplies Fit
		Supplementary Fit
	Identification with the Organization	Sense of Pride
		Belonging and Attachment
		Desire to Stay
	Perceptions of Justice and Fairness	Distributive Justice
		Formal Procedures
		Interactional Justice
Norm-related	Internal Sense of Obligation	General Loyalty
		Employee Loyalty
		Indebtedness
	Psychological Contract	Transactional Contracts
		Relational Contracts
		Balanced Contracts
		Psychological Contract Adherence
Cost-related	Work-related Investments	Costs of Leaving
		Relationships
		Job Security Needs
		Skill Specificity
		Growth and Development
		Monetary (Salary/Benefits)
	Employment Alternatives and Opportunities	Availability of Alternatives
		Attractiveness of Alternatives
	Non-work-related Investments	Community or Area Ties
		Personal and Family Ties
Organizational Commitment	Affective Commitment	Affective Commitment
	Normative Commitment	Normative Commitment
	Continuance Commitment	Continuance Commitment: LoAlt
		Continuance Commitment: HiSac

Person-organization fit includes features assessing the compatibility between an employee and the organization. These features emphasize the extent to which the person and the organization have similar characteristics and/or meet each other's need. Traditionally person-organization fit include characteristics of culture, climate, values, goals and norms (Kristof, 1996; see Einolander, 2016).

Identification with the organization assesses a person's sense of being part of and perceived oneness with an organization, and the feeling of the organization's successes and failures as one's own (Mael & Ashforth, 1992). It describes how the employee has linked their organizational membership to their self-concept, either cognitively (e.g., feeling a part of the organization, internalizing organizational values), emotionally (pride in membership), or both (Riketta, 2005; see Einolander, 2016).

Perceptions of justice and fairness includes features assessing how employees feel how fairly they have been treated in their job. Their perceptions of distributive justice and procedural justice influence their OCBs. When employees perceive that they are treated fairly or perceive the process by which outcome allocation decisions are made to be fair, they are likely to reciprocate by performing actions that are beneficial to the organization, which go beyond the normal performance requirements of their jobs (Niehoff & Moorman, 1993; see Einolander, 2016).

Internal sense of obligation contains features assessing feelings of loyalty, in general, and toward the current employer, as well as feelings of indebtedness. General feelings of obligation can develop based on early socialization experiences, which can give a sense of suitability of particular attitudes or behaviors (Meyer & Allen, 1997). Organizational socialization experiences, as a new employee, can influence their feelings of loyalty, as well as the feeling of felt cared for by their employer (Meyer & Allen, 1997). Feelings of indebtedness can develop, for example, based on some investment by the organization, which seems difficult for the employee to reciprocate (Meyer & Allen, 1997; see Einolander, 2016).

Psychological contracts are the shared obligations that exist in the exchange between the employee and the employer; which are sustained through the norm of reciprocity. These obligations arise out of the belief that a promise has been made either explicitly or implicitly, and that the fulfillment of these obligations is contingent upon the fulfillment of obligations by the other party (Conway & Briner, 2005; Coyle-Shapiro & Parzefall, 2008; Rousseau, 2000). These contracts are assessed in transactional, relational and hybrid (also known as balanced) forms (Rousseau, 2000; see Einolander, 2016).

Work-related investments refer, in this case, to anything that could result in considerable potential loss, if the employee decides to leave the organization (Allen & Meyer, 1990). Once individual realizes that changing to a new company would result in the loss of benefits, they may decide to stay within the current employer, rather than lose the investments. Work-related investments that are assessed include such things as (time, effort or money spent on acquiring) skills or training, which are non-transferable to another organization, the potential loss of benefits, and giving up a senior position and rewards associated to it, such as retirement money, status or job security (Allen & Meyer, 1990; Romzek, 1990; see Einolander, 2016).

Employment alternatives and opportunities refer to the employee's perception of the availability of alternative employment placements. Perceptions of available alternative jobs may result, for example, from knowledge of the external environment (economic climate etc.) or from the awareness of the marketability of their skills or based on previous job search attempts. Employees evaluate other opportunities based not only on their availability but also their attractiveness and suitability for them personally (Meyer & Allen, 1997; see Einolander, 2016).

Non-work-related investments contains features assessing the potential disruption of personal obligations or relationships, for example, from the expense and human cost of relocating a family to another city, i.e., the family is unable to relocate (Meyer & Allen, 1991; see Einolander, 2016).

Affective commitment includes features assessing the employee's emotional attachment to, identification with, and involvement in the organization (Meyer & Allen, 1991). Employees with a strong affective commitment remain with their organization because they want to do so. Affective commitment is believed to be influenced by various antecedent characteristics, including personal characteristics, structural characteristics, job-related characteristics and work experiences (Meyer et al., 1993; see Einolander, 2016).

Normative commitment includes features assessing a feeling of obligation among employees to continue their employment (Meyer & Allen, 1991, 1997). Normative committed employees remain with the organization because they feel they ought to do so. Employees develop normative commitment and moral obligation, based on possible investments that the organization has made in them (Meyer & Allen, 1991), or from the socialization practices of the organization (Wiener, 1982). Socialization refers to the process by which the values, norms and beliefs of members are brought into line with those of the organization (Wiener, 1982; see Einolander, 2016).

Continuance commitment includes features that assess the commitment based on the awareness of the costs associated with leaving the organization. It refers to the employee's decision to stay with the organization because they feel it would be too costly, in other words, too high a sacrifice, to leave the organization (Meyer & Allen, 1991). These costs can reflect a belief about limited alternative employment opportunities (LoAlt) or the high sacrifice (HiSac) of losable side bets, such as accumulated seniority privileges, the vesting of pension benefits and retention bonuses (Powell & Meyer, 2004; see Einolander, 2016).

3.2 Commitment and engagement model for academia – Helix Academic

This chapter briefly describes the Helix Academic ontology. The creation of this ontology came as a spin-off from ontologies designed for organizational use. Helix Academic was made to assess university students' engagement and commitment to their studies and to their university, as well as test whether a management support system could be utilized to tackle the dropout problem, which is currently hindering many universities.

The framework for building the ontology and its statements mostly came from Bean's research about student attrition (Bean & Metzner, 1985; Bean, 1979). This model is based on the organizational commitment literature and view student withdrawal in the same way as employee turnover in work organizations. Therefore, the use of Bean's model was a natural choice to be utilized as a base in this research.

The Helix Academic assessment system contains 124 linguistic statements, which are used to assess 15 features of an educational institution. In Helix Academic, these features are divided into six categories: academic performance, institutional qualities, experienced outcomes, social integration, attachment and environmental variables. The features and categories/classes of this assessment system are presented in Table 6. Helix Academic uses the same research method as discussed earlier. The categories and features are described in more detail in the attached research paper by Einolander, Vanharanta, Chang and Kantola (2016).

Table 6. Helix Academic – features, categories and main classes

Construct	Categories	Features
Academic Engagement and Commitment	Academic Performance	Sense of Competence
	Institutional Qualities	Academic Advising
		Institutional Quality
		Centralization
		Distributive Justice
		Routinization
	Experienced Outcomes	Utility
		Satisfaction
		Stress
		Goal Commitment
		Development
	Social Integration	Social Integration
	Attachment	Institutional Commitment
		Intent to Leave
	Environmental Variables	Environmental Variables

Bean (1979) argued that, in the process of student attrition, students stay in their higher educational institutions for similar reasons to employees in organizations, such that students and employees leave for similar reasons. Students' interaction with the organization plays an important part in the longitudinal attrition process, which influences their decision to stay or drop out (Bean, 1981a). According to Bean (1981a), student attrition (a term used interchangeably with "dropping out") can be defined as the cessation of individual student enrollment at a particular institution (Bean, 1981a).

In the next chapter, the operating principles of the assessment system are presented. This chapter illustrates how the evaluation system operates and how evaluation is performed at a practical level, as well as presents an example of the analysis report.

3.3 Operating principles of the evaluation system

The Helix and the Helix Academic assessment systems have the same operating principles. The principle follows the Evolute methodology. The structure and operating principle of the assessment system are illustrated through different levels in Figure 13.

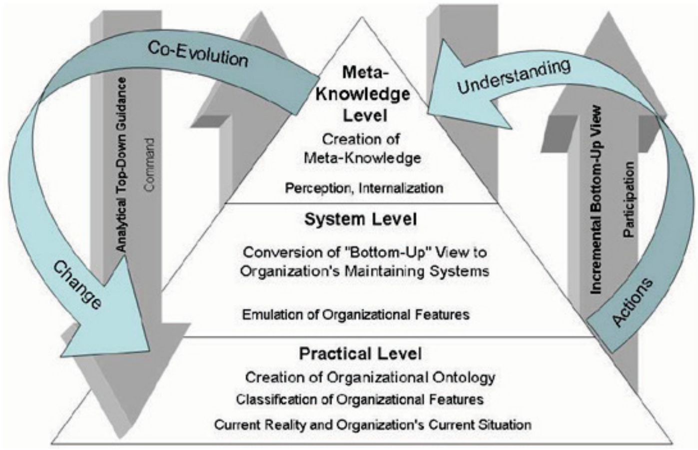

Figure 13. The different levels of the assessment system (Paajanen, 2012)

In the assessment system, there are three levels: practical level, system level, and meta-knowledge level. The practical level has the developed ontology, including its main categories, categories/classes and features. At the practical level, the MOs are evaluated by the employees of the organization. They have the original knowledge about the current state of things in the organization. They are the only ones who can give an introspective view about the current situation in their conscious experience.

With the help of statements, respondents evaluate their current reality and their wish or target for the future in their current situation using a web-based graphical user interface (Kantola et al., 2006; Kantola, 2005). The respondents give an indication of how they feel, at that moment, about their organization, and how they would like or envisage the situation to be in the future, in addition to how important they consider the essence of the statement.

The application screens the current reality and compares it with the target state. The greater the gap between the current and future state, the higher the proactive vision and prioritizing potential for that feature. This shows the collective desire for change and improvement.

The ontological classification of affecting features helps management to start a conversion from the bottom-up to the system level (Aramo-Immonen et al., 2005). It is very important to consider the evaluated current and target state views at the collective or group level when making development plans for the organization in order to promote its internal operating environment. The utilization of the co-evolutionary learning loop gives the management the analytical top-down guidance when using applications continuously to monitor the state of the organization. Figure 14 shows an example of linguistic evaluation in the Helix A application.

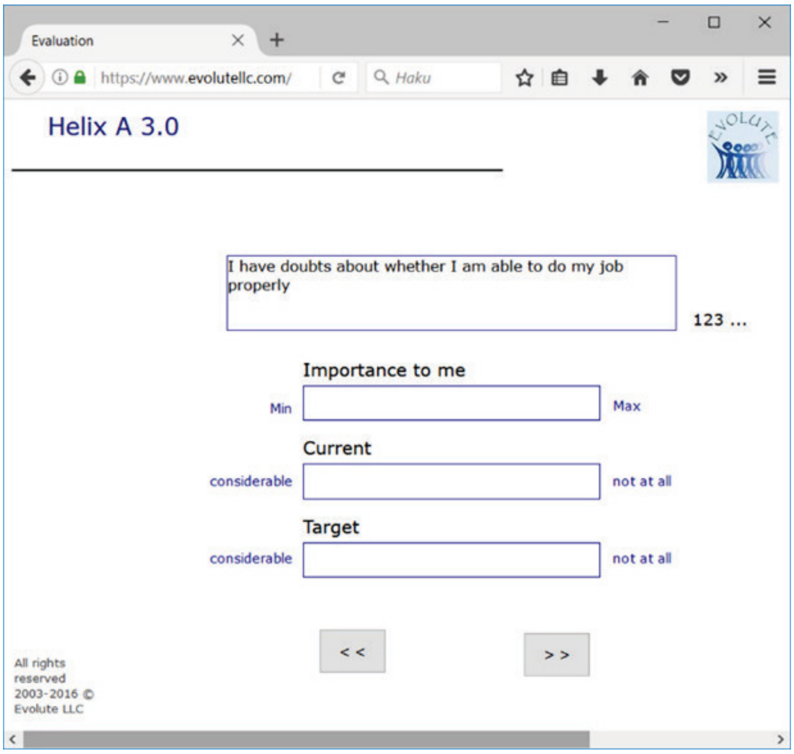

Figure 14. Example of an evaluation window and a statement from the Helix A application

The respondents use web-based GUI to evaluate the statements by selecting the level at which they think best describes the situation presented in the linguistic statement on three levels, i.e., current state, target state (expected future state) and its importance. The respondents compare the statements with linguistic labels on a continuous scale. As a result, the application produces a meta-classification, which connects the theoretical framework to the system's practice (Paajanen, Kantola, Karwowski & Vanharanta, 2006).

In the Helix system, fuzzy logic was applied to deal with the imprecise information typical to human decision-making processes and the natural fuzziness related to the evaluations made by individuals (cf. Kantola, 2005). Fuzzy logic is a conceptual system of reasoning, deduction and computation, which enables precise reasoning with imperfect information. Imperfect information is information that, in one or more respects, is imprecise, uncertain, incomplete, unreliable, vague or partially true (Zadeh, 2009).

According to Kantola (2015), the Evolute system used in this research uses fuzzy logic to capture the subjective, abstract and vague nature of the organizational resource ontologies without respondents having to convert anything to numerical scale. The goal of the system is to capture a true bottom-up view of the current reality and envisioned future of the features and practices of organizational resources. The fuzzy application in the Evolute system resembles managers' task of evaluating the state or quality of organizational resources.

In general, as the complexity of the system increases, people's ability to make precise and yet significant statements about its behavior decreases (Zadeh, 1973). Fuzzy logic-based systems offer decision support and powerful reasoning capabilities by using fuzzy sets, which provide a mathematical way of representing vagueness in linguistics (Lin & Lee, 1996; Zadeh, 1965). In the application, the reasoning from the indicative statement evaluation to the visualized proactive vision is made with fuzzy logic, whereby the statements are semantic entities and the ontology is the information resident in a knowledge base (Zadeh, 1973, 2009).

A general fuzzy logic controller consists of four modules: fuzzification module, fuzzy inference engine, fuzzy rule base and defuzzification module (Klir & Yuan, 1995). The fuzzy logic calculation module of the Evolute system controls the informational fuzziness related to human decision-making processes, while the natural fuzziness is related to individuals' assessments (Paajanen, 2012). The developed assessment system works as a generic fuzzy rule-based system according to the following stages (Kantola, 2015):

1. In the first stage, the statements describing the ontology features are evaluated (instance). The statements representing the organization's features are described in linguistic form. Inputs from the evaluation are converted into fuzzy sets (fuzzification).

2. Next, the fuzzified inputs are used by an inference engine to evaluate fuzzy decision "if-then" rules in the fuzzy rule base. As a result, one fuzzy set for each concept in the ontology is generated (inferencing). See more about the used fuzzy rules in Kantola (2015).

3. In the last step, the fuzzy sets are aggregated and converted into crisp values, which represent the state of the organizational resource, based on individual perception. Defuzzified meaning is graphically and numerically/statistically presented individually for the respondents and collectively for decision-making.

Figure 15 shows how assessment results are formed at the system level, based on the “bottom-up” self-evaluation according to these steps.

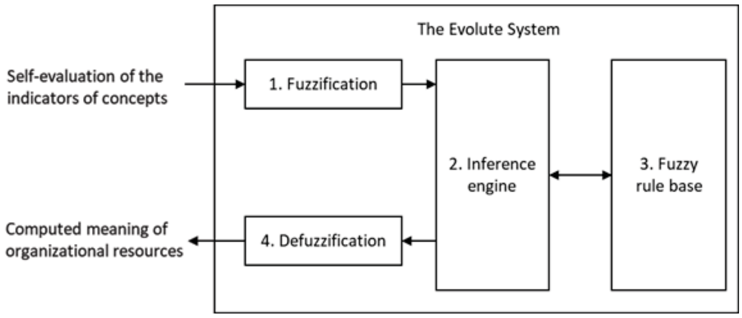

Figure 15. Interconnections between modules of the Evolute system (Kantola, 2015)

As a result, the system creates a graphical report for individual respondents and collective reports for management. Figure 16 shows an example of a graphical report for an individual user of the Helix assessment system after evaluation.

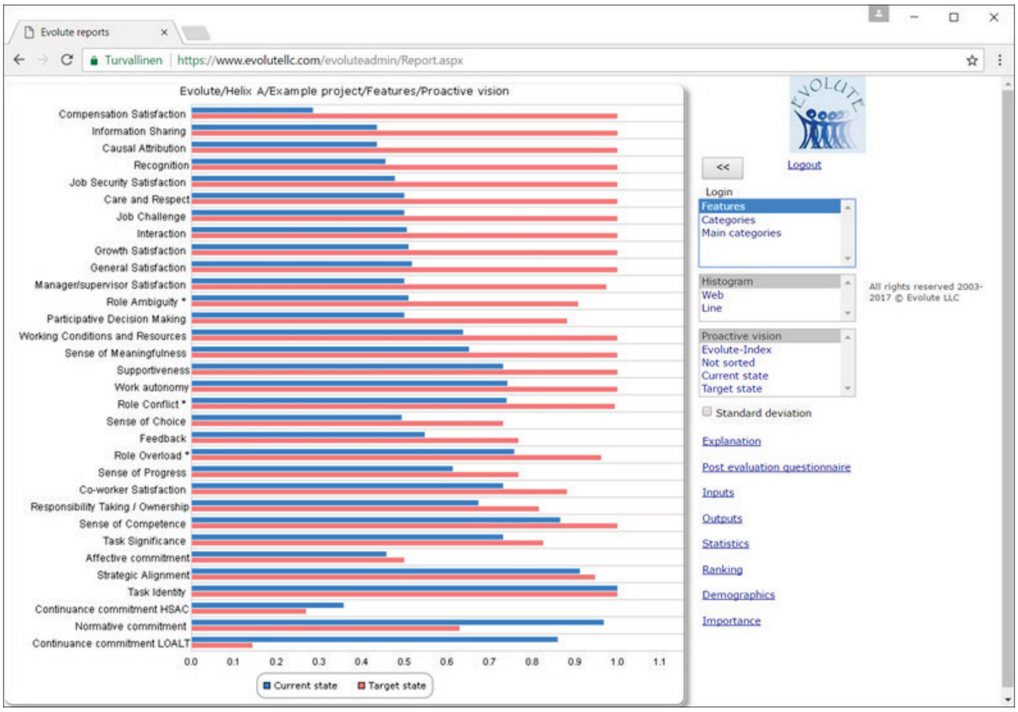

Figure 16. Graphical report example generated by the Helix A assessment system

The results can be examined visually and numerically (statistically). The graphical report, as shown in Figure 16, presents features included in the Helix A assessment system. The blue bars represent assessments of the current state, while the red bars represent assessments of the target or future state. The Helix assessment system generates similar graphical reports related to main and other categories, in addition to feature-level reports. The reports can be viewed as histograms, web charts or line charts, as well as sorted differently.

The application also computes rankings and statistical data, including medians, averages, standard deviations and variances. The numerical results can also be imported into a neural net self-organizing map (SOM) software application to find out hidden relationships in data (Kohonen, 2001). SOMs have been used in many computer applications for data mining, and proven to be among the most powerful algorithms in data visualization and exploration (Alhoniemi et al., 2004).

The collective results of the assessment can be used as a basis for the opening discussion about the prevailing state in the organization and when creating development plans and activities for the organization, as well as educating management and employees to learn about these concepts. This long-term development work requires management to follow it up regularly. Repeating the assessment at certain intervals, for example, on a yearly basis, clearly shows whether the investments that may have been made in engagement initiatives are paying off. In Chapter 4, the empirical case results are presented.

4 RESULTS OF EMPIRICAL STUDIES

The first phase of the research was to gather knowledge about organizational commitment, e.g., its antecedents, correlates and other factors that contribute to its development. This was done in order to develop an assessment system, which could be used to evaluate the state of an organization's HR environment. The first version of the assessment system was developed in light of the literature review.

Before using the applications in real case settings, they were tested by students at the Pori Unit of the Tampere University of Technology in Finland, and at the Poznan University of Technology in Poland. The first version of Helix was tested by 48 students. After the first tests, the students gave written feedback on the functionality of the application, which highlighted the errors and deficiencies. Two professors from the Tampere University of Technology and the Korea Advanced Institute of Science and Technology were included in the feedback process, as well as three managerial personnel from business organizations in Finland and Greece.

The process of ontology development followed an evolving development process model (Figure 8). The development of the prototype ontology continued in response to feedback and as more was learned about the subjects of the ontology. After making multiple modifications to the application and to the structure of the ontology, the second version of the application was tested by 44 students. Finally, after this second set of tests, the found errors and shortcomings were corrected in order to make the application more user-friendly and practical for organizational use. This included reducing the total number of statements and making changes to the wording of the statements to make them clearer. Finally, in order to enhance the applications' practicality and usability, it was decided to split the third version of Helix two applications (A and B) for assessing different aspects of organizational commitment and engagement. A similar process was used in the design of the Helix Academic application.

The development of the applications resulted in case studies. In this chapter, the research results from single cases and from combined case studies are presented. With the methods presented here, it is fairly easy to analyze a large amount of data in a visual and statistical form. The presented visual analysis is easy to use and informative for management and leadership purposes, especially for people who are not accustomed to various statistical analysis methods. The case analyses in this dissertation are based on Helix A and B, whereas, in the research papers, they are based on Helix Version 3. An analysis using Helix Academic is also presented. More cases analyses utilizing different research methods can be found among the research papers attached to this dissertation, which are described in the next subchapter.

4.1 Research papers

This chapter presents summaries of the research papers attached to this dissertation. The research papers illustrate the different phases of this research and deal with the creation of the ontologies and the applications, different case studies and methods for analyzing evaluation results. Figure 17 highlights the continuum of the research and the papers it produced.

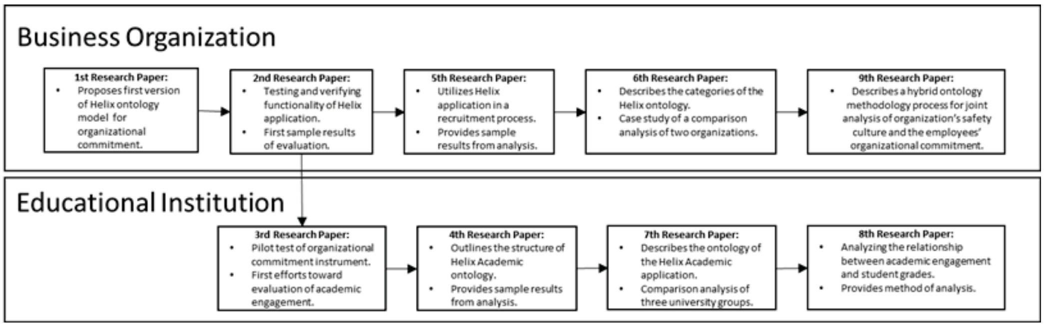

Figure 17. Research papers and their targets

First research paper

The first research paper, "Basics of ontology-based organizational commitment evaluation", proposes an ontology model for the development of organizational commitment. The theoretical part of the paper defines different types of organizational commitment and describes processes believed to affect the development of commitment. The paper also highlights some opportunities to influence commitment through HRM. Based on the theoretical framework, the research paper describes the state of the ontology, as of that date, and how it is being developed. The proposed ontology model is divided into three main sections, which cover the process from the time before joining the organization to actual commitment and to its presumed outcomes.

Second research paper

The second research paper, "Organizational commitment among purchasing and supply chain personnel", deals with the issue of organizational commitment linked to the context of purchasing and supply chain management. The theoretical part of the paper discusses organizational commitment and its importance in supply chain management and in the purchasing function of an organization. This research paper also demonstrates the application principles for commitment evaluation purposes, as well as presents the results from the first phase of the research. The first testing of the instrument was performed with 18 Finnish industrial management MSc program students with various engineering backgrounds at the Pori Unit of the Tampere University of Technology. The goal of this research paper was to show how the Helix application can be used to obtain a systematic overview of an organization's HR environment regarding the respondents' organizational commitment. The main goal of the case study was to verify the technical functionality and validity of the Helix application.

Third research paper

The aim of the third research paper, "Degree of commitment among students at a technological university – testing a new research instrument", was to test whether the organizational commitment and engagement instrument could be used for investigating university students' commitment to their university. This study was also used as a pilot test for our organizational commitment instrument and served as one step toward finalizing the instrument for a real-life business study. In this research, we proposed to evaluate organizational commitment to an academic educational institution by adapting the instrument for the academic context and extracting suitable statements. The case study presented in this paper was prepared during a purchasing and supply chain management course at the Tampere University of Technology, with the sample consisting of 40 Finnish MSc program students. The results obtained from this research informed the start of the development work on the Helix Academic application.

Fourth research paper

The fourth research paper, "Assessment of student retention using the Evolute approach, an overview", describes a method to discover the engagement of university students regarding their studies and educational institution, and the sources of this engagement using the Evolute methodology. The paper describes the structure of an ontology-based instrument, named Helix Academic, and defines the categories and concepts of the instrument. The paper presents an example of collective results from one case study from a Finnish technological university, where 67 students participated in the assessment.

Fifth research paper

The fifth research paper, "New tools to help in the recruitment process", describes a case study where the Helix application was used in the recruitment process of "tenure track" candidates at the Tampere University of Technology. The application was used to narrow down candidates for a cluster analysis using SOMs to check the shortlist and make pairwise comparisons against the desired profile. The paper presents fundamentals of a new, partly automated approach to recruitment screening. The sample in this study was 55 candidates applying for two tenure track positions. By using the analysis, six candidates were shortlisted and interviewed.

Sixth research paper

The sixth research paper, "Organizational commitment and engagement in two Finnish energy sector organizations", describes the Helix 3 instrument and how it is used to analyze levels of organizational commitment and engagement within an organization using the Evolute framework. The theoretical part of the paper discusses the importance of organizational commitment and engagement, as well as factors that are related to them as antecedents, determinants or correlate factors. After this, the paper describes the structure of the ontology and defines the evaluated categories. The empirical part of this paper presents a comparative analysis of two organizations in the Finnish energy sector: Company A was a large Finnish electricity producer, and Company B was a Finnish utility company operating in the energy production and district heating market. The evaluation was performed by 54 employees. The paper demonstrates a ranking-based comparison method of results acquired with the Evolute Helix system. The method of analysis uses Friedman's test to analyze the group-level results.

Seventh research paper

The seventh research paper, "Comparing university students' commitment – a multicultural case study", describes a method for helping university management in their leadership of students. The theoretical part of this research paper describes studies on academic commitment and theories of student persistence and retention. Based on the theoretical framework, the paper describes the created assessment method and the ontology behind the Helix Academic application, e.g., the evaluated categories and concepts. The empirical part of this research compares the commitment factors of multicultural students in three different universities. The participants were from a university in South Korea and from two universities in Finland (one with all Finnish students and the other with students of different nationalities). Altogether, 41 university students responded to the assessment through self-evaluation. A case study comparing the three groups of respondents is presented.

Eighth research paper

The eighth research paper, “Masters students’ commitment and engagement in their course behavior”, seeks to find out whether there is a relation between students’ grades and the degree of their engagement and commitment using the Helix Academic application. The research group in this study consisted of two distinct groups of master’s degree students studying in the business and built environment and computing and electrical engineering faculties. Altogether, 59 students participated in this study. The analyses used the Evolute-type visual and scatterplot approach and confusion matrix-type analysis.

Ninth research paper

The ninth research paper, “Safety culture and collective commitment in organizational context”, describes a new hybrid ontology methodology approach for the joint analysis of an organization’s safety culture and employees’ organizational commitment. The theoretical paper describes the importance and linkages of safety culture and commitment in the development of the company’s profitability and competitiveness. The paper presents a multistage assessment process of these two important organizational characteristics.

4.2 Case companies and database used in this study

The data in the organizational research come from eight separate cases. Five of the cases are based on business organizations operating in the energy, information technology and service design industries, while three of the cases are from universities. Given the confidentiality of the research, comprehensive data to identify the case companies cannot be published; therefore, the descriptions of companies have been left at a general level. In this study, the cases are known as Case A, Case B, Case C, Case D, Case E, Case F, Case G and Case H. Table 7 presents basic characteristics of the case groups in the organizational research.

Table 7. Characteristics of the case groups

	Respondents	Age (mean)	Work experience (mean)	Work experience in current organization (mean)
Case A	10	41.6	18.9	8.9
Case B	44	40.6	16.3	8.0
Case C	7	40.9	17.0	7.7
Case D	47	38.3	14.0	8.1
Case E	7	38.6	10.3	1.0
Case F	9	30.6	9.0	1.4
Case G	32	25.2	2.1	0.5
Case H	32	26.7	6.5	1.8

- Case A is a Finnish municipal utility company operating in the energy production, and electricity and district heating market, with approximately 280 employees (see more about respondent characteristics in Einolander, 2015, 2016).

- Case B is a large Finnish nuclear electricity producer with approximately 890 employees (see more about respondent characteristics in Einolander, 2016; Koskialho, Einolander & Vanharanta, 2017).

- Case C is a joint case involving two Greek companies: one designs, constructs and operates motorways, while the other is involved in mobile app development.

- Case D is from the Tampere University of Technology, where the respondents were applicants for the tenure track process. In this case, the respondents comprised various nationalities and the application was used in the recruiting process (see more about respondent characteristics in Visa, Einolander & Vanharanta, 2015).

- Case E is from a large Finnish information technology company involved in mobile software development with more than 13,000 employees globally of which 30% in Finland (see more about respondent characteristics in Böös, 2014).

- Case F is a Finnish service design company employing 18 people.

- Case G comprised university students from Finnish and Polish universities, many of whom were working alongside their studies (see more about respondent characteristics in Einolander & Vanharanta, 2013, 2014).

- Case H is from a Polish business college. The respondents all worked in various companies in the Greater Poland region. The respondents were English-speaking students enrolled on a degree program in a business college.

The respondents gave responses on both the current state and the target state for all the statements presented on the Internet-based application, thus giving two unique database inputs per statement. A total of 46,248 responses were gathered for Helix A (188 respondents x 123 statements x 2 responses/statement), and a total of 45,120 responses for Helix B (188 respondents x 120 statements x 2 responses/statement).

In addition to the current state and the target state, the respondents evaluated the importance of the statements. However, since this was not mandatory, only 143 respondents performed the evaluations, some of whom did so partially. In light of missing values, the data were treated with a multiple imputation procedure, using a regression method (Dong & Peng, 2013) and IBM SPSS Statistics Version 22. The aim of multiple imputation is to fill in missing values by using the information contained in the observed data to create different plausible imputed data sets and appropriately combining results obtained from each of them (Sterne et al., 2009). The multiple imputation procedure handles missing data in three steps: 1) imputes missing data m times to produce m complete data sets; 2) analyzes each data set using a standard statistical procedure; and 3) combines the results into one (Dong & Peng, 2013). After the missing data imputation, the full sample size was 143 respondents.

In addition to the cases where Helix A and B applications were used, a database of responses to Helix Academic was created. In the various cases conducted, a total of 679 student evaluations were made in nine universities in Finland, Poland, South Korea, Spain and Greece. The student respondents gave answers to 124 statements from the current state and target state point of view, thus giving a database of 168,392 responses. In addition to the current state and the target state, the respondents evaluated the importance of the statements, which created a database of 70,858 importance values. However, similar to the organizational cases, not all of the respondents answered all the importance questions.

By using the gathered input database, averages were calculated for the distinct levels of the ontologies, i.e., statement level, feature level and class level. Finally, the differences between the target and the current levels were calculated to reveal the creative tensions at each level.

4.3 Analyses used in this study

Cronbach's alpha analysis was used to measure the internal consistency of the scales. The analysis was conducted on each of the categories/classes (subscales) for both Helix A and Helix B ontologies for the current state scale and for the target state scale. It was found that the alpha values ranged from .74 to .96 for the current state in Helix A, and .64 to .95 in Helix B. The alpha values for the target state scales ranged from .67 to .96 in Helix A, and from .71 to .93 in Helix B. Cronbach's alpha values for each class are presented in Table 8 and Table 9.

Table 8. Cronbach's alpha values for classes in Helix A

Helix A classes	Cronbach's Alpha (Current state)	Cronbach's Alpha (Target state)
Total scale score	.98	.97
Attributions of HRM practices	.74	.67
Intrinsic motivation	.89	.85
Job satisfaction	.96	.96
Motivating potential of job	.92	.89
Organizational dynamics	.91	.90
Organizational support	.91	.87
Person-role congruence	.83	.77
Affective commitment	.84	.74
Normative commitment	.79	.72
Continuance commitment	.77	.82

In Helix A, the class of "attributions of HRM practices" had an alpha level of .67 for the target state scale, which indicated that the subscale has a questionable inter-item reliability. It was found that, by deleting any of the items, the alpha level is not significantly increased. All other classes in Helix A had an adequate level of inter-item reliability. In Helix B, the class of "employment alternatives and opportunities" had an alpha value of .64. However, it was found that, by deleting two items, the alpha value could be increased to the level of .67. The accepted minimum alpha value is considered to be .65-.70. In Helix B, all other classes had an alpha value of at least .70, which indicates an acceptable alpha level.

Table 9. Cronbach's alpha values for classes in Helix B

Helix B classes	Cronbach's Alpha (Current state)	Cronbach's Alpha (Target state)
Total scale score	.98	.97
Employment alternatives and opportunities	.64	.71
Identification with organization	.93	.86
Internal sense of obligation	.89	.86
Non-work-related investments	.70	.72
Perceptions of justice and fairness	.95	.93
Person-organization fit	.91	.80
Psychological contract	.95	.90
Work-related investments	.85	.83

In the following subchapters, examples of the results are analyzed using different methods. The first analysis uses a visual method to analyze the results from one case. Next, a collective ranking-based analysis is presented, where all the cases are analyzed side by side. Third, the results from a single case are analyzed based on organizational commitment profiles. Fourth, the importance of statements is analyzed, based on all the respondents, in order to find out which characteristics the respondents' value the most. Lastly, the single-case results from the Helix Academic application is presented using a visual analysis method. The presented analyses only use a small amount of the data that were collected during the research, thus offering considerable potential for further research using various analysis methods.

4.4 Single-case results – example of one company's analysis

This chapter presents an analysis of Case A. In this case, a hyperlink to respond to a survey was distributed to all the organization's senior salaried staff and management team, including the CEO. Forty employees were asked to join in the research; in the end, 10 completed surveys were received, thus giving a response rate of a 25%. 40% of the respondents who gave answer the demographic questions were men with a mean age of 47.2 years, while 30% were women, with a mean age of 39 years. Three respondents did not answer the demographic questions. The respondents had been in their current jobs for an average of 4.9 years (SD 3.8), in their organization for an average of 8.9 years (SD 6.0), and had an average of 18.9 years of work experience (SD 10.3).

The values of the classes (categories) and feature groups presented here are average values calculated from the responses from the participants in the Case A. All the analyses in this chapter are based on the calculated averages of the current state, target state and creative tension. The figures are constructed on the basis that the higher the value, the higher its committing affect will be.

4.4.1 Category-level results – Helix A

Figure 18 and Table 10 show the calculated current and target state values of respondents for class levels in the Helix Application, along with their difference, known as creative tension. The figure is sorted based on the current state.

The figure shows that, in Case A, intrinsic motivation is at the highest level, in addition to motivating potential of the job and job satisfaction. The respondents felt that the lowest current state was in the classes of continuance commitment, normative commitment, person-role congruence and attributions of HRM practices.

When looking at organizational commitment categories/classes, affective commitment is at the highest level, while normative commitment is somewhat lower (minus 0.11 units), while the degree of continuance commitment is at the lowest level (minus 0.18 units). The numerical values of the classes can be seen in Table 10, where the data are sorted based on creative tension values. In the table, three classes with the highest values are highlighted with in red, while three classes with the lowest values are highlighted in green.

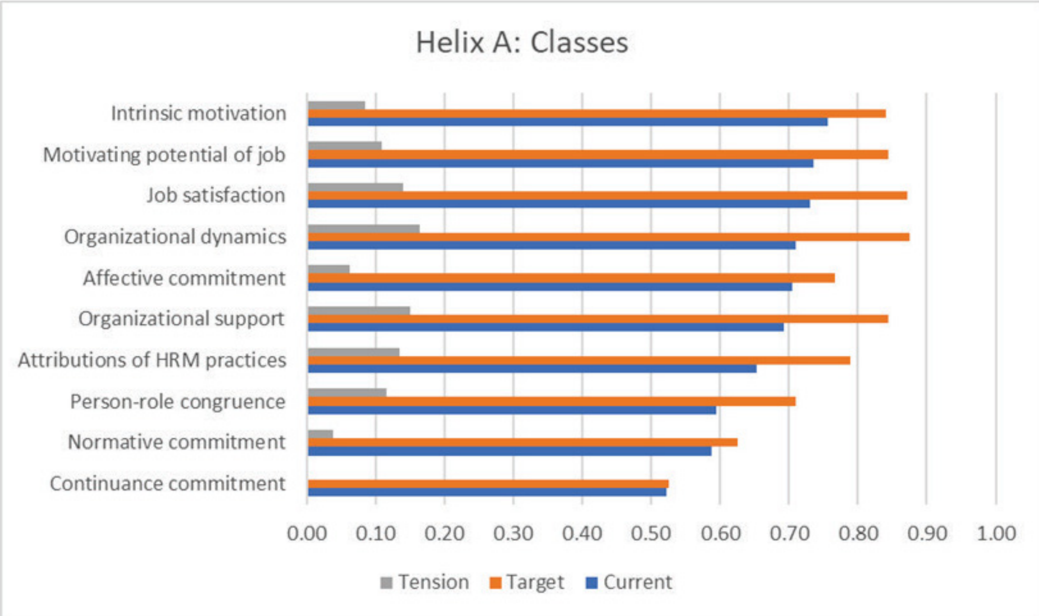

Figure 18. Visual presentation of Helix A classes sorted based on current state

Figure 19 illustrates the averages of respondents by class in relation to the target state values. The figure clearly distinguishes two classes, of which the target state value is higher. These two classes are organizational dynamics and job satisfaction. Motivating potential of the job, organizational support and intrinsic motivation are also valued highly at a similar level.

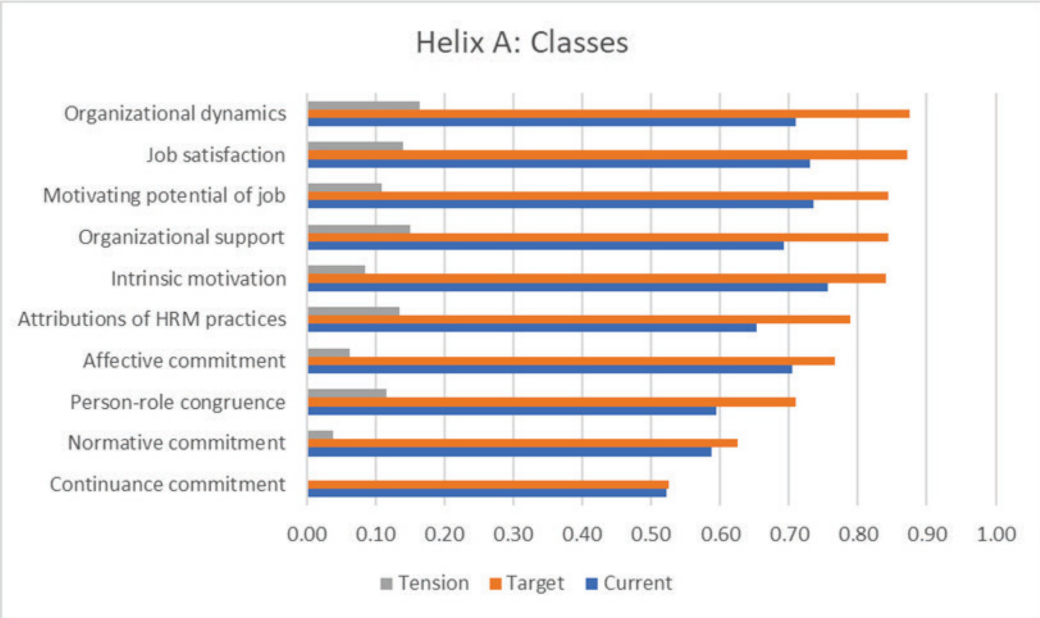

Figure 19. Visual presentation of Helix A classes sorted based on target state

The lowest target state values are in continuance commitment, normative commitment and person-role congruence. The numerical values of the figure are also presented in Table 10.

In Figure 20 and Table 10, the classes are represented in the order of the calculated creative tension. It can be seen that, in all organizational commitment classes, current state matches quite closely to respondents' target state values. However, for affective commitment and intrinsic motivation, there is a small amount of creative tension, but they are quite close to the target levels with values of less than 0.1 units.

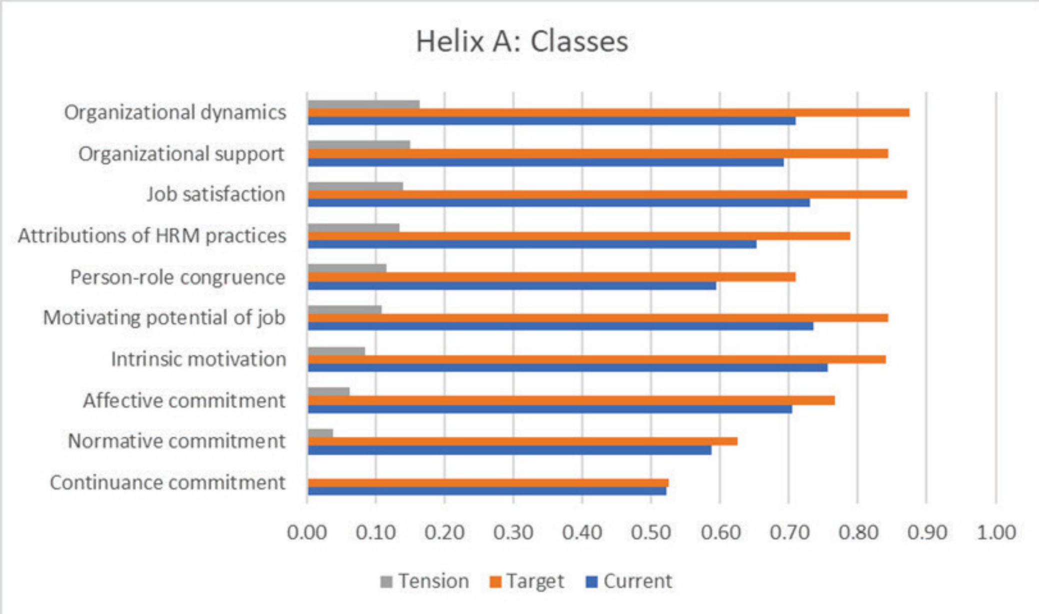

Figure 20. Visual presentation of Helix A classes sorted based on creative tension

The highest creative tensions can be found in organizational dynamics, organizational support and job satisfaction. When looking more closely at the class of organizational dynamics, even though its current level is one of the highest, its target state is the highest. This means that organizational dynamics have the highest creative tension at 0.17 units, and collectively they are at the core of development activities. When looking at job satisfaction and attributions of HRM practices, it can be seen that their creative tensions are at the same level, at 0.14 units. However, there is a substantial difference between their current and target states. As job satisfaction has a much higher target state, it can be argued that job satisfaction's importance is valued more highly than that for attributions of HRM practices.

Table 10. Helix A classes sorted based on creative tension

	Helix A: Classes	Current	Target	Tension
1	Continuance commitment	0.52	0.53	0.00
2	Normative commitment	0.59	0.63	0.04
3	Affective commitment	0.70	0.77	0.06
4	Intrinsic motivation	0.76	0.84	0.08
5	Motivating potential of job	0.74	0.84	0.11
6	Person-role congruence	0.59	0.71	0.12
7	Attributions of HRM practices	0.65	0.79	0.14
8	Job satisfaction	0.73	0.87	0.14
9	Organizational support	0.69	0.84	0.15
10	Organizational dynamics	0.71	0.87	0.17

4.4.2 Feature-level results – Helix A

The values of features presented here are the averages of the responses from the case study in Company A. The analyses are based directly on the averages calculated from the answers.

Figure 21 illustrates the values of the current state and target state of all respondents for each feature. The calculated creative tensions are also presented. This analysis goes deeper into the structure of the ontology than the previous class-based analysis. The chart is sorted based on the current state. The figure clearly shows the weakest features: role overload, compensation satisfaction, feedback, role conflict and sense of progress, in addition to continuance commitment features. The strongest features, on the other hand, are ownership, work autonomy, job security satisfaction and task identity. In the following feature-level figures and table, the asterisk indicates reversed meaning in the scale (i.e. higher the value, less role overload, ambiguity or conflict is desired).

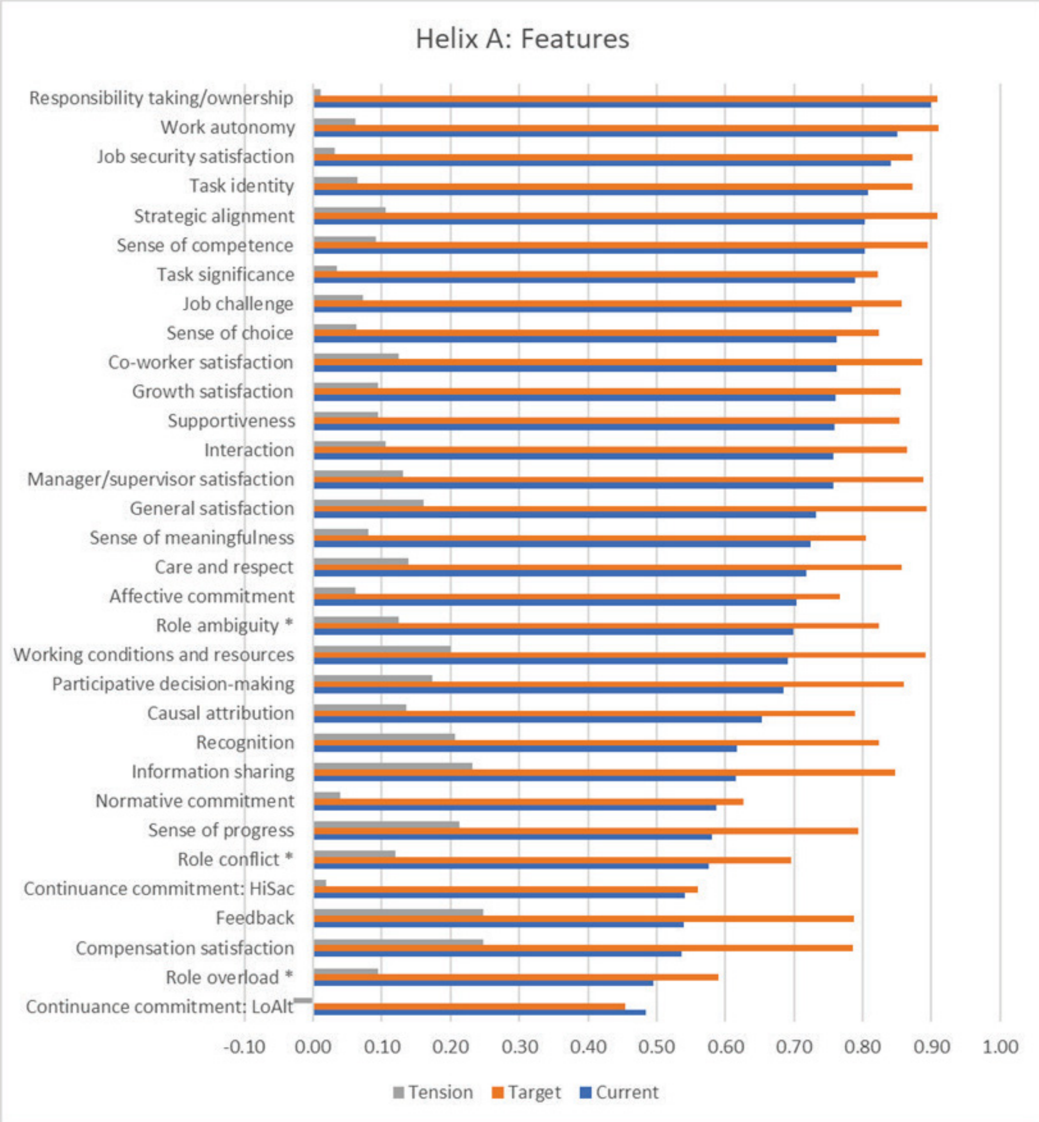

Figure 21. Visual presentation of Helix A features sorted based on current state

When looking at current states, the top 10 features at the highest level are ownership, work autonomy, job security satisfaction, task identity, strategic alignment, sense of competence, task significance, job challenge, sense of choice, and co-worker satisfaction. These features correspond to the highest categories/classes of intrinsic motivation, motivating potential of the job, job satisfaction and organizational dynamics, as shown in Figure 19. Numerical values for the figure are presented in Table 11, where the data are sorted, based on the calculated creative tension values. In the table, the five highest and five lowest values are highlighted.

Figure 22 shows the same feature-level result, albeit sorted based on the target state. According to Figure 22, the 10 features with the highest target state values are work autonomy, ownership, strategic alignment, sense of competence, general satisfaction, working conditions and resources, manager satisfaction, co-worker satisfaction, task identity, and job security satisfaction.

The features with the lowest target state are both features of continuance commitment, role overload, normative commitment and role conflict. Features with a target state under 0.8 units are also in the features of affective commitment, compensation satisfaction, feedback, causal attribution and sense of progress.

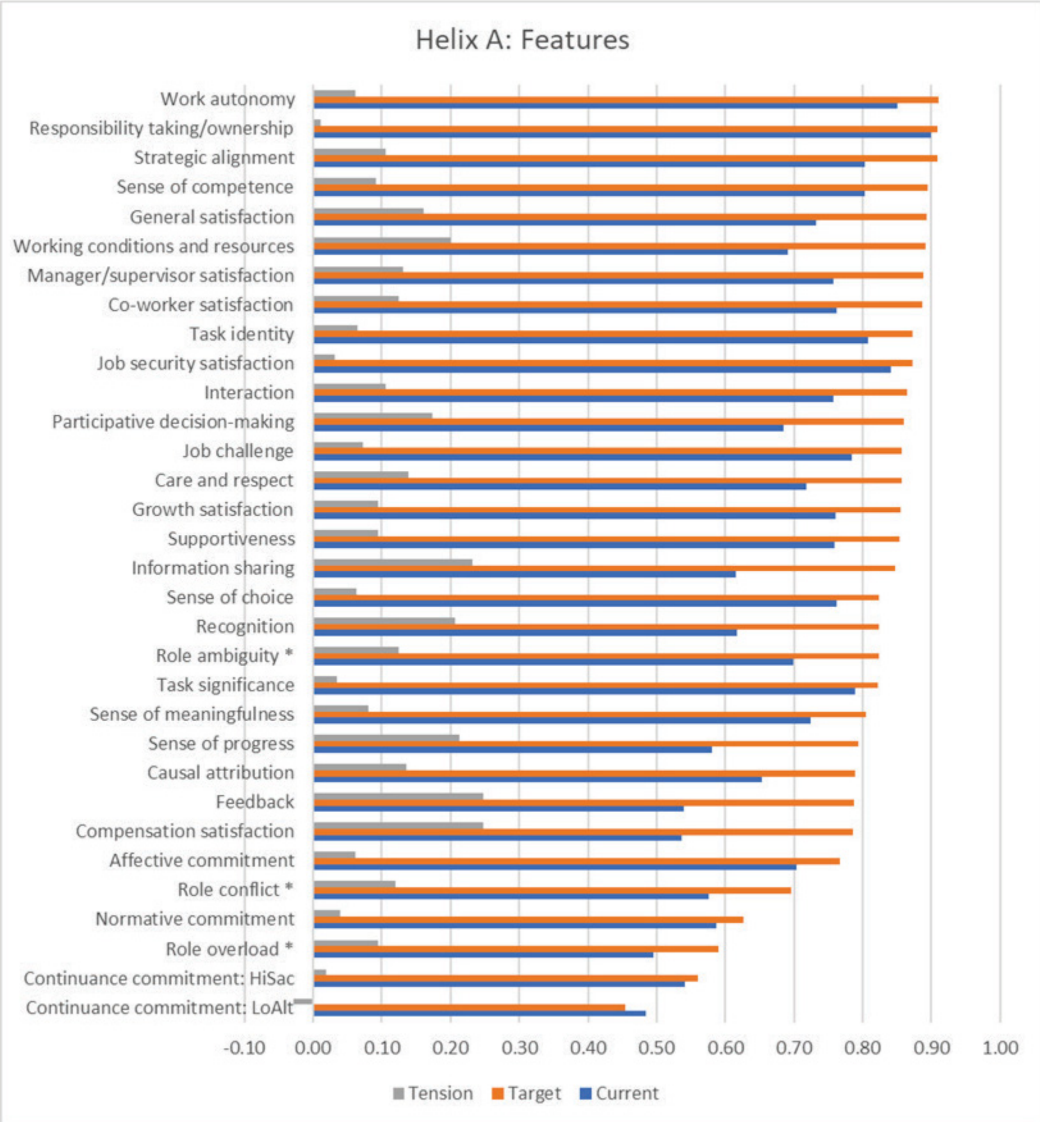

Figure 22. Visual presentation of Helix A features sorted based on target state

Out of the 10 features based on the highest level of the target state, seven are also among the 10 highest valued features based on the current state. These are ownership, work autonomy, job security satisfaction, task identity, strategic alignment, sense of competence and co-worker satisfaction. These features can be regarded as being at the right level, and there is nothing much to do for their betterment; however, they should be monitored in case of changes in the future.

Figure 23 shows the data sorted according to creative tension. This graph shows that the highest gap between the current and target states are in compensation satisfaction, feedback, information sharing, sense of progress, recognition, working conditions and resources, and participative decision-making. Interestingly, even though compensation satisfaction has the highest creative tension, its target state value is among the lowest. These are the features that, according to the respondents, should be addressed first, if looking solely at creative tension or the amount they wish for in the future. However, based on the nature of how employees' feelings about the compensation they are receiving, its true state and potential must be analyzed thoroughly.

When comparing features with the highest creative tension and features with the highest target states, two features can be found in the same groups. These are working conditions and resources, and general satisfaction. These are the features that respondents value the most and wish to develop the most. When deciding the actions to be taken, based on these respondents, these could be considered the ones to start the planning with. The numerical values of the data are presented in Table 11.

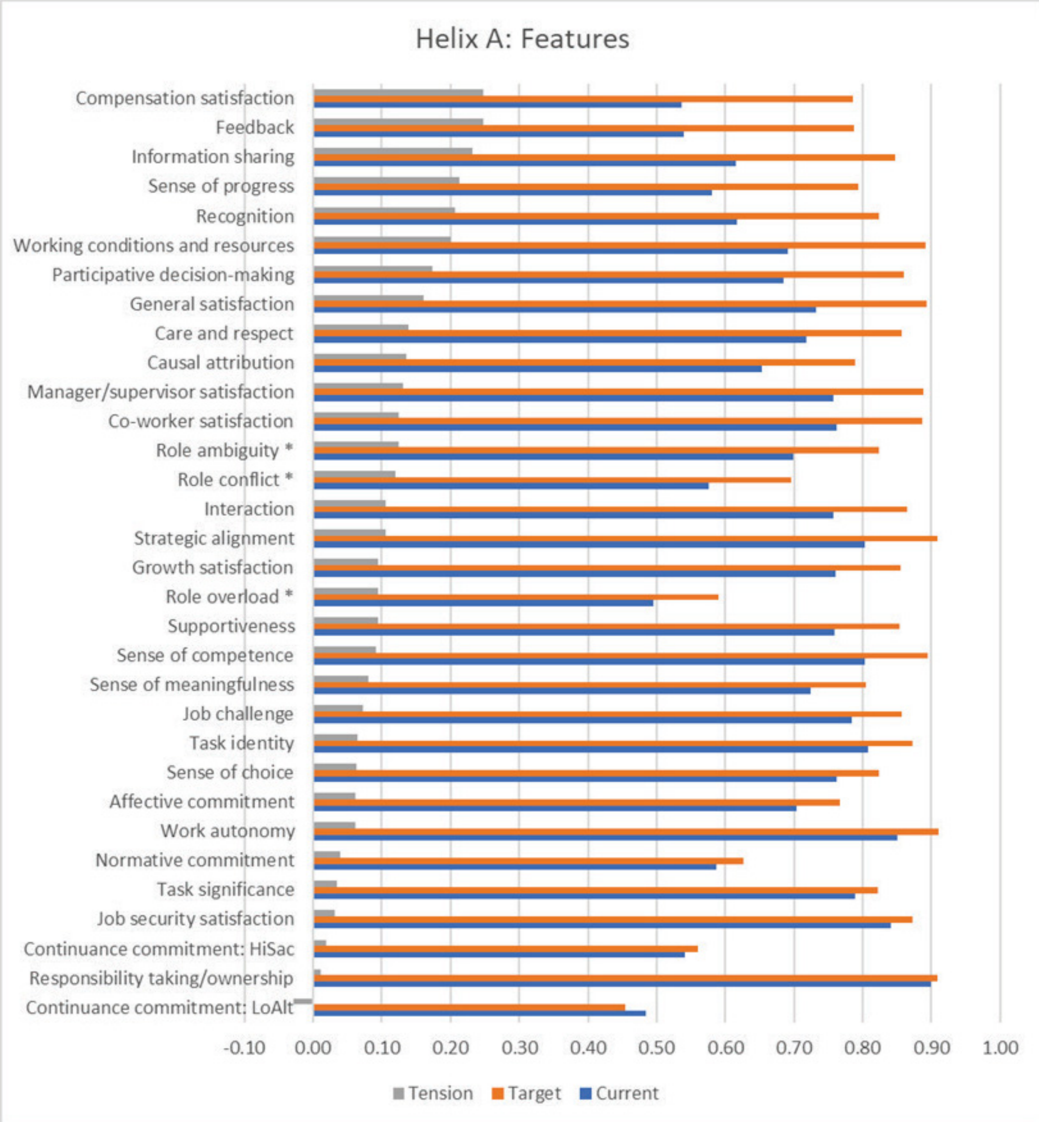

Figure 23. Visual presentation of Helix A features sorted based on creative tension

According to Figure 23, the features that correspond best with the envisioned target state are ownership, job security satisfaction, task significance, work autonomy, sense of choice, task identity, job challenge, sense of meaningfulness, sense of competence, supportiveness, role overload and growth satisfaction. From these five, work autonomy, ownership, sense of competence, task identity and job security satisfaction are among the 10 features with the highest target state.

Table 11. Helix A features sorted based on creative tension

	Helix A: Features	Current	Target	Tension
1	Continuance commitment: LoAlt	0.48	0.45	-0.03
2	Responsibility taking/ownership	0.90	0.91	0.01
3	Continuance commitment: HiSac	0.54	0.56	0.02
4	Job security satisfaction	0.84	0.87	0.03
5	Task significance	0.79	0.82	0.03
6	Normative commitment	0.59	0.63	0.04
7	Work autonomy	0.85	0.91	0.06
8	Affective commitment	0.70	0.77	0.06
9	Sense of choice	0.76	0.82	0.06
10	Task identity	0.81	0.87	0.07
11	Job challenge	0.78	0.86	0.07
12	Sense of meaningfulness	0.72	0.81	0.08
13	Sense of competence	0.80	0.90	0.09
14	Supportiveness	0.76	0.85	0.09
15	Role overload *	0.50	0.59	0.09
16	Growth satisfaction	0.76	0.86	0.09
17	Strategic alignment	0.80	0.91	0.11
18	Interaction	0.76	0.86	0.11
19	Role conflict *	0.58	0.70	0.12
20	Role ambiguity *	0.70	0.82	0.12
21	Co-worker satisfaction	0.76	0.89	0.13
22	Manager/supervisor satisfaction	0.76	0.89	0.13
23	Causal attribution	0.65	0.79	0.14
24	Care and respect	0.72	0.86	0.14
25	General satisfaction	0.73	0.89	0.16
26	Participative decision-making	0.69	0.86	0.17
27	Working conditions and resources	0.69	0.89	0.20
28	Recognition	0.62	0.82	0.21
29	Sense of progress	0.58	0.79	0.21
30	Information sharing	0.62	0.85	0.23
31	Feedback	0.54	0.79	0.25
32	Compensation satisfaction	0.54	0.79	0.25

It is important to note that people feel and experience the state of the organization and their situation very differently; however, the mean values present a simple but useful picture of how the features are perceived and understood, as well as what should be developed. It is also clear that the company cannot develop all the key features simultaneously. Such development requires a lot of experience, planning, capability, competence and know-how from company management and leadership. In the next subchapter, the analysis, based on results from the Helix B application, is presented.

4.4.3 Category-level results – Helix B

This subchapter analyzes classes (categories) and features from the Helix B ontology. Figure 24 shows the results from Case A sorted by the current state. In this case, the current state shows that classes of person-organization fit, organizational identification, psychological contract and affective commitment are currently at the highest level. These all have values over 0.7 units. The lowest current states, in this case, are in employment alternatives and opportunities, and continuance commitment with values slightly over 0.5. The numerical values are presented in Table 12. In the table, the values are sorted based on current state values.

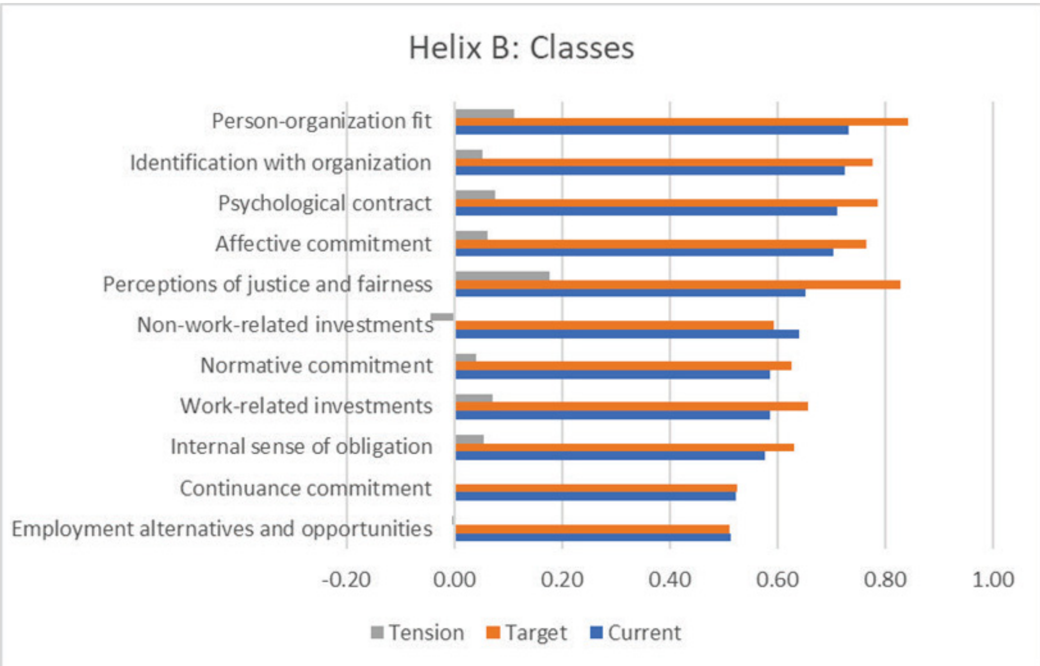

Figure 24. Visual presentation of the Helix B classes sorted based on current state

In Figure 25, the classes are sorted based on the target state. From these, it can be seen that the respondents from Case A wish to have person-organization fit and justice and fairness at the highest level in the future. Both of these have a numerical value over 0.8. The next three classes that are valued the highest are psychological contract, identification and affective commitment. The lowest target state values are in the classes of employment alternatives and opportunities, and continuance commitment.

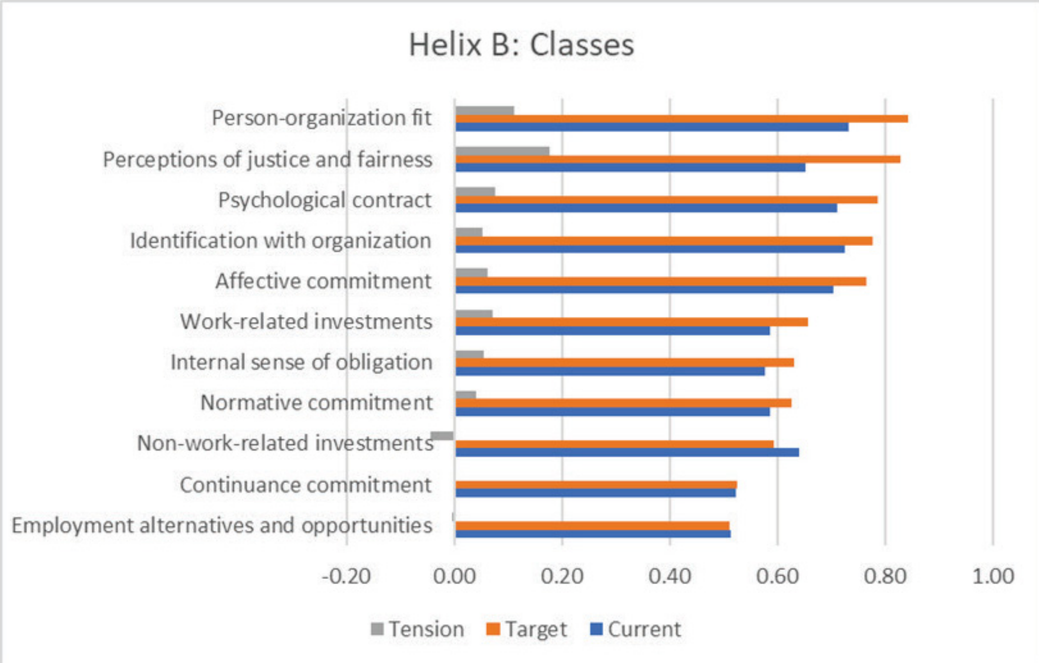

Figure 25. Visual presentation of Helix B classes sorted based on target state

When looking at creative tensions in Figure 266, the two classes with the highest wish for change are justice and fairness, and person-organization fit. According to the results, the respondents have the highest wish for change in relation to justice and fairness that the organization shows to its employees.

When looking at the lowest creative tensions, there is one negative value of creative tension and two classes with zero creative tension. The lowest creative tensions are in the classes of non-work-related investments, continuance commitment, and employment alternatives and opportunities. As these classes do not have any creative tension, respondents see no need for change in these classes. The numerical values are illustrated in Table 12 and sorted according to creative tension values. The three highest and three lowest values are highlighted in the table.

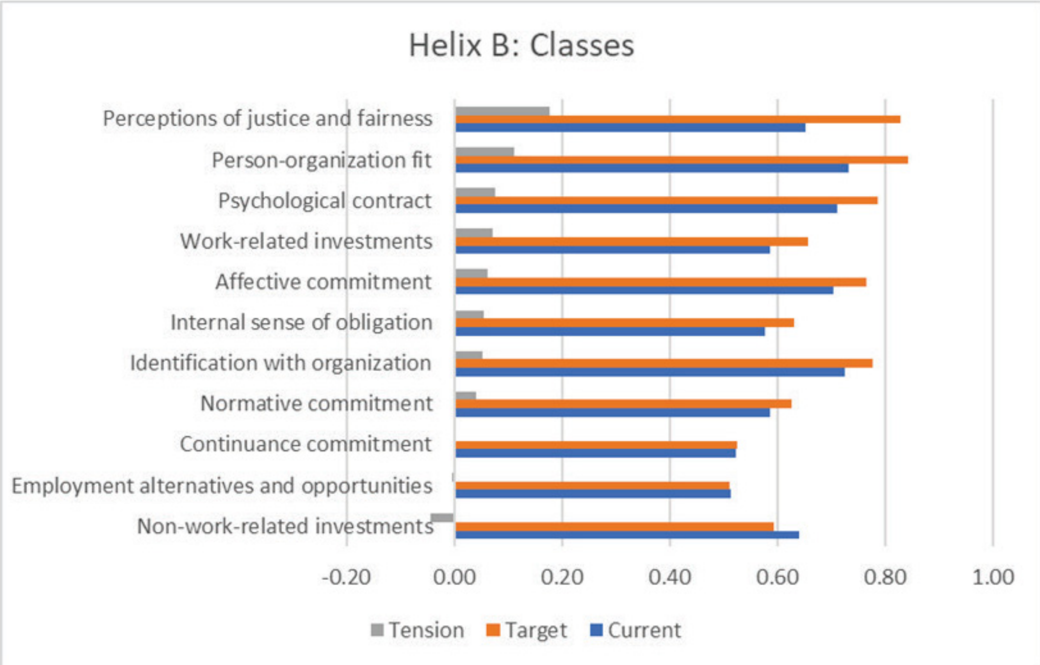

Figure 26. Visual presentation of Helix B classes sorted based on creative tension

Table 12. Helix B classes sorted based on creative tension

	Helix B: Classes	Current	Target	Tension
1	Non-work-related investments	0.64	0.59	-0.05
2	Employment alternatives and opportunities	0.51	0.51	0.00
3	Continuance commitment	0.52	0.53	0.00
4	Normative commitment	0.59	0.63	0.04
5	Identification with organization	0.73	0.78	0.05
6	Internal sense of obligation	0.58	0.63	0.06
7	Affective commitment	0.70	0.77	0.06
8	Work-related investments	0.59	0.66	0.07
9	Psychological contract	0.71	0.79	0.07
10	Person-organization fit	0.73	0.84	0.11
11	Perceptions of justice and fairness	0.65	0.83	0.18

4.4.4 Feature-level results – Helix B

The values presented here are the averages of unique responses from Case A. The analyses are based directly on the averages calculated from the answers. In Figure 27, the values are sorted according to the current state results. According to the figure, the respondents have the highest current states in job security needs, adherence to psychological contracts, transactional contracts, and sense of pride, in addition to belonging and attachment.

The lowest current state values are in monetary work-related investment (salary/benefits), low alternatives-based continuance commitment, and availability of alternatives. Numerical values of the figure are presented in Table 13. In the table, the values are sorted according to creative tension, with the five highest and lowest values highlighted. In the following feature-level figures and table, the asterisk indicates reversed meaning in the scale (i.e. lower the value, more alternatives are desired).

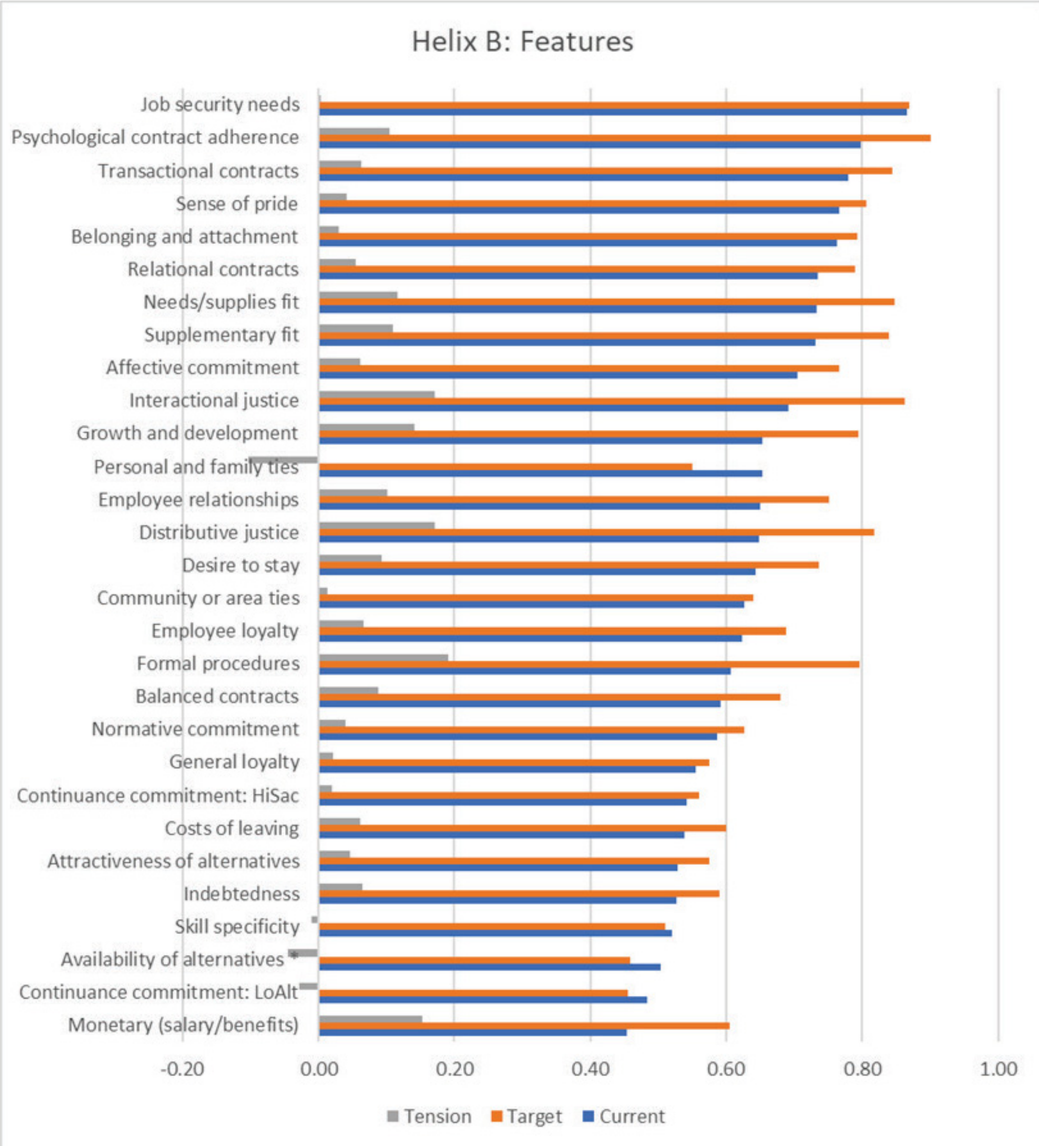

Figure 27. Visual presentation of Helix B features sorted based on current state

In Figure 28, the values are sorted based on the target states. According to the figure, what respondents value the most is that their organization adheres to psychological contracts, job security, interactional justice and need-supplies fit, in addition to transactional contracts and supplementary fit. These features have numerical values over 0.8. The lowest target states are in low alternatives-based continuance commitment, availability of alternatives and skill specificity, with numerical values of around 0.5. All the numerical values can be seen in Table 13.

Figure 28. Visual presentation of Helix B features sorted based on target state

In Figure 29, the features are sorted based on the calculated creative tension values. This figure shows that the respondents feel that there is the most room for improvement or positive change in the features of formal procedures, interactional and distributive justice, monetary investments, and growth and development.

The lowest creative tension in this figure is negative, meaning that the respondents wish to have fewer personal and family ties to their company, and would like more possibilities for alternative employment. In Table 13, the values are presented numerically. In the table, five of the highest and five of the lowest values are highlighted.

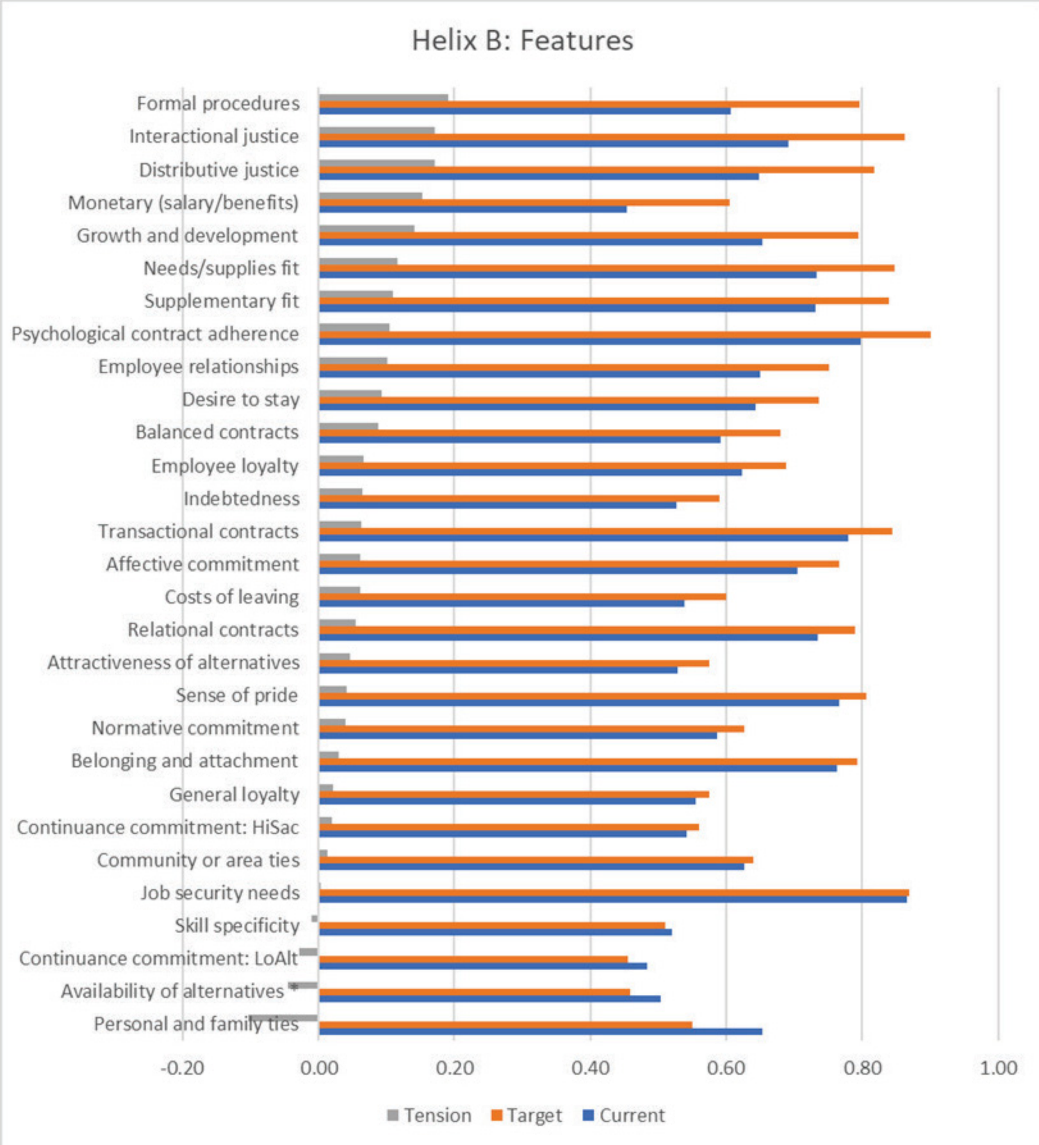

Figure 29. Visual presentation of Helix B features sorted based on creative tension

Table 13. Helix B features sorted based on creative tension

	Helix B: Features	Current	Target	Tension
1	Personal and family ties	0.65	0.55	-0.10
2	Availability of alternatives *	0.50	0.46	-0.04
3	Continuance commitment: LoAlt	0.48	0.45	-0.03
4	Skill specificity	0.52	0.51	-0.01
5	Job security needs	0.87	0.87	0.00
6	Community or area ties	0.63	0.64	0.01
7	Continuance commitment: HiSac	0.54	0.56	0.02
8	General loyalty	0.55	0.58	0.02
9	Belonging and attachment	0.76	0.79	0.03
10	Normative commitment	0.59	0.63	0.04
11	Sense of pride	0.77	0.81	0.04
12	Attractiveness of alternatives	0.53	0.57	0.05
13	Relational contracts	0.73	0.79	0.05
14	Costs of leaving	0.54	0.60	0.06
15	Affective commitment	0.70	0.77	0.06
16	Transactional contracts	0.78	0.84	0.06
17	Indebtedness	0.53	0.59	0.06
18	Employee loyalty	0.62	0.69	0.07
19	Balanced contracts	0.59	0.68	0.09
20	Desire to stay	0.64	0.74	0.09
21	Employee relationships	0.65	0.75	0.10
22	Psychological contract adherence	0.80	0.90	0.10
23	Supplementary fit	0.73	0.84	0.11
24	Needs/supplies fit	0.73	0.85	0.12
25	Growth and development	0.65	0.79	0.14
26	Monetary (salary/benefits)	0.45	0.61	0.15
27	Distributive justice	0.65	0.82	0.17
28	Interactional justice	0.69	0.86	0.17
29	Formal procedures	0.61	0.80	0.19

As a summary of the analysis, it can be stated that the organization is perceived to be very dynamic, where the company's personnel have a high strategic alignment in order to direct their actions to the fulfillment of the company's goals. However, the respondents feel that dynamics must still be improved by focusing on information sharing and participative decision-making practices. It should also be noted that employees' self-motivated willingness to improve their knowledge and participation in business matters is very beneficial for the company.

Further, the respondents feel their work is highly intrinsically motivating and that their job provides high job satisfaction. Moreover, the employees feel a high level of ownership, work autonomy, job security and task identity about their job. They also feel that their job task is significant and challenging. Despite the high-level nature of the current feelings, respondents are looking forward to an even more motivating job, better working atmosphere and higher job satisfaction.

The respondents perceive that the person-organization fit, organizational identification and psychological contracts are currently at a high level. When analyzing the results more deeply, the highest current states are in the need for secure employment, adherence to psychological contracts, balance in transactional contracts and feeling of pride, in addition to feelings of belonging and attachment to the current organization.

At the moment, continuance commitment, normative commitment, person-role congruence, and feelings of attributions of HRM practices are at a relatively low level. In a more detailed analysis, the state is the worst in overloading role expectations, satisfaction with compensation, quality of feedback, conflicting role requirements and feelings of progress, in addition to features related to continuance commitment. However, the low state of continuance commitment can be regarded as positive from an organizational perspective.

From the results, it can be seen that there are two features with high creative tension and the highest target state: working conditions and resources, and general satisfaction (Figure 23). These features are valued the most by the respondents, based on their target state values, which they wish to improve even more. However, when looking only at the creative tension results at the feature level, the respondents wish to develop the prevailing state of justice and fairness, which the organization shows to their employees (Figure 29), as well as, for example, receive more and better-quality feedback, see an enhancement of information sharing practices, be recognized more for their efforts, benefit from improved working conditions and some adjustments to the pay system (Figure 23). These are the ones that should be addressed inside the company at management level and analyzed further to determine, for example, how different leadership practices could enhance their development in order to boost employees' future engagement and affective commitment.

When looking at the organizational commitment categories, we see that affective commitment is at the highest level, while normative commitment is somewhat lower, and the degree of continuance commitment is at the lowest level. In addition, it can be seen that all current states of organizational commitment classes correspond quite closely to the respondents' target state values, meaning that employees do not see an immense need for them to be changed. From both the organization's and the employees' perspective, it is good to observe that affective commitment is at the highest level, while continuance commitment is at the lowest. However, a more detailed analysis of organizational commitment should incorporate the profiling of employees according to their distinct commitment profiles in relation to groups, which will offer more detailed analysis results than by only examining average responses.

One type of more detailed analysis of organizational commitment classes is presented in chapter 4.6. In this chapter, Case B is analyzed according to organizational commitment profiles. Profiling the employees' degree of organizational commitment according to distinct types of commitment can be a very useful tool for organizational management and leadership.

4.5 Multiple-case results – collective ranking-based analysis

Normally, in human sciences, sums and means are used to present group results. However, if interpreted strictly in statistical sense, rankings should be used to present group results instead of direct values. Therefore, in order to compare the cases, the data had to be treated for this analysis.

In the case studies, there were several related samples in the data. According to Conover (1999), the most effective test for several related samples of data, in which the number of different variables is more than six, is Friedman's test. Friedman's test can be considered as a two-way analysis of variance on ranks. In this test, each respondent's answers to statements, features or classes are converted into corresponding rankings. The smallest value is replaced by the ranking of 1 and the highest value by the total amount of statements, features or classes. If there are identical values, then ranking is divided by those with the same values. After the ranking, it is possible to calculate sums and means from the rank numbers to create group results for each level.

By using ranking-based analysis, the effect of subjective opinions of each individual respondent is reduced regarding the whole results. The final group-level results are based on the relationship between all answers of each respondent. This is useful because respondents who systematically experience the states of statements, either at a clearly lower or higher level, may have a significant effect on the average of the whole results.

Friedman's test also has one additional benefit compared with sums and averages. By using post hoc tests, one can decide which groups are significantly different from each other. Conover proposed post hoc tests based on the mean rank differences of the groups (Conover & Iman, 1979; Conover, 1999). By using Conover's (1999) post hoc analysis of Friedman's test, one can calculate the minimum statistical difference (MSD) that the sums must have, after which they are regarded as unequal (see, e.g., Porkka, Salo-Pihlajamäki & Vanharanta, 2010). This technique is used in order to be able to mark out differences between the values of the classes. The differences may be calculated with different significance levels, which are also denoted as alpha or α. In this study, an alpha value of .05 was used. Other commonly used values for values are .01 and .001. In this research, Friedman's test and its post hoc analyses were performed using MedCalc for Windows software.

In the following figures, all the classes with a value within the MSD range from the highest value are considered statistically equal with the highest value. These classes are marked in dark gray in the figures. These have been calculated by subtracting the MSD value from the highest rank value. The line for the bottom group is correspondingly obtained by adding the MSD to the minimum value, as marked in blue. By using this kind of analysis, we can find categories that are valued collectively in terms of similar strength and group them in statistically valid classes (Conover, 1999; Porkka & Paajanen, 2014).

Here, in this analysis, only the results of the classes are presented and analyzed. The following tables present the ranked class-level (sum) variables for all case companies based on their current state, target state and creative tension. Each of these states can be looked at individually or together to have a more comprehensive view of the situation, and to see whether there are similarities or differences between the cases. Table 14 presents the current state rankings of all seven cases and combined results of all cases.

Table 14. Current state rankings of Helix A

HELIX A CURRENT STATE Category/class	All cases md=0.52 n=188	Case A md=2.20 n=10	Case B md=0.95 n=44	Case C md=2.86 n=7	Case D md=0.82 n=47	Case E md=2.54 n=7	Case F md=2.33 n=9	Case G md=1.41 n=32	Case H md=1.40 n=32
Intrinsic motivation	7.77	7.40	8.23	7.43	8.77	8.00	7.89	6.47	7.09
Motivating potential of job	7.40	7.80	7.93	7.14	8.17	8.14	7.78	6.47	6.16
Job satisfaction	6.68	7.30	7.30	6.14	6.87	6.29	6.33	6.44	5.88
Organizational dynamics	6.32	6.20	6.57	6.29	6.15	5.00	6.33	6.31	6.58
Organizational support	6.03	6.10	6.23	6.71	5.98	4.71	6.56	5.56	6.25
Attributions of HRM practices	5.19	4.30	3.86	6.43	5.79	4.43	5.56	5.97	5.44
Person-role congruence	5.07	3.20	5.14	3.14	5.00	6.86	2.89	5.78	5.59
Affective commitment	4.25	6.60	4.11	5.57	4.09	2.43	5.56	4.13	3.81
Normative commitment	3.41	3.30	2.95	3.43	2.73	2.29	3.78	4.58	4.02
Continuance commitment	2.88	2.80	2.68	2.71	1.46	6.86	2.33	3.30	4.19

As shown in Table 14, the gray areas represent classes with high rankings, while the blue areas represent classes with low rankings. The violet area means that the class in question belongs to both high- and low-level rankings. This can be seen in Case C.

Intrinsic motivation and motivating potential of the job are classes with a high current state in rankings in all cases. Job satisfaction also had a high current state ranking in all but one case. In addition, classes of organizational dynamics and organizational support had high current state rankings in five cases. These classes had a significantly higher current state than the others.

According to this test, the class of continuance commitment had a statistically significantly low current state ranking in all cases except one, which was Case E. In this case, continuance commitment was ranked in a high category, unlike in other cases. The class of normative commitment also received significantly low rankings in most of the cases, except in Case D where it received a neutral ranking.

It seems that all classes evaluating the degree of organizational commitment have the lowest rankings, and are mostly regarded as having statistically significant low current states compared to factors having an effect on them. However, affective commitment has a statistically high-level ranking in Case A, while, in Case C, affective commitment is among the statistically highest and lowest current state. The reason for this is apparently the essence of the statements compared to others, as their meaning relationships in the respondents' mind are not as easily understandable. Therefore, analyzing organizational commitment classes could be more beneficial when done separately.

In the table, there are more classes marked with high rankings than low ones. This means that the respondents failed to have a common view of the rankings of the different classes. The greater the consensus among the respondents, the fewer the number of classes in the groups of high- and low-level rankings. As shown in Table 14, Cases A, C, E, F, G and H, have the most classes in the groups of high- and low-level rankings. However, in Cases D and B, most classes receive a neutral ranking, meaning that there is quite a considerable consensus among the respondents. Based on the current state results, when looking at all the cases, work motivation and job satisfaction were perceived at a higher level than classes of organizational commitment. Table 15**.** presents the current state rankings of all the cases regarding the Helix B application.

Table 15. Current state rankings of Helix B

HELIX B CURRENT STATE Category/class	All cases md=0.59 n=188	Case A md=2.23 n=10	Case B md=1.11 n=44	Case C md=3.09 n=7	Case D md=0.81 n=47	Case E md=2.94 n=7	Case F md=2.38 n=9	Case G md=1.52 n=32	Case H md=1.60 n=32
Person-organization fit	8.61	9.40	9.59	5.71	9.77	7.00	5.67	7.75	6.34
Perceptions of justice and fairness	7.76	5.50	6.89	7.29	9.04	8.71	7.44	8.03	7.66
Psychological contract	8.13	9.00	9.07	5.43	8.87	6.00	5.11	7.34	6.72
Employment alternatives and opportunities	4.89	2.90	5.86	7.71	3.14	9.71	8.44	4.63	6.58
Identification with organization	6.93	8.10	7.05	4.29	7.94	3.71	4.67	6.13	5.63
Work-related investments	5.95	5.30	6.02	3.14	5.30	5.29	4.00	6.63	6.63
Affective commitment	5.99	8.20	5.75	3.29	7.19	3.29	3.56	5.13	4.64
Normative commitment	4.74	4.60	4.16	8.14	4.60	4.00	8.78	6.02	4.78
Internal sense of obligation	4.80	4.00	3.73	9.00	4.66	4.71	9.00	5.66	5.66
Non-work-related investments	4.20	5.70	3.91	6.86	3.36	5.57	7.11	4.06	5.56
Continuance commitment	4.01	3.30	3.98	5.14	2.14	8.00	2.22	4.64	5.81

Table 15 does not give consistent results among the cases to the same extent as Table 14. According to Table 15, in all cases, except one, the class of person-organization fit is regarded with a high current state ranking. Further, in most cases, perceptions of justice and fairness are considered as being on a high level. However, similar to Table 14, when comparing the continuance commitment class with other classes in Helix B, there are low current state rankings in all cases, except in Case E. Table 15 shows that, in Cases C, E, G and H, there are many classes in the groups with high- and low-level rankings. In these cases, the respondents did not have a unanimous view of the rankings. However, in the case of Group D, most of the classes received a neutral ranking, meaning that there was a greater consensus among the respondents than in the other cases. Based on the current state results, the case companies mostly tend to value person-organization fit, and justice and fairness, which are related to affective commitment. In addition, adherence to psychological contract, and employment alternatives and opportunities were very highly valued, based on the rankings. Table 16 presents the target state rankings of all the case companies for the Helix A application.

Table 16. Target state rankings of Helix A

HELIX A TARGET STATE Category/class	All cases md=0.45 n=188	Case A md=1.50 n=10	Case B md=0.75 n=44	Case C md=2.16 n=7	Case D md=0.82 n=47	Case E md=1.66 n=7	Case F md=1.62 n=9	Case G md=1.24 n=32	Case H md=1.27 n=32
Job satisfaction	8.29	8.40	8.89	8.71	8.30	9.14	9.44	7.56	7.56
Organizational dynamics	6.95	8.80	6.57	6.71	7.02	5.86	6.78	6.98	7.09
Intrinsic motivation	6.79	7.00	6.98	6.86	7.40	8.71	6.11	5.69	6.41
Attributions of HRM practices	6.12	5.80	6.36	6.79	5.84	5.29	7.00	7.02	5.20
Motivating potential of job	6.69	7.10	7.20	6.86	7.34	6.29	6.67	6.30	5.34
Organizational support	6.68	6.50	6.73	7.07	6.38	7.00	7.00	6.28	7.27
Person-role congruence	5.12	3.20	5.69	3.29	4.65	6.57	5.44	5.19	5.53
Affective commitment	3.54	4.60	3.06	4.57	4.01	2.14	3.33	3.45	3.39
Normative commitment	3.20	2.40	2.16	3.14	2.93	2.43	2.00	4.47	4.55
Continuance commitment	1.62	1.20	1.36	1.00	1.13	1.57	1.22	2.06	2.66

The class of job satisfaction has the highest target state ranking in all cases. Therefore, according to the respondents, the class of job satisfaction has the highest priority in terms of keeping it at a high level. Again, the class of continuance commitment has a low target state ranking in all cases. When looking at all the cases, only Case C has many classes in the groups of high- and low-level rankings. In this case, the respondents did not have similar views of the target states.

Based on the target state rankings, it can be concluded that there is more consensus among the respondents about the classes whose state should be on a high level. In these cases, the class of job satisfaction, which is related to affective commitment, was valued at a high level. Issues related to continuance commitment and normative commitment had low target state rankings. The result is quite similar to the current state rankings for Helix A in Table 14. Next, Table 17 presents a similar target state analysis for Helix B.

Table 17. Target state rankings of Helix B

HELIX B TARGET STATE Category/class	All cases md=0.43 n=188	Case A md=1.38 n=10	Case B md=0.66 n=44	Case C md=1.64 n=7	Case D md=0.59 n=47	Case E md=2.31 n=7	Case F md=1.12 n=9	Case G md=1.25 n=32	Case H md=1.33 n=32
Perceptions of justice and fairness	9.76	9.70	10.02	9.29	9.96	10.71	10.11	9.38	9.28
Person-organization fit	9.77	10.10	10.30	10.57	10.30	9.71	10.44	9.00	8.56
Psychological contract	8.43	8.80	9.23	8.71	8.91	8.86	9.00	7.25	7.34
Identification with organization	6.84	8.00	7.41	7.29	7.28	5.71	8.22	5.69	5.97
Internal sense of obligation	4.72	4.10	4.11	4.86	4.51	4.86	4.44	5.91	4.91
Affective commitment	6.13	7.70	5.80	7.43	7.43	4.57	6.44	5.63	4.69
Work-related investments	6.39	5.50	6.57	6.14	5.34	6.43	6.33	7.00	7.41
Normative commitment	5.15	4.40	4.02	5.29	4.98	5.00	3.89	6.56	6.11
Employment alternatives and opportunities	2.97	2.10	3.59	2.29	2.57	4.00	2.56	2.47	3.53
Non-work-related investments	3.34	3.50	2.55	2.57	3.00	3.14	2.44	3.69	5.02
Continuance commitment	2.51	2.10	2.41	1.57	1.72	3.00	2.11	3.44	3.19

Table 17 shows that the classes of justice and fairness, and person-organization fit, have high-level rankings. These were also ranked highly in the current state analysis. Again, continuance commitment has low target state rankings in all companies. Further, five cases have low-level rankings in the class of non-work-related investments, which is related to continuance commitment. Similarly, as in Table 16, there seems to be more consensus among the respondents concerning their responses about the target state than the current state. Table 18 and Table 19 present the creative tension rankings of the cases. The creative tension is the gap between the target state and the current state.

Table 18. Creative tension rankings of Helix A

HELIX A CREATIVE TENSION Category/class	All cases md=0.53 n=188	Case A md=2.09 n=10	Case B md=0.90 n=44	Case C md=2.80 n=7	Case D md=1.08 n=47	Case E md=2.03 n=7	Case F md=1.96 n=9	Case G md=1.33 n=32	Case H md=1.27 n=32
Job satisfaction	7.54	7.90	7.52	7.86	7.89	7.43	8.00	6.97	7.31
Organizational support	6.81	7.40	7.27	6.86	6.23	7.00	7.00	6.70	6.81
Attributions of HRM practices	6.61	7.30	8.08	6.14	5.82	6.00	6.39	6.47	5.98
Organizational dynamics	6.70	6.60	6.68	5.86	7.51	6.14	6.56	6.92	5.69
Person-role congruence	6.16	6.50	7.08	7.43	5.87	5.86	8.89	5.09	5.31
Intrinsic motivation	4.74	5.20	4.82	5.71	3.84	5.14	5.00	5.09	5.06
Motivating potential of job	5.35	5.80	5.20	5.57	5.38	4.14	5.22	6.13	4.81
Normative commitment	4.20	2.50	3.00	3.57	4.76	5.43	2.94	4.69	5.33
Affective commitment	4.27	3.40	3.59	4.00	4.32	5.14	3.11	4.59	5.25
Continuance commitment	2.63	2.40	1.75	2.00	3.37	2.71	1.89	2.34	3.44

Creative tension rankings were not perceived as having a high level of unanimity because, in many cases, there are several classes in the groups of high- and low-level rankings. The class of job satisfaction has high creative tension rankings in all cases. Further, class organizational support has a high-level ranking in all cases, except in Case D. The continuance commitment class had low creative tension rankings in all cases, while the affective commitment class also has low creative tension in Cases A, C, D, F.

Based on the creative tension rankings, it can be concluded that the respondents, in most cases, seek more job satisfaction, support from their organization, more transparent HRM practices, and dynamic participation in organizational issues. In many cases, issues related to different forms of organizational commitment are perceived to have the lowest creative tension. Accordingly, respondents feel these issues as already being at a satisfactory level or are not aware of how these issues should be developed.

Table 19. Creative tension rankings of Helix B

HELIX B CREATIVE TENSION Category/class	All cases md=0.55 n=188	Case A md=2.08 n=10	Case B md=0.93 n=44	Case C md=2.43 n=7	Case D md=1.19 n=47	Case E md=2.93 n=7	Case F md=1.93 n=9	Case G md=1.36 n=32	Case H md=1.50 n=32
Perceptions of justice and fairness	9.06	10.80	10.55	10.43	8.34	8.14	10.11	8.69	7.53
Person-organization fit	8.24	8.30	8.32	8.71	8.28	7.29	9.89	8.11	7.84
Psychological contract	7.59	7.40	8.45	8.43	7.13	8.86	8.56	7.06	6.91
Work-related investments	7.02	7.90	6.89	7.43	7.21	6.00	7.44	6.69	6.97
Identification with organization	6.03	6.20	6.52	4.57	5.26	7.14	5.89	5.97	6.63
Affective commitment	6.10	6.00	6.08	5.71	5.90	7.00	5.67	6.45	6.13
Normative commitment	5.82	4.60	4.92	5.43	5.94	7.00	4.89	6.77	6.42
Internal sense of obligation	5.32	5.20	5.11	5.71	5.60	5.43	3.89	5.78	5.06
Non-work-related investments	4.38	2.60	3.70	4.86	4.61	4.00	4.44	4.81	5.08
Employment alternatives and opportunities	3.11	3.60	2.63	2.00	3.86	2.57	2.11	2.44	3.84
Continuance commitment	3.32	3.40	2.83	2.71	3.88	2.57	3.11	3.23	3.59

According to Table 19, in all cases, the respondents feel that the class of perceptions of justice and fairness has a statistically higher creative tension ranking that other classes. The respondents in six cases also ranked person-organization fit as having high creative tension rankings. The classes of employment alternatives and opportunities, and continuance commitment, had significantly low creative tension rankings in all cases. Based on creative tension, respondents had the most creative tension in classes related to affective organizational commitment, and the lowest creative tension in classes related to continuance commitment.

4.6 Organizational commitment profiles

This analysis utilizes the three organizational commitment classes within the ontology. The classes of affective commitment, normative commitment and continuance commitment are based on Meyer et al.'s (1993, 1991, 1997) TCM of commitment. This analysis used K-means clustering to examine the data and combine commitment profiles (Wasti, 2005). In contrast, just by looking at different forms of commitment separately, this analysis tried to identify different profiles of commitment with various amounts of different forms of commitment (Meyer & Herscovitch, 2001; Meyer et al., 2002; Wasti, 2005). K-means clustering is a type of unsupervised learning with the goal of finding groups in the data, with the number of groups represented by the variable K. K-means clustering can be used in business research to confirm business assumptions about what types of groups exist or identify unknown groups in complex data sets (Trevino, 2016). This is a non-hierarchical data analysis technique, which uses an algorithm to partition individual cases into a prespecified number of clusters based on their commitment scores, in a manner that maximizes between-cluster differences and minimizes within-cluster variance (Wasti, 2005).

According to Meyer and Allen (1991, 2001), the best profile would be the one with high or "pure" affective commitment (e.g., above the scale's midpoint), while continuance commitment would be considerably lower (e.g., below the scale's midpoint), followed by the "pure" normative commitment profile and then the "pure" continuance commitment profile. Concerning profiles with high levels of multiple commitment forms, Meyer and Herscovitch (2001) contemplated that high affective commitment, combined with high levels of normative or, specifically, continuance commitment, would be less desirable than a pure affective commitment profile in terms of predicting desirable behavior.

In addition, they speculated that profiles with high affective commitment, regardless of the amount of normative and/or continuance commitment, would be better than pure normative or continuance commitment profiles. However, if the profile is low on affective commitment, Meyer and Herscovitch (2001) argued that a profile characterized by a pure normative commitment would be better than a profile with high levels of normative and continuance commitment, or a pure continuance commitment profile. Lastly, the worst profile with low levels of all three types of commitment arguably leads to the least positive effect for the organization.

In this study, the items in the three commitment classes were firstly summed into scale scores, after which they were standardized (z-scores) and used for k-means cluster analysis. A six-cluster solution yielding six commitment profiles was used. A six-cluster solution was used because, according to Wasti (2005), it provides clearer profiles than the eight-cluster solution hypothesized by Meyer and Herscovitch (2001). The analyses were made using IBM SPSS Statistics Version 22. Figure 30 illustrates the six profiles of commitment in all the respondents, and how many respondents are within each of the groups.

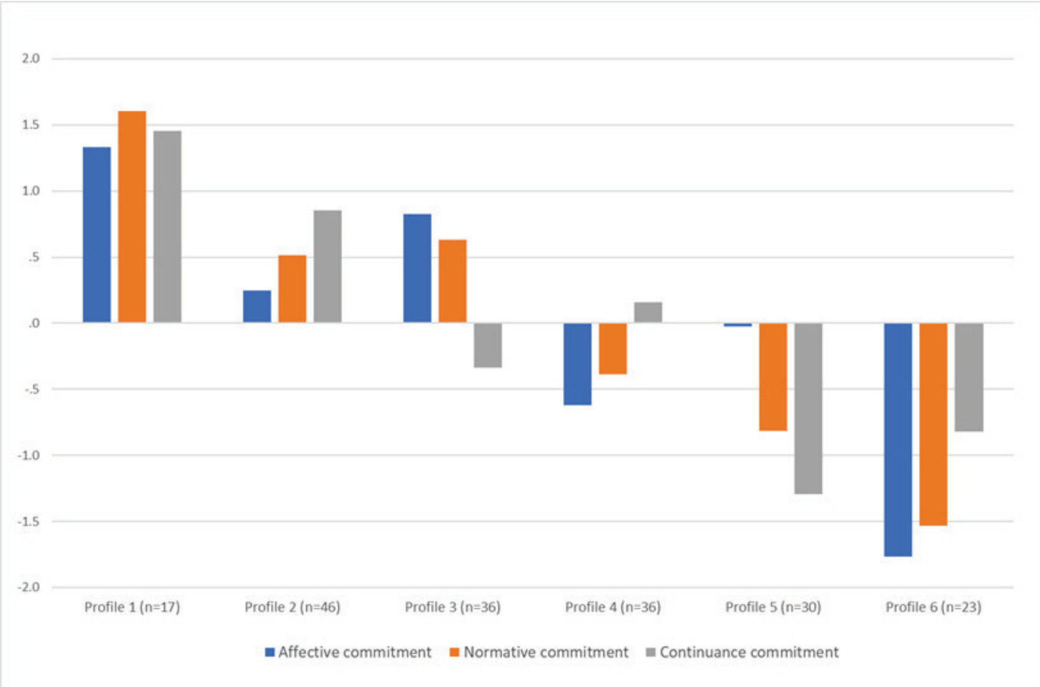

Figure 30. Profiles of organizational commitment

Figure 30 displays the profiles of the means on the commitment scales. As can be seen in the figure, Profile 1 is over the averages in all of the commitment categories; these individuals can be considered to be "highly committed". In this profile, the categories are almost one standard deviation over the mean values. In contrast, in Profile 6, all the commitment categories are well below the mean. These individuals can be considered as "non-committed". In this profile, affective commitment and normative commitment are at least one standard deviation below average, while continuance commitment is more than half the standard deviation below average. Between these high and low committed groups, there are four other types of profiles characterized by different amounts of specific forms of commitment. For example, Profile 4 displays commitment levels that are slightly below and above, which can be considered as "neutrally committed". The other three profiles have different weightings about which type of commitment is dominant. Figure 31 shows how the profiles vary according to the cases.

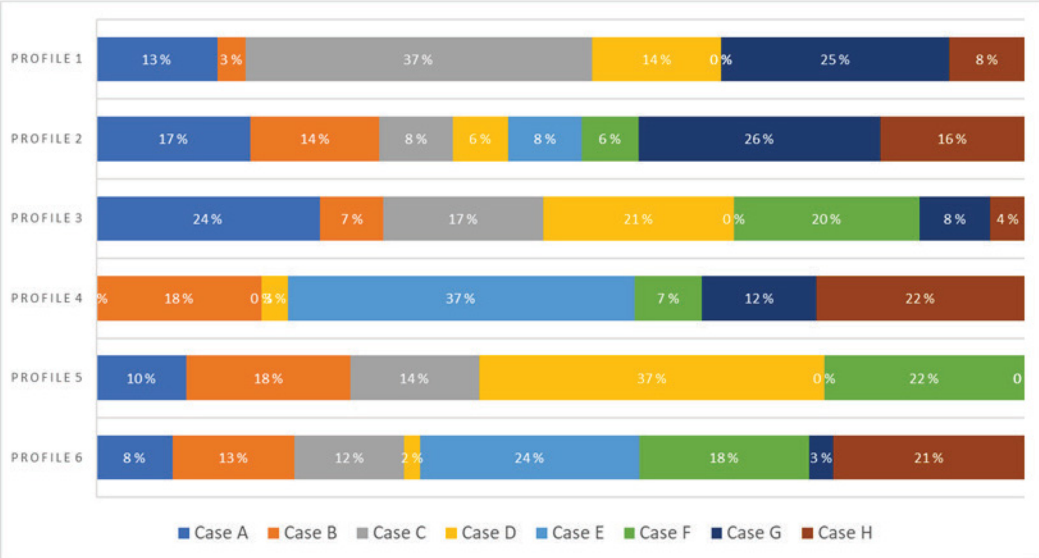

Figure 31. Profile distributions across the cases

This kind of analysis promotes the use of the obtained data in support of organizational management and leadership. In turn, it is possible to create a commitment profile for each employee. By looking at average-based information on how the employees are committed, as well as seeing how different components affect overall commitment and to what degrees, management has better chances of trying to address potential weaknesses. For example, if there are many employees in a non-committed profile, management should try to affect their commitment by planning a specific set of HRM practices; or, if there is a lot of neutrally committed employees, attempts should be made to advance their commitment to a higher level. These types of commitment profiles could be created for organizations, departments or business units in order to conduct comparisons because different profiles will have different implications for work-related outcomes. In this analysis, the data from all the respondents were used. If performed separately for specific cases, the analysis can more useful for management purposes. Next, a commitment profile analysis from Case B is presented.

In this case, 50 employees were selected randomly from the organization's R&D unit, employing 150 people. In the end, 44 employees completed the evaluation, giving a response rate of 88%. 77% of respondents were men and 23% were women. The average age of the respondents was 40.6 years old with a standard deviation of 10.6 years. All of the respondents in this sample were senior salaried staff, three of whom were in supervisory positions. Five respondents (11%) decided not to answer the questions describing demographics. The respondents had been in their current jobs for an average of 6.3 years (SD 6.6), in their organization for an average of 8.4 years (SD 8.5) and had an average of 17.5 years of work experience (SD 10.8). In Figure 32, respondents from Case B are analyzed based on their commitment profiles.

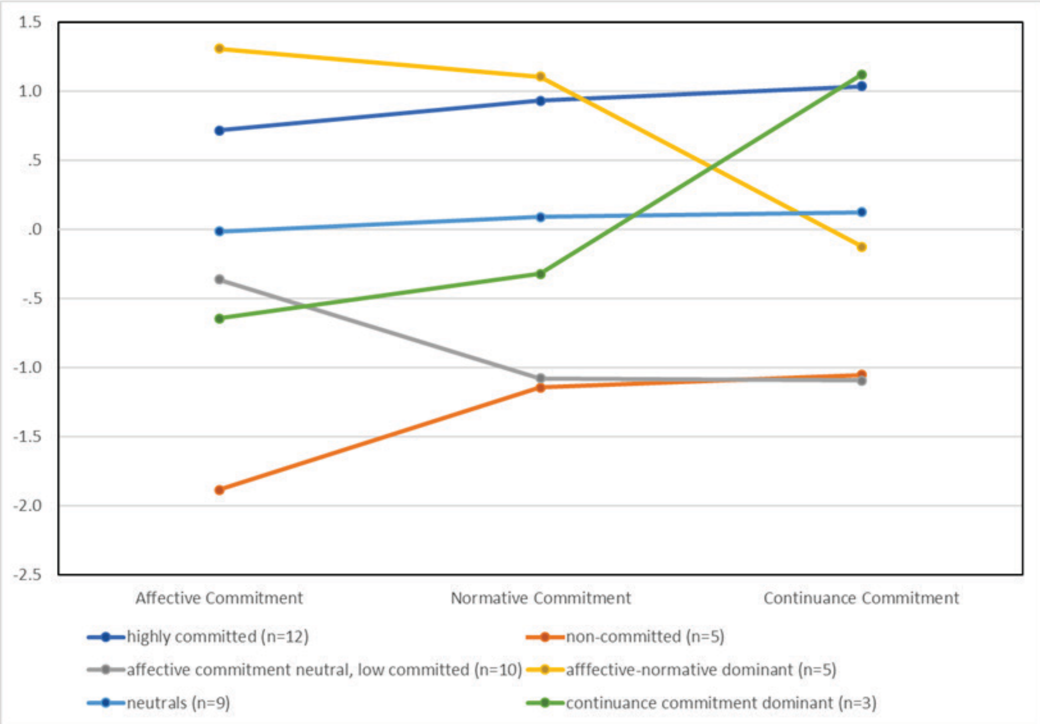

Figure 32. Commitment profile of Case B

Figure 32 displays the profiles of the means on the commitment scales in Case B. As in Figure 30, the commitment items were summed into scale scores, after which each scale score was standardized and used for k-means cluster analysis. As can be seen in this figure, which has similarities with Figure 30, a group with below average levels of all types of commitment. This group can be labeled as "non-committed". In this group, the commitment levels are at least one standard deviation below the mean values. In this profile, the affective commitment and normative commitment are at least one standard deviation below average, while continuance commitment is more than five sixths below average concerning the standard deviation. Further, a group of employees with all the types of commitments above average levels can be identified. These were labeled as "highly committed". In this case, an "affective-normative dominant" profile was also identified, in addition to a "continuance commitment dominant" profile. One of the profiles consisted of respondents who displayed almost average levels of all forms of commitment. This group was identified as comprising "neutrals". The last profile was characterized by slightly below average levels for affective commitment, and over one standard deviation below average levels for normative and continuance commitment.

The analysis of the research results for Case B showed that, overall, 38% of respondents belong to highly committed or affective-normative dominant profiles. Such employees are strongly bound to the organization, due to the internally driven nature of their attachments, and can be seen as being the most beneficial for the organization. 20% of the respondents belong to the neutral profile. However, the remaining respondents, totaling 41%, belong to the least desirable profiles, of which 11% were profiled as non-committed. These "at-risk" profiles are the most important ones to target. As non-committed employees may be at particular risk of leaving the organization, they could benefit most from interventions to increase retention. Employees belonging to the continuance commitment profile should also be targeted because they seem to remain in the organization only because of investment-related ties, thus showing lower levels of productivity and general well-being. It could be easier to target employees in the neutral profile, which should be done in order to encourage them to be more affectively committed. According to Wasti (2005), as the neutral profile could be as bad as the continuance commitment dominant profile, with respect to all job-related outcomes, those in this profile should be targeted for commitment enhancing interventions. Stanley et al. (2013) argue that relevant interventions should address all forms of commitment, for example, through competitive compensation, fair performance appraisal processes, mentoring, leadership training, and flexible work arrangements, which may be successful, given the capacity for high levels of affective commitment to transform the other components into more intrinsic ties.

4.7 Analysis of statement importance

After the imputation of missing importance values (see Chapter 4.3), the values of statement importance were ranked for each respondent and then averaged giving one value of importance for each statement. The values' minimum and maximum, therefore, ranged from 0 to 1. The ranking method was similar to the one presented in Chapter 4.6.

The next step in the analysis was to categorize the importance value into five groups. The statements were categorized into: very important, important, moderately important, of little importance, and unimportant groups. The classification was made using the mean and standard deviation of the data set (mean=0.74, SD=0.13). The first group (very important) consisted of a value greater than 1.5 standard deviations above the mean value (>0.93); the second group (important) consisted of values from one standard deviation above the mean to 1.5 standard deviations above the mean (0.87-0.93); the third group (moderately important) consisted of values within one standard deviation of the mean value (0.61-0.87); and the fourth (0.54-0.61) and fifth (<0.54) groups were constructed in a similar way as the first and second groups, but negatively.

After classifying all the statements in relation to their corresponding groups by their importance values, the first group included 14 statements (7%), the second group 19 statements (9%), the third group 145 statements (69%), the fourth 14 statements (7%), and the fifth group 18 statements (9%). Figure 33 presents the five groups of importance and to where the statements belong. In the figure, the statements are grouped by their classes.

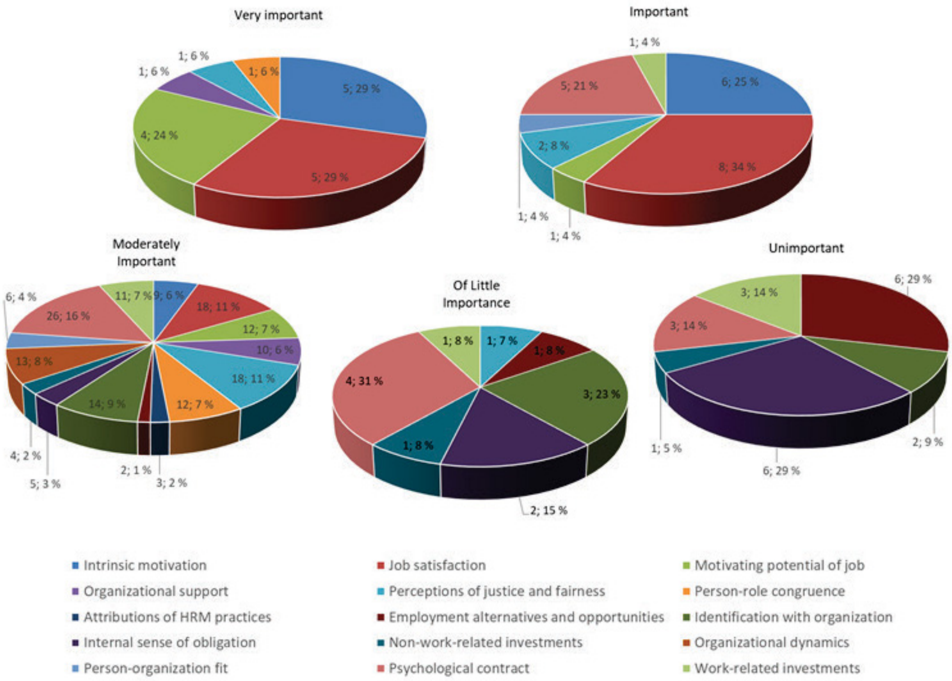

Figure 33. Categories of importance

The category “very important” includes statements from six classes: intrinsic motivation, job satisfaction, motivating potential of the job, perceptions of justice and fairness, and person-role congruence. Both intrinsic motivation and job satisfaction had five statements ranked as very important. In addition, the class motivating potential of the job had four statements ranked as very important, while organizational support, perceptions of justice and fairness, and person-role congruence had one statement each, which was ranked as very important. It should be noted that, in the ontology, one statement can be included in several classes.

Therefore, in this case, some of the 14 unique statements influenced multiple classes.

When looking at the results for the "very important" category at the feature level, three statements belong to sense of meaningfulness and two to general satisfaction and job challenge, while task identity, role ambiguity, interactional justice, sense of competence, work autonomy, sense of progress, compensation satisfaction, working conditions and resources, manager/supervisor satisfaction, and supportiveness had one statement, ranked as "very important". Table 20 presents the statements that were valued as the most important.

Table 20. Statements in the "very important" group based on the respondents' evaluations

Statement	Scale	Mean rank
I am .... with my job	[dissatisfied - - - satisfied]	1.00
I enjoy my work very much	[disagree - - - agree]	1.00
I am able to see the results of the work I do	[never - - - always]	1.00
The activities I do in this job are .... interesting and rewarding	[not at all - - - very]	1.00
I know exactly what my responsibilities are	[not at all - - - completely]	0.99
I am always treated ....by my manager/supervisor	[unfairly - - - fairly]	0.98
I feel .... in my job	[incompetent - - - competent]	0.97
My work is challenging	[not at all - - - considerably]	0.95
My job is .... simple and repetitive	[very - - - not at all]	0.95
My job provides me with the ability to be responsible for planning my job	[never - - - always]	0.95
During my work I ....feel a sense of progress and achievement	[never - - - usually]	0.94
I am .... with the pay and fringe benefits I receive	[dissatisfied - - - satisfied]	0.94
My working conditions are pleasant	[not at all - - - completely]	0.94
My organization or manager/supervisor provides support when needed	[never - - - always]	0.94

The most important statements clearly highlighted job satisfaction, motivating potential of the job and internal motivation, the support provided by the organization, prevailing justice and fairness in the organization, and accuracy of the job description. The statements reflect the meaningfulness of work, the identity and control over one's own work tasks, the fair treatment, challenges and rewards provided by work, and the sense of progress and achievement. In addition, enjoyment and general satisfaction, and working atmosphere and working conditions, as well as satisfaction with compensation, were seen to be the most important factors.

In the "important" group, there were statements belonged to the classes of job satisfaction (8), intrinsic motivation (6), psychological contract (5), perceptions of justice and fairness (2), motivating potential of job (1), person-organization fit (1), and work-related investments (1). Within this group, similar to the "very important" group, the classes of job satisfaction and intrinsic motivation dominated, with much more variety in the essence of the statements. These statements highlighted satisfaction and enjoyment within the organization, being flexible and taking responsibility for one's own tasks, feelings of accomplishments, and exercise of one's own volition. In addition, the statements focused on chances for professional growth and competence, feedback, and fulfillment gained from the job. In Table 21, the statements and their mean ranks are displayed.

Table 21. Statements in the "important" group based on the respondents' evaluations

Statement	Scale	Mean rank
I believe I have .... chances for professional growth and advancement in this organization	[no - - - good]	0.93
It's hard for me to care much whether or not my work gets done right	[agree - - - disagree]	0.92
I get a feeling of accomplishment from doing my job	[never - - - always]	0.92
My organization provides me the things I am looking for in a job	[not at all - - - completely]	0.91
I like the people I talk to and work with at work	[disagree - - - agree]	0.91
I am .... with the amount of independent thought and action I can exercise in this job	[dissatisfied - - - satisfied]	0.91
I am .... with my performance on this job	[dissatisfied - - - satisfied]	0.91
I believe that my job is secure with this organization	[not at all - - - completely]	0.90
I am ....paid for what I contribute to this organization	[unfairly - - - fairly]	0.89
My employer fulfills its promises to me	[not at all - - - completely]	0.89
I am flexible and work the hours necessary to get the job done	[not at all - - - definitely]	0.89
Overall, I am .... with this organization	[dissatisfied - - - satisfied]	0.88
It is .... my responsibility to get this job done right	[not at all - - - clearly]	0.88
I feel I don't have a say in the selection of my tasks	[agree - - - disagree]	0.88
I get a(n) .... amount of feedback from my manager/supervisor	[insufficient - - - sufficient]	0.88
I feel comfortable and I like working in my current organization	[not at all - - - completely]	0.88
I feel I should personally take blame or credit for the results of my work	[not at all - - - definitely]	0.88
I have access to all the information and resources I need to do my job effectively	[never - - - always]	0.87
Employee policies and practices are ....in this company	[unfair - - - fair]	0.87

Figure 34 displays to which classes the statements in the "very important" and "important" groups are related. According to the respondents, most of the statements that were considered important are in the classes of job satisfaction and intrinsic motivation. This is to be somewhat expected since people want to be satisfied with the job they do. The results show that employees feel it is important to have a job and a work environment that satisfies their needs, is motivating, fair and trustworthy, and provides job security and fair compensation.

These results support theories in the management literature on employees' needs, as well as being factors influencing employees' passion and engagement. Most of the statements from the respondents most importantly reflected the following three key psychological conditions of engagement: meaningfulness, safety and availability to employees (Kahn, 1990). According to Kahn (1990), meaningfulness refers to workers' feelings about being worthwhile, useful and valuable, and that they are making a difference and are appreciated for the work they do. Kahn (1990) describes safety as an environment where employees feel a sense of openness and support, and when they feel connected to others. Safety can occur when individuals are free to express themselves without fear of negative consequences, and where the boundaries are clear and organizational norms are known (Kahn, 1990). According to Kahn (1990), the third psychological factor denominated as availability refers to the sense that employees have the physical, emotional and psychological resources necessary to engage in their job tasks within their respective role at any particular moment. Kahn (1990) states that there are psychological conditions related to engagement, which can also, to some degree, be controlled by management.

These factors are widely considered to be important to employees and can lead to great positive outcomes for organizations as well. For example, a vast amount of research indicates the importance of job satisfaction and employee motivation in increasing performance, loyalty, employee retention, productivity and providing a better level of external service quality to customers. Therefore, management must provide a responsive work environment, and increase satisfaction and motivation among employees, in order to gain extra benefits from them.

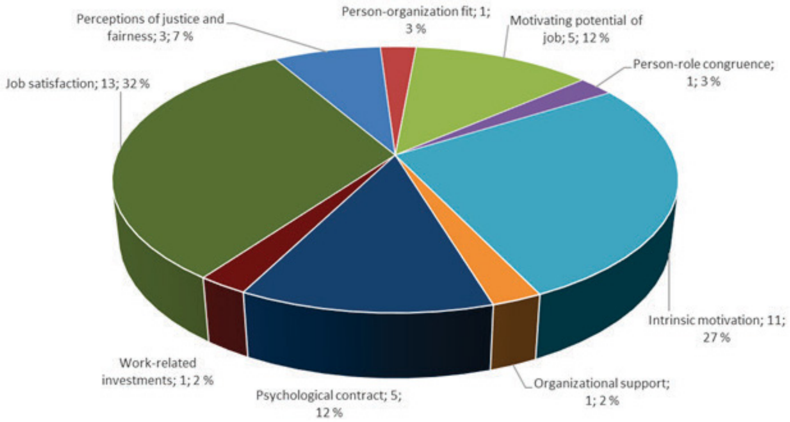

Figure 34. Classes of the statements in the “very important” and “important” groups

According to Figure 19 and Figure 25, and Table 10 and Table 12, these classes mostly involve the highest target state values as well. The target state indicates where the respondent would like the construct to improve. Further, when looking at Table 16 and Table 17, in many cases, the classes whose statements were valued as highly important are within the statistically highly ranked classes. Job satisfaction, perceptions of justice and fairness, and person-organization fit are in all cases in the significantly high groups. In addition, intrinsic motivation is, in three cases, within the high target state group, with psychological contract in two and motivating potential of the job in one. Having both a high target state value and high importance indicates that the respondents value these construct highly and would like them to be advanced in the future. Based on the results, all the presented analyses give similar results and are complementing each other.

4.8 Single case results – example of Helix Academic analysis

This chapter presents an example analysis of the Helix Academic application. Helix Academic is a byproduct of the development of Helix ontology and intended to be used specifically in the evaluation of university students' commitment and engagement. The use of this application is intended to tackle the dropout problem that many universities are experiencing, as well as the problem whereby many students spend more than the planned amount of time to complete their degree. The used methodology, as well as the created application, offers fast visual research results, with which both the current and the future state of commitment and engagement can be analyzed. The application has been used in nine universities and over 670 individual evaluations have been made. More case analyses using different methods can be found in the literature (e.g., Einolander et al., 2016; Einolander, Vanharanta & Visa, 2017; Einolander & Vanharanta, 2015).

The presented case is from the Tampere University of Technology in Finland, with 67 students enrolled on a course on the basics of industrial management participating in this research. All of the students had a prior bachelor-level degree in some field of engineering or business administration and had been in employment before starting their masters-level studies. The course, which was taken at the end of the first semester of the master's degree training program, was selected to give a baseline score for the new students. Normally, the course was been considered as highly demanding, usually involving a great variation in learning results. The students participated using the Helix Academic application, with the results of this research reported in the following figures taken from the Evolute system.

Figure 35 is an example of the feature-level results from the case study. In the figure, the blue bars represent the group's collective perception of the current reality (perceived current state) and the red bars represent their vision for the future. The difference between the bars is their collective creative tension. In the figure, the results have been sorted based on the highest proactive vision, i.e., the greatest collective feeling of tension between the current and envisioned future state.

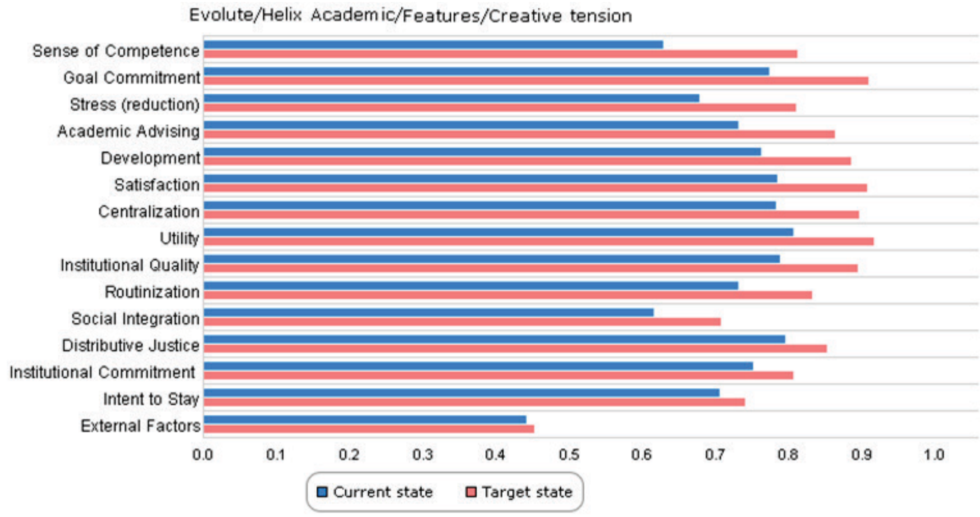

Figure 35. Current and future state analysis at the feature level using Helix Academic

The results show that the respondents have the largest relative creative tension in the features of a sense of competence, goal commitment, stress, academic advising and development. In contrast, they have the lowest relative creative tension in external factors, intent to stay and institutional commitment.

In this case, the evaluations were made during their first semester at the university. This could explain why the biggest improvement gap was in their performance and competences to study. This feature was assessed using six statements, such as "I am satisfied with my performance during my studies" and "I feel competent regarding the courses I am taking".

The second-highest creative tension was in the feature of goal commitment. This was assessed by six statements including "I complete my assignments and projects on time" and "I feel a high degree of personal responsibility about my studies". However, even if the respondents saw that there was a lot to improve in this feature, they regarded the current state as being at a very high level. Therefore, when examining the result, one should not only focus on the amount of creative tension. This result was expected, since the students were motivated to continue their studies after having a prior bachelor's degree and work experiences, and want to achieve a higher level of education.

The lowest creative tension in both the current and the target state is in the feature of external factors. In this case, this feature is perceived to be in a significantly lower state than other features. External factors describe binding variables that are external to the study environment, such as family obligations. Therefore, little creative tension in this feature should be expected. However, in this feature, there was the most deviation in the answers from the respondents (see Figure 36).

Figure 36 presents the averages and standard deviations of the same feature-level results as in Figure 35. The blue bars represent the current state results and their standard deviation in the research group, while the red bars represent the feature-level results and their standard deviation in the future target state in the case group. The lines represent the averages of the current and target state results.

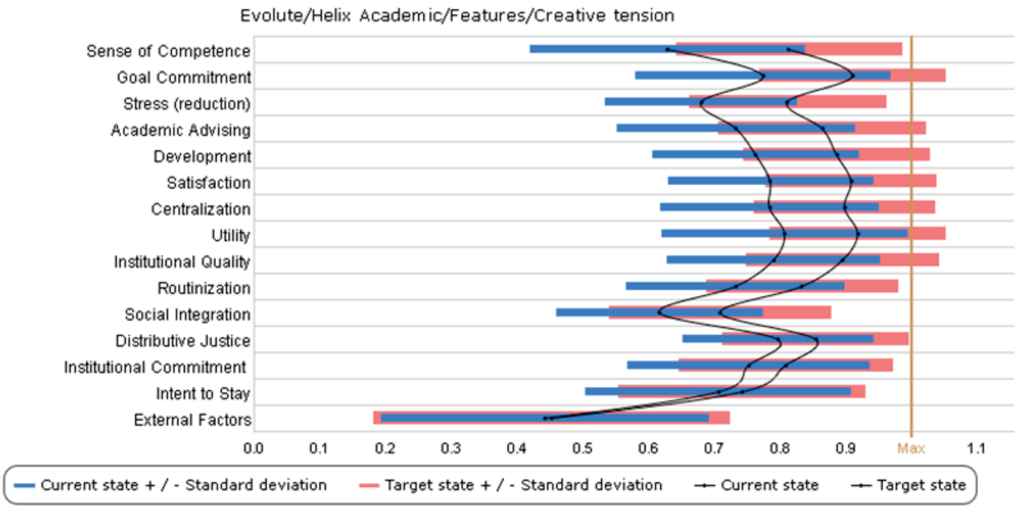

Figure 36. Variation analysis: feature-level results and their standard deviation using Helix Academic

From Figure 36, we can conclude that there is a large variation in the answers. The results show clearly how each person viewed his or her situation in the academic world. The main goal of the assessment was to provide hidden information for university management and new tools to help them in their management and leadership. The target of the studies using this application was to help university administrators to find out the most important drivers of student commitment and engagement within their respective student population. By analyzing the test results and producing a multifaceted synthesis of qualitative and quantitative test results, a comprehensive understanding of the complex constructs in the university context can be derived.

5 DISCUSSION AND CONCLUSIONS

Organizational commitment and employee engagement are important issues in today's organizations. Major organizational changes are common nowadays, with organizations constantly trying to control the effects of change. Management needs to have a good overview of the level of commitment in their organization, so that it can be led in the best direction for the company. It is important to determine the different levels of commitment within the workforce, so that the focus of activities can be shifted in the right direction for managing change.

The objective of this research was to develop and test an ontology-based assessment system for the evaluation of the organization's HR environment regarding organizational commitment and engagement. This was done in order to support organizations in their strategic management and leadership, and in their development of HRM practices. Based on the literature, organizational commitment is a multidimensional construct that connects employees to a certain organization. The main model utilized in this study was Meyer and Allen's (1991) multidimensional model for organizational commitment. This multidimensional model integrates attitudinal and behavioral approaches to organizational commitment in order to create three distinct dimensions, i.e., affective, continuance and normative commitment. However, transforming the vast amount of research on commitment and engagement into a usable form for management has been an issue. The studies have shown that employee engagement and commitment are highly valuable and directly related to positive organizational and business outcomes, such as increased efficiency, higher levels of customer satisfaction, higher productivity and lower turnover rates (Buhler, 2006). According to Lockwood (2007), an engaged workforce tends to be more committed to their organization and work harder than their peers, and are likely to exceed their goals in an effort to help their organization. Alvesson (2000) argues that the knowledge of employees is the most valuable asset of the organization, especially in knowledge-intensive companies.

Many employees have their own feeling-based knowledge, for example, informed by experience, about what commitment means or what affects it in their own mind. However, the definitions in people's minds can vary. By using an ontological view, equal knowledge, based on theory and previous scientific studies, can be taught so that management and different organizational levels have common concepts to work with. With the help of the developed systems, organizations can be taught about concepts related to organizational commitment and engagement, assess their collective state and aspirations among the members of the organization, and start a dialogue in order to plan development activities within the organization.

Results from an evaluation within an organization could make management aware of areas of need and enable the development of specific strategies in order to target those areas. Management should continually focus on implementing policies and practices that increase engagement within the workforce, which, in turn, can be expected to increase the overall productivity of individual employees and the organization as a whole.

Three research questions have been stated in this thesis:

- What are employee commitment and engagement and are the sub-constructs that influence them?
- How can the influencing factors be modeled in a usable way for organizational management and management support system (software) development?
- How can the states of employees' commitment and engagement at distinct levels be assessed and presented in an effective way for management and leadership?

These research questions were answered by this thesis, with the answers presented in brief here as follows:

This thesis answers the first research question by using the literature review to discuss various aspects of employee engagement and organizational commitment. The literature review examines their development, their antecedent and correlate factors, and how management can influence their development.

This research suggests an ontological view of the subjects. By modeling different components and factors as an ontology, they can be presented in a usable way to teach and learn about the concepts. Ontologies are very well suited to defining common words and concepts, as well as meanings, which describe and represent an area of knowledge. An ontology model is also ideal for use in the development of DSS applications by explicitly describing concepts and enabling the computational processing of information.

This research produced three ontology-based soft computing applications, which can be utilized as DSSs. The use of DSSs is often characterized by problems involved qualitative data, or incomplete or uncertain knowledge. The presented applications enable the gathering of data directly from individual employees and converting this information into different levels as usable data for management and leadership purposes. By understanding the ontology and its concepts, management can include more perspectives on their strategic thinking and day-to-day leadership, and thus make more sophisticated decisions.

This chapter summarizes the main findings and contributions of the study. The contribution of the study is discussed at theoretical and managerial levels. This chapter also discusses the validity, reliability and generalizability of the results, as well as addresses limitations of the study and suggests possibilities for future research.

5.1 Theoretical contribution

The study highlights the significance of organizational commitment and engagement in the development of organizations. The main objective of this research was to clarify vast and complicated concepts of organizational commitment and engagement, as well as bring them closer to organizational management. This is challenging because these and related concepts and their development are often very abstract in nature. This study combined existing theories to create a new kind of synthesis in the form of ontologies. The research clearly indicates that management should focus on these, not only as a part of HR programs, but also from the perspective of the core business strategy.

For this purpose, two theoretical MOOs were developed for the use of business organizations, while an ontology was developed for use in the management of educational institutions. The developed ontologies contain the key features that influence the development of organizational commitment and engagement, as well as engagement and persistence in educational institutions, such as universities. The ontologies were constructed based on a literature review and support earlier theoretical and empirical studies. The ontology model includes Meyer and Allen's theories of organizational commitment. The present study provides a new type of research method, which supports decision-making in order to strengthen HR in the real world.

The ontologies present a new learning model and framework for assessment and evaluation using statements connected to the discovered features. Several different questionnaire-based measurement methods of organizational commitment and engagement have been developed in the past. However, the method utilized in this study goes into more detail in the assessment phase.

The ontology models utilize web-based applications involving a fuzzy logic-based scale in their evaluation, which can be used to provide management information about their employees (or students) and support management decision-making in the development of the company. By utilizing this technique, the intangible abstract concepts that exist in people's minds are captured, so that they can be used in strategy-making, based on factual understanding and knowledge. The application is based on identifying the meaning relationships in the respondents' mind, which in turn gives an authentic picture of how things are experienced in their conscious experience. The application aims to provide a holistic view on commitment in order to find out how participants feel in their own situation.

The ontologies have been used in many cases when evaluating the degree of organizational commitment and engaging factors, as well as in a recruitment case for the evaluation of job applicants. The academic version has also been used in many student cases in many countries. From the empirical studies, an extensive database, consisting of 91,368 data inputs for the organizational application, and 168,392 data inputs for the academic version, was acquired, including the current and target state evaluations. This offers an extensive database for future research.

5.2 Managerial implications

In addition to a theoretical contribution, there is also a practical contribution, since the self-evaluation applications are evidently functioning in practice. Practical contributions are important in industrial management studies, since the research domain is the real world, while the aim is to improve the operations of the organizations concerned. The research method used contemporary digitalization, given that the evaluations could be done in a controlled manner over the Internet. Currently, the applications have been used in different countries, and in many universities and organizations.

Based on the empirical results, it can be concluded that the applications clearly recognize individuals' own current reality and their wishes for development, and can be used as practical and flexible managerial and leadership tools for HR purposes. This enables management to obtain a holistic and factual picture of the respective company's state. By using the results of the evaluation, management can, if necessary, assist and advise employees before problems arise. By acquiring the target state picture, management can also predict and estimate scenarios for the future.

The practical contribution concerns the benefits that the companies utilizing the system and their respondents can receive and apply to the development of the company's properties. The practical benefits of using the developed systems are obtained when organizations get to know the real needs of individuals more specifically, and when they use the results and the information in the development of their management practices. In addition, better knowledge and understanding of the presented concepts will lead to increased thinking and scrutiny when planning new effective management practices. By understanding the ontology and its concepts, management can include more perspectives on their strategic thinking and day-to-day leadership, and thus make more sophisticated decisions. The shared vocabulary provided by the ontologies and an understanding about the current states, the target levels, the importance of different factors, and collective development directions will lead to better planning and development strategies. However, the extent to which development activities have an impact on business performance was not in the scope of this study and therefore has not been explored.

The applications can be utilized in two ways: firstly, as a testing tool to analyze the prevailing state of an organization; and, secondly, as tools for generating new strategies and managerial practices, based on the information gathered directly from employees. By letting the organization's members contribute, through their feelings and opinions, to the new strategy and development activities, the more committed they will be to changes.

The key is to gather information from the individual level, which can then be combined and analyzed, in order to lead at the collective level. By utilizing such an application, for the basis and support of decision-making, it is possible to find concrete features of engagement, which can be used to perceive, understand and internalize employees' and students' degree of engagement, and generate a holistic view of their current commitment and their desire to improve their degree of engagement individually and collectively. It is essential to tie commitment management to the long-term strategy.

Using the self-evaluation application at several organizational levels gives top management an understanding about the degree of different features of commitment at all levels of the hierarchy. It is possible to find out where the commitment profiles and other features of the groups are in relation to others, compare them and see whether one group is more committed than another, such that development activities can be targeted in the right places. A clear strength of the applications is the visual summary report, where the whole group's collective results can be viewed easily at a glance.

Based on the organization specific research results, the management can choose which aspects to target for development. When choosing the target areas and methods, it is good to get acquainted with various analyzes of target states and creative tension, as well as priorities of the employees, in addition to managements own views. At this point, different workshops or meetings can be beneficial for planning and interpreting the analyses.

After identifying the groups of key employees, whose commitment matters the most, or for other reasons should be managed, the management of the organization can find out how much time, effort and precision must be implemented in the process of managing commitment, in addition to being aware of the cost associated with the potential practices. The groups whose commitment is being managed with the same practices should not be too big because, after all, commitment is a multifaceted phenomenon whose components differ from people to people. As the application is situation-specific, its use should be repeated at a future date, for example, after one year, in order to review the possible changes.

Finally, the ontologies created in this research can be further modified for different purposes. The ontologies can be modified to make more specific applications for the evaluation and study of, for example, only job satisfaction, loyalty or employees' perceptions of the prevailing environment of justice and fairness in the organization.

5.3 Assessment of the research results

In this research, three MOOs were created. These ontologies were built in a generic web-based application environment, which can be used in their evaluation over the Internet (Kantola, 2009, 2015). The created ontologies were tested in multiple-case studies. A multiple-case study offers more analytic power than a single-case study (Eisenhardt & Graebner, 2007). Based on the cases, several research papers have been published. Chapter 4 presents different analyses of the cases and brief descriptions of the research papers. The case studies have demonstrated the technical functioning of the application and its usability for such research. The case studies were also used to validate the research results and study the reliability of the research method in practice.

In this research, several research methods were used to present the results. The results have been analyzed, for example, visually and numerically, as well as by using rankings and Friedman's test-based analysis. The results showed that the application can determine the collective degree of the factors affecting employees' commitment and engagement, as well as engaging factors of the students. The analyses were also able to show which factors were regarded by employees as the most important to them. The presented method is practical and can be used in different types of organizations for management and leadership purposes. By analyzing and presenting the data in several ways, different perspectives from which to view the desire for change is given to management in order for them to effectively manage the features within the ontology.

However, before beginning the assessment and planning in more detail with regard to the different HR practices and their results, general attitudes among senior management must be clarified; they should also be made aware of the importance of the subject. If management are not completely aware of the concepts and do not believe the positive impacts, their development is likely to only be a scratch on the surface, for example, because of limited resources. While the importance of both the theoretical and the empirical research to organizations has been shown, the management needs to believe in the subject if they are to allocate resources and facilitate active participation in their processes.

This study provides management and other employees with information on employee commitment and engagement. The evaluated organizations in the case studies may benefit from the research results by obtaining information on the state of their employees and, based on this, could develop HR strategies to address the weaknesses according to the research results. Other organizations may also benefit from the results by gaining a greater understanding of the importance of employee engagement, and how it can be easily measured at several levels. Once the degree of commitment has been measured, management can develop change strategies and practices and intervene in response to detected weaknesses, thereby improving employee engagement in their organization. This can, for example, lead to an increase in the overall effectiveness of the organization and possibly reduce work-related stress. The employees of the company, who perform the evaluation, can benefit from an increased awareness of what commitment and other concepts mean in their working life, and understand how they affect their own activities, performance and mood, as well as see how engaging work has positive impacts. In addition, people working in a supervisory position can benefit from the research by understanding how their own activities and actions affect their subordinates. If supervisors are not committed and engaged in their work, and fail to create a positive atmosphere, this will make it difficult for subordinates to commit effectively, as the closest supervisors' behaviors are closely scrutinized and related to employees' commitment. Hence, supervisors should create a working environment, which includes positive features that are relevant to affective commitment and engagement, so that they themselves and their subordinates can become more engaged in their job and their organization. Finally, the presented method can be used to conduct similar research in different organizations and different occupational fields.

The presented research method supports a new stream of research about microfoundations in strategic management. This new line of research is based on examining actions and interactions of individuals and their effect on the organizational functioning and strategic management (Molina-Azorin, 2014). According to microfoundations research, collective outcomes such as organizational performance can be explained by the actions and interactions of individuals or other lower level entities. Also, these micro entities may be influenced by macro entities (Foss, 2016). The method presented in this research provides an application to be used between the employees and the company. It provides to the microfoundations of HRM strategy by giving the possibility to collect individual-level data in a simple, visual, immediate and easy-to-use manner for decision support for strategic management.

This method gives employees a democratic way to give their input in the development of a company's human resource management practices. Their influence is enhanced when they can express both what they are feeling and in what direction they want activities to be developed. The method allows examining the direction in which the employees wish things to evolve and see the differences between employees' thoughts. However, as the microfoundations theory is still developing and has certain challenges is has not been included more in this research but will be the good starting point for future studies.

5.3.1 Validity and reliability of the study

Reliability means the extent to which a measuring method produces the same results when used repeatedly (Price, 1997). According to Saunders (2009), it refers to the extent to which the data collection technique or analysis procedure will yield consistent findings. Reliability is also often called by its synonym "consistency". Cronbach's alpha is the most common way to assess reliability in organizational research. While the alpha coefficient is a number ranging from zero to one, the acceptable minimum alpha level cited in the literature is often .70 (Price, 1997). In this research, the reliability of the ontology-based questionnaires has been analyzed with Cronbach's alpha values. Based on the alpha values, the instrument can be considered as reliable and consistent. The alpha values for each category and feature are presented in Tables 8 and 9.

Validity, in turn, refers to the ability of the used instrument to measure exactly what it intends to measure; in other words, the degree to which a measure captures the concept it is designed to measure. This type of validity is often referred to as "internal validity". In qualitative research, validity relates to the theoretical and operational definitions used in the study, and how they are consistent (Olkkonen, 1994). According to Leung (2015), validity in qualitative research means "appropriateness" of the tools, processes and data. It is crucial that the measures using survey instruments adequately represent the constructs under examination (Hinkin, 1998). In this study, the validity is largely based on the researcher's understanding and knowledge of the research context, as well as careful consideration and assessment (Olkkonen, 1994). Content validity refers to the extent to which the questions in the questionnaire provide adequate coverage of the investigative questions (Saunders, 2009). In this study, the concepts of the research were defined according to a thorough theoretical conceptual analysis, then discussed with professors and adjusted if necessary. In addition, the definitions were provided to the case respondents in order to create a shared understanding of the concepts. The validity of the assessment method was also enhanced with many student respondent cases and comments in the development phase. Generally speaking, it can be concluded that, by using the case studies, the technical functionality of the instruments was confirmed, the research results were validated and their reliability was studied. The DSS applications were able to produce research results that represented the case groups, based on earlier understanding.

5.4 Limitations and suggestions for future research

When looking at the results of the study, it should be noted that, even though these case study results indicate that the model has functioned in these cases, the generalizability of the results must be taken with caution, with the results viewed as indicative. However, because of the general nature of the instruments and the increased awareness about the subject gained during the research, there is no reason to think that the model would not also function in other companies and case settings.

Potential limitations of this study include the use of relatively long questionnaires with many statements. There are no strict rules about the optimal number of questions, but having too many can lead to response biases caused by boredom or fatigue (Hinkin, 1998). In future, the scales could be condensed into shorter forms or the ontologies could be separated into more specific ones. In certain cases, a shorter form of ontology could be constructed based on the gathered importance data. However, Harvey, Billings and Nilan (1985) suggest that at least four items per scale are needed to test the homogeneity of items within each latent construct. It is also important to ensure that the domain of interest has been adequately sampled with enough items, as inadequate sampling is a primary source of measurement error (Hinkin, 1998).

Further, the sample size in the cases was relatively small. In future studies, it would be good to have cases with more respondents from the same organization. This would provide more usable results from the organization's perspective, as well as a more generalizable result within the organization.

A major assumption of this study is that all respondents would truthfully respond to the statements. However, one possible limitation of this research was the research topic itself. It was noticed, during the research, that it may have been difficult for the respondents to discuss their commitment. This has been acknowledged in companies as resistance to providing responses, as well as questioning the motives behind the research. In such cases, it is important to emphasize the respondents' anonymity and gather the responses in large enough groups such that nobody can identified. Sometimes, in open-ended questions, the respondents can be identified by their closest managers, for example, if the answer is particularly critical. This research instrument removes such a possibility, which should be clearly emphasized. This should provide a better chance of receiving responses based on genuine thoughts and opinions. This is especially important when the instrument is intended as a management support tool, dealing with a subject that the respondents might not want to directly talk about.

In terms of future research, the collected data could be analyzed deeper using even more sophisticated analysis methods to find more meaning in the data. The data could be analyzed further, for example, to try to find different clusters in the data, and to profile the employees to distinct groups. Self-organizing maps (SOM) could be one way to pursue this type of analysis. Another area of future research could be to analyze the data in relation to performance measures. For example, in the academic setting, the engagement data could be analyzed together with the data about students' academic records and actual drop-out levels to further study their relations.

Also, it would be interesting to study the commitment and engagement of teaching staff in educational institutions and their students at the same time. As Ostroff (1992) states, there are significant correlations between aggregated teachers' job satisfaction and organizational commitment, and many indicators of school performance (student test scores, dropout rate, student satisfaction, teacher turnover). It should be important for universities to identify their employees' commitment as they are largely funded by public sources and play a vital role in the development of future knowledge.

The user interface of the application could also be developed so as to be even more usable. Regarding the internalization of the statements, it could be beneficial if the statements were available in audio format as well. In addition, the application could be developed to produce other types of analyses and reports in order to reduce the need to use additional software applications for analysis purposes, thus making it a more complete management support tool.

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Basics of Ontology-Based Organizational Commitment Evaluation

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Abstract The concept of organizational commitment has been studied extensively during the past decades and it is still one of the most challenging and studied concepts in organizational research.
This paper represents the basics of an ontology model for the development of organizational commitment. The proposed model is divided into three main sections that cover the process from the time before joining the organization to actual commitment and to its presumed outcomes.
Our objective is to create an instrument for management and leadership purposes that could be used to assess the degree of collective commitment and its types in a given organizational context. With this information, management can better lead the change and direct its human resource management practices in a direction beneficial to the organization. Highly committed employees have been seen to have a strong desire to belong to their organization and work towards its goals.

Keywords: organizational commitment; ontology; collective; degree of commitment; evaluation

1 INTRODUCTION

The concept of organizational commitment has been studied extensively and defined in various ways during the past decades, and it is still one of the most challenging and studied concepts in organizational research. Today's dynamic business environment further emphasizes its importance for organizations. Committed employees have been found to contribute to organizational effectiveness if they identify with the organization's goals and values and are willing to engage in activities that go beyond their immediate role requirements.

This paper proposes an ontology model for the development of organizational commitment. The ontology model will be used as a basis for creating a computer application using the generic Evolute system (Kantola 2009) on the Internet. This process type ontology model builds upon the strengths of current approaches on commitment. The theoretical framework for the ontology is based on literature relating to organizational commitment, its antecedents, propensities, and several processes believed to affect its development. Our objective is to create an instrument for management and leadership purposes that could be used to assess the degree of collective commitment and its types in a given organizational context. With this information, management can better lead the change and direct its human resource management practices in a direction beneficial to the organization.

2 ORGANIZATIONAL COMMITMENT

The concept of organizational commitment (OC) has been at the centre of studies into individual and organizational performance for several decades. During this time is has been defined in various ways (see e.g. Meyer and Allen, 1997, p. 12) and studied extensively. However, much has happened during this time to the ways in which organizations behave, including the evolution of new forms of employee relations and new psychological contract (Swailes, 2002). Now for more than 20 years the leading approach to organizational commitment research has been Meyer and Allen's (1984; 1997) three-component conceptualization of organizational commitment which was affected by strengths and weaknesses of earlier conceptualizations. They describe them as distinguishable components, rather than types of attitudinal commitment and denominate them as affective, continuance, and normative commitment. According to this model, the affective component refers to employees' emotional attachment to, identification with, and involvement in the organization, while the continuance component refers to the commitment accumulated based on sacrifices and investments made by employee which would be lost if the activity were discontinued (e.g. pension, seniority). Lastly, the normative component refers to employees' feeling of obligation to remain with the organization (Meyer and Allen, 1997). Each type of commitment ties the individual to the organization in different ways and will differently affect his/her behavior in the workplace. They argued that employees can experience each of these psychological states to varying degrees. This model has been subjected to the greatest empirical scrutiny and has arguably received greatest support (e.g. Meyer and Allen, 1997).

However, some studies have found high correlations between affective and normative commitment which has placed the contribution of the concept of normative commitment under strict scrutiny (Cohen, 2007). Consequently, Cohen (2007) argued that normative commitment should be rather viewed as pre-entry commitment propensity than actual commitment that develops after one's entry into organization. He argued that as the normative commitment is probably mostly shaped by early socialization and cultural factors and measuring normative commitment after entry into the organization provides little information about commitment of current employees (Cohen, 2007). In addition, Cohen tried to avoid potential overlap between continuance commitment and outcomes such as turnover intentions and some problems with its construct and predictive validity by shifting the focus from the costs of leaving the organization to the instrumental exchange focusing on the perceptions about the benefits of staying i.e. instrumental commitment.

2.1. Antecedents of Organizational Commitment

There have been several comprehensive studies regarding the antecedents of organizational commitment (see e.g. Allen and Meyer, 1990; Meyer and Allen, 1997; Mowday et al., 1982; Mathieu and Zajac, 1990). These are the factors believed to contribute to the development of organizational commitment. Antecedents of affective commitment have arguably gained the most attention. This might be because affective commitment is the most desirable form of commitment and it also has been studied most extensively.

In addition to the organizational antecedent factors employees have been influenced by many cultural institutions before joining the organization, for example, family, community, nation, state, church, education systems, and other work organizations (Hatch 1997). These pre-employment associations shape their attitudes, behavior, and identity which affect their propensity i.e. an inclination to become committed while working in the organization.

Affective Commitment

Antecedents of affective commitment have generally been categorized in three main groups: organizational characteristics, person characteristics, and work experiences (Meyer and Allen, 1997). Further, person characteristics have usually been categorized into two types of variables, i.e. to demographic variables (e.g., gender, age, tenure) and dispositional variables (e.g., personality, values).

Mathieu and Zajac's (1990) meta-analysis identified that among personal characteristics, age and tenure tend to have a low positive association with commitment although it may be non-linear. Cohen found that correlations were stronger for younger employees and for those with high tenure. This may be because employees could need to attain a certain amount of experience in order to become strongly attached to the organization, or perhaps only the employees who will develop affective attachment will remain in the organization in the long run (Meyer and Allen, 1997). Education level was found to have a non-significant or low negative association. Gender did not appear to have influence on organizational commitment. Meyer and Allen (1990) found that perceived personal competence correlates strongly with commitment (Swailes, 2002).

However, Meyer and Allen (1997) conclude that the relations between affective commitment and demographic variables have not found to be strong or consistent. Consequently, like many other studies Meyer and Allen (1997) argue that it is more likely that personal characteristics involve the development of affective commitment through particular work experiences. A great amount of research concerning the importance of work experiences highlights the organization's supportiveness to its employees, fair treatment and enhancing of employees' senses of personal importance and competence (Meyer and Allen, 1997).

Organizational policies and fairness behind organizational acts has been found to correlate positively with affective commitment. Also, the way which the new policies are communicated to employees' tends to have an effect on affective commitment (Meyer and Allen, 1997). In addition, many studies have reported strong correlations between job scope characteristics and affective commitment. Specifically, affective commitment has been positively correlated with job challenge, degree of autonomy, and variety of skills the employee uses (Meyer and Allen, 1997).

Continuance Commitment

Conceptually, the development of continuance commitment is fairly straightforward. Continuance commitment can develop as a result of any action or event that increases the costs of leaving the organization, provided the employees recognizes that these costs have been incurred. In Meyer and Allen's (1991) three-component model these actions and events were categorized as two sets of antecedent variables: investments and alternatives (Meyer & Allen 1997).

Employees can make investments in organizations in many ways, for example, by incurring the expense and human cost of relocating a family from another city or by spending time acquiring organization-specific skills. Leaving the organization could mean that an employee would lose or have wasted the time, money, or effort that was invested (Meyer & Allen 1997).

The other hypothesized antecedent of continuance commitment is the employee's perception of employment alternatives. Employees who have several possible alternatives will have lower continuance commitment than those who think their alternatives are few (Meyer & Allen 1997).

With respect to process considerations, it is important to point out that neither investments nor alternatives will have an impact on continuance commitment unless or until the employee is aware of them and their implications (Meyer & Allen 1997).

Normative Commitment

Normative commitment to organization develops on the basis of a collection of pressures that individuals feel during their early socialization (from family and culture) and during their socialization as newcomers to the organization. Socialization experiences are extremely rich and varied and carry with them all sorts of messages about the appropriateness of particular attitudes and behaviors (Meyer & Allen 1997).

It has been also suggested that normative commitment develops on the basis of a particular kind of investment that the organization makes in the employee –specifically, investment that seem difficult for employees to reciprocate. These might include such things as organization-sponsored tuition payments or a "nepotism" hiring policies. Given norms of reciprocity it is argued that employees might find this sort of imbalance or indebtedness uncomfortable and, to rectify this imbalance, will feel a sense of obligation (normative commitment) to the organization. It is possible that cultural differences exists in the extent to which people have internalized the reciprocity norms and, therefore, in the extent to which organizational investments will lead to the feelings of indebtedness (Meyer & Allen 1997).

Normative commitment might also develop on the basis of the "psychological contract" between an employee and the organization (Meyer & Allen 1997). Psychological contracts refer to the perceived exchange agreement between the two parties, i.e. things offered by the organization, or by the employees, that are conditional on something the other party does in return (Conway & Briner, 2005). In other words, psychological contracts consist of the beliefs of the parties involved in an exchange relationship regarding their reciprocal obligations (Meyer & Allen 1997).

This chapter summarized some of the themes found in literature concerning antecedents of commitment. Next, we discuss the processes believed to influence the development of organizational commitment.

2.2. Commitment Processes

In addition to commitment related antecedent variables, researchers have identified several intervening, complimentary processes that are believed to have an effect on the development of commitment. Each of these processes are related to different components (i.e. affective, normative, continuance) of commitment. Fig. 1 shows, nine groups of variables that may be affecting the development of organizational commitment i.e. the commitment processes. In the following sections, these processes are discussed briefly.

Organizational Commitment	Affective Commitment	Attribution	Antecedent variables (e.g. personal characteristics, role states, work experiences, idiosyncratic variables, socialization experiences)
		Rationalization	
		Met expectations	
		Person-Environment Fit	
		Need Satisfaction	
	Normative Commitment	Expectations	
		Obligations	
	Continuance Commitment	Alternatives	
		Investments	

Fig. 1. Variables of Commitment Ontology

2.2.1 Affective Commitment Processes

Role of Causal Attribution

Attribution addresses the perceived cause of others' behaviors (e.g., compliance with law, out of habit, genuine concern for employees). It is believed that the impact of HRM practices on commitment is moderated by employees' perceptions of the motives behind these practices (eg. Koys, 1988, 1991).

Retrospective rationalization

Affective commitment to an entity will develop on the basis of behavioural commitment via retrospective rationality or justification processes. Retrospective rationality occurs very quickly and without the person's awareness (Meyer & Allen, 1997). Salancik (1977) indentified four determinants that measure human acts which included explicitness, or deniability of act, revocability of the act, volition, or the motivation behind the act, and publicity, or linkage of the act in a social context. Extending this rationalization to organizational context Meyer and Allen (1997) suggests that the employees will be more likely to remain with the organization if they joined the organization of their own volition, they made their choice public, and the decision could not be reversed easily. After being "bound" to the organization employees will attempt to justify their actions, retrospectively, by developing emotional attachment to the organization.

Met expectations

Employees have different expectation about the job when they enter the organization. These expectations moderate the extent to which an actual experience within the organization will be related to affective commitment. Employees develop positive attitudes towards the organization when the experiences within the organization meet their expectations. Negative attitudes develop, however, if those expectations are disconfirmed. Studies have shown that the discrepancy (or lack thereof) between expectations and experiences is what influences affective commitment (Meyer and Allen, 1997).

Person Environment Fit

The concept of P-E fit has been conceptualized as an overarching construct that subsumes several other conceptually distinct types of fit e.g. Person-Job (P-J) Fit and Person-Organization (P-O) Fit (Sekiguchi, 2004). PJ-Fit can be defined as the compatibility between abilities of individuals and demands of specific jobs or the desires of a person and the attributes of a job (Kristof, 1996). Most researchers broadly define P-O fit as the compatibility between individuals and organizations, emphasizing the extent to which a person and the organization share similar characteristics and/or meet each other's needs (Kristof, 1996).

Needs satisfaction

The fulfillment of personal needs i.e. the needs satisfaction process has long been assumed to be related to affective commitment but it has not or cannot be studied empirically (Meyer and Allen, 1997). It is believed that employees will develop affective commitment to an organization to the extent that it satisfies their needs, meets their expectations, and allows them to achieve their goals. In other words, affective commitment develops on the basis of psychologically rewarding experiences (Meyer and Allen, 1997).

2.2.2. Normative Commitment Processes

Some studies have shown overlapping between affective and normative commitment conceptualizations that has caused researchers to question the contribution of normative commitment to the conceptualization of commitment (Cohen, 2007).

Expectations

Meyer and Allen (1997) concludes that normative commitment develops on the basis of pressures felt by individuals in their early socialization (from family and culture) and during their socialization in the organization. Through these socialization processes including conditioning (rewards and punishments) and modeling (observation and imitation of others), individuals learn what is expected of them e.g. appropriateness of particular attitudes and behaviors. The presumed process here is the process of internalization of the appropriateness of being loyal to one's organization.

Dunham et al's (1994) study supports the conclusion that the expectations could influence the development of normative commitment.

Obligations

Rousseau (1990) linked the obligation-related antecedents and processes of the normative commitment to the psychological contract. Rousseau (1990) argued that psychological contract is implicit rather than explicit agreements between organization and its employees. They can also change over time as one or both parties perceive obligations to have been fulfilled or violated and can take different forms (i.e. transactional and relational). Relational contracts (social exchange) seem to be more relevant to normative commitment, whereas, transactional (economic exchange) might influence on the development of continuance commitment (Conway and Briner, 2005).

Meyer and Allen (1997) argue that normative commitment may also develop based on investments (e.g. paid tuition) that organization makes in its employees that are hard to reciprocate. Employees might feel the imbalance or indebtedness uncomfortable and, to rectify this, will feel a sense of obligation to the organization (Meyer and Allen, 1997).

2.2.3. Continuance Commitment Processes

Continuance commitment is believed to develop as a function of the employment alternatives and accumulations of investments. These potential costs can develop with full recognition by the employee (e.g. special skills training) or they can accumulate over time without employees awareness (e.g. employees skills become useless elsewhere). However, unless they are recognized they have no impact on continuance commitment.

Employment Alternatives

Evidence (Allen and Meyer, 1990) suggests that the perceptions of the availability of alternatives are related to employees' need to remain with the organization. Employees who have several possible alternatives will have lower continuance commitment than those who think their alternatives are few (Meyer and Allen, 1997).

Investments

The investment process draws on Becker's (1960) side-bet theory. Becker argued that commitment can result from accumulation of side bets person makes. Applied to organizational commitment, side bets involve the investments (e.g., time, effort, money) that an employee would lose if he or she left the organization (Meyer and Allen, 1997).

To conclude this chapter, it must be noted that although the processes believed to be involved in the development of different components have been described separately, they occur, to a large extent alongside. Also, some of the processes identified here have encountered criticism concerning that they provide little support in explaining the process of commitment formation. However, they have all been presented here because of mixed results in the different studies. Further, the above mentioned antecedents and processes have some similarities and are interlinked together closely to foster the development of commitment. Lastly, the theoretical discussion of this paper focused on the commitment towards the organization, it is clear that people develop commitment to various work-related domains such as workgroups, unions or teams.

3 HUMAN RESOURCE MANAGEMENT AND COMMITMENT

Organizational policies and human resource management (HRM) practices can have a significant effect on employee commitment. HRM practices promote, reinforce, and influence commitment through selection, placement, development, rewards, and retention (Wimalasiri, 1995). Shahnawaz and Juyal (2006) argue that commitment is one of the key factors of HRM policy for an effective organization and that it should be central to organizational strategy.

Stum (2001) claims that the development process of the commitment can be described with a model conducted from the Maslow's Hierarchy of Needs which he calls the Performance Pyramid. The levels of the pyramid were combined based on the information gathered from the extensive Workforce Commitment Index studies investigating the factors and conditions that have the most impact on commitment between the individual and the organization. The five levels of workforce needs are safety/security, rewards, affiliation, growth, and work/life harmony.

Stum's (2001) findings show that there is a hierarchy of organizational factors that build upon one another to construct higher levels of commitment in the workforce. Attending to higher level need when lower level issues are below employees' expectations do not enhance commitment. For example, the employee must feel physically and psychologically safe in the work environment for commitment to be possible at higher levels and that the organization has to meet expectations for affiliation before trying to fulfill growth of work/life level. As each of these needs are satisfied the individual focuses on attaining the needs at the next level thus moving up the hierarchy as in Maslow's model (Stum 2001). In other words, organization has to fulfill or exceed employees' expectations at the each level in the hierarchy in order them to move up the hierarchy towards commitment, and consequently towards presumed organizational outcomes of high levels of commitment.

Addressing the issues requires organization-wide HR policies and practices that support the meeting or exceeding expectations at each level. HR provides the architecture that supports the pyramid levels and thus creates an environment where the highest level of commitment and retention can be attained. However, the interpretation and implementation of the policies and attributes will either support of inhibit higher retention and commitment (Stum 2001). It is believed that the impact of HRM practices on commitment is moderated by employees' perceptions of the motives behind these practices (e.g. Koys 1988; 1991). In support of above contention, Gaertner and Nollen found that the perceptions of HRM practices contributed over and above context factors (supervisor relations, participation in decision making, and communication) in explaining differences in commitment (Meyer and Allen, 1997).

4 BUILDING THE ORGANIZATIONAL COMMITMENT ONTOLOGY

The creation of overall ontology is problematic because the views on commitment are so diverse. To be most effective ontology should incorporate the most empirically and conceptually warranted components of the process.

Using the theoretical research we have constructed a new ontology for evaluating organizational commitment. Fig 2 presents the current process type construct of the ontology. The ontology encompasses commitment-related variables and the relations between them. The ontology model draws upon existing research on commitment processes (Meyer and Allen, 1997; Mowday et al., 1982; Cohen, 2007; Swailes, 2002). The theoretical part of this paper discussed the factors that have been identified to affect the development of commitment towards a given work-related domain. These factors of the ontology are portrayed in Fig 2 in a process-like manner.

Meyer and Allen's (1984; 1997) multidimensional model of commitment seems to be subjected to greatest empirical validation and has arguably received greatest support. Therefore, we have used it as the main model to distinguish different components of commitment. However, we have added to our ontology the new findings and the criticism their model has encountered (e.g., Cohen 2007; Swailes, 2002). In addition, we are planning to incorporate to our ontology the time before joining the organization including the reasons why a prospective employee would choose to become a member in a given organization, and the motives behind the selection decision.

The proposed ontology model is divided into three main sections that cover the process from the time

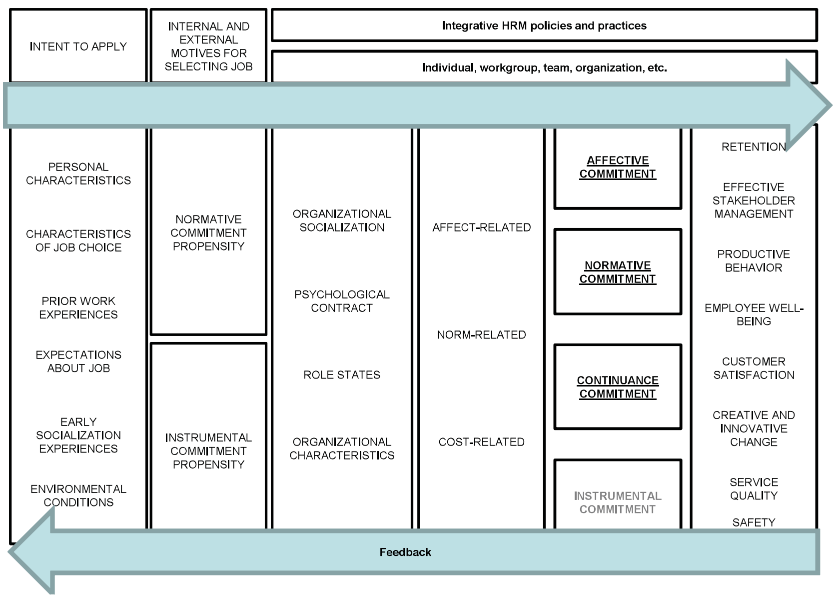

Fig. 2. The Current Process Ontology Model of Organizational Commitment

before joining the organization to actual commitment and to some of its presumed outcomes. Further, the classification of the commitment process has been divided into two stages: (a) pre-entry, job choice influences, and propensity to become committed which develops before entry into the organization; and (b) the development actual subsequent commitment, which develops after entry into the organization.

The ontology will be used as a basis for creating a new decision support system using generic Evolute platform (e.g. Kantola 2009; Kantola et al. 2006). The work on the ontology is still ongoing, and more research is required to finalize the construct for research purposes. Fuzzy logic will be used as the key technology in the proposed methodology and application.

4.1. Research Objectives and Evaluation

The goal of our research is to collect the verified and mostly accepted components and measurement of methods of commitment into an ontology and consequently under one application. We hope that this application will help to bring the knowledge from several scientific studies and the views of scientific communities regarding organizational commitment and the variables affecting employees' commitment closer to strategic decision making and daily leadership and management.

The current state of collective commitment will be evaluated in our future application partly with some of the existing conceptually and empirically verified measuring methods and their statements, and partly with new statements concerning the variables presented in the ontology. The degree of commitment is obtained by collecting the states of the different variables, and the collective commitment can be determined by gathering the commitment levels of the group in question. As a result, we obtain a picture of the overall degree of commitment within the target group. This information could help management to design and implement specific actions to improve and foster employees' commitment and, in turn, the effectiveness of the organization and wellbeing of the employees. Furthermore, this information might help to be able to lead the change better and to prepare to the future turnover of the staff.

In organizations there is always employee turnover and total commitment is not necessarily required from all of its employees. In our study we do not try to determine the actual commitment of every employee individually but rather to evaluate the degree of commitment and its types collectively.

5 CONCLUSIONS AND FUTURE WORK

The results obtained from various scientific studies and models have little effect on organizational decision making if they cannot be made clear and usable for management. We believe that an easy way to measure commitment and its related constructs is needed by organizations in order to create effective HRM strategies and utilize this information in day-to-day operations. We aspire to create such a measurement application by designing an ontology for organizational commitment and its closely related constructs. As the views regarding organizational commitment are partially diverse in this study an attempt was made to create model which describes at the concept of commitment from various viewpoints in one go. The theoretical framework for the ontology is based on literature relating to organizational commitment, its antecedents, propensities, and several processes believed to affect its development.

The first stage of building the new application is completing the first version of the ontology, including the compilation and creation of the statements describing the process of commitment. Next, the statements will be converted into a new Evolute system. After the functionality of the application has been confirmed, case studies will be processed and evaluated. As more is learned about the concepts and their relations, it is possible to fine-tune the behavior of the application with fuzzy rules, such as the weights of the different variables or statements.

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RESEARCH PAPER

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Organizational Commitment among Purchasing and Supply Chain Personnel

Testing Research Instrument

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***Abstract*— The concept of organizational commitment has been studied extensively during the past decades, and remains one of the most challenging and studied concepts in organizational research. In purchasing as well as in supply chain management, commitment plays a central role, because the personnel work directly with outside organizations, and consequently their performance can have a significant effect on the total effectiveness of the organization. This paper discusses organizational commitment and its importance in supply chain management and in the purchasing function. In addition, the principles of our newly developed Internet-based evaluation instrument are highlighted. This application has been preliminarily tested and the verification and validation processes are currently under evaluation.**

Keywords—organizational commitment; purchasing; supply chain management; evaluation; measurement

I. INTRODUCTION

Organizational success is one of the main goals in leadership and management. It is assumed that through good leadership and management, success can be achieved. Success greatly depends on how well leaders can manage the workforce and get them to work towards their shared goals and objectives. Employees have been found to contribute to organizational effectiveness and work efficiently towards its goals if they identify with the organization's goals and values and are willing to engage in activities that go beyond their immediate role requirements. One of the main sources of competitive advantage for today's organizations is the ability to retain talented employees. In other words, long-term sustained success and growth can be achieved by attracting and retaining the best talent [1]. Heinen and O'Neill [1] argue that the relationship with the employees' immediate manager has the greatest effect on employee commitment, growth, and development. Furthermore, organizational policies and human resource management practices can have a significant effect on employee commitment. Therefore, successful development and execution of organizational policies, systems, management, and leadership are crucial because otherwise, they could hinder highly committed employees from converting their commitment into performance outcomes [2]. All these characteristics have been repeatedly associated with the concept of organizational commitment. Particularly, it is assumed that employees are likely to exert great effort on behalf of the organization if their commitment is based on affective attachment to the organization.

The theoretical part of this paper deals with the issue of organizational commitment linked to the context of purchasing and supply chain management. The performance of activities in the purchasing and supply chain function can have a significant effect on the total performance of the organization [3]. Special focus is directed on purchasing personnel, since, as boundary spanners, employees in the purchasing function represent their firm's strategic goals and intentions as they play a significant role in initiating and establishing relationships with outside organizations. Consequently, they can have a significant effect on their organization's reputation and image [4] and therefore the effectiveness of their performance can have an enormous effect on the company's bottom line. These are some of the reasons why organizations would like their employees to be highly committed and why we believe that organizations should first evaluate the degree of commitment and the factors affecting it to find the best course of action for trying to manage it.

II. THEORETICAL FRAMEWORK

A. *Organizational Commitment*

Organizational commitment refers to the extent to which an individual regards him or herself as an organizational person. In particular, organizational commitment refers to "the relative strength of an individual's identification with and involvement in a particular organization" [5]. Reichers [6] defines commitment as a process of identification with the goals of an organization's multiple constituencies [6], such as organization, occupation, job, supervisor, workgroup, or organizational goals.

While there are several definitions of organizational commitment, a common three-dimensional theme is found in most of these definitions: (1) committed employees believe in and accept organizational goals and values, (2) they are willing to devote considerable effort on behalf of their organization, and (3) they are willing to remain with their organization [7; 8]. Hence, organizational commitment can be described as a psychological state that binds an individual to an organization [9] and influences individuals to act in ways that are consistent with the interests of the organization [5; 10]. Meyer and Allen [11; 12] defined organizational commitment as consisting of three components: affective, continuance, and normative

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commitment. They argue that these components reflect distinct psychological states and that employees can experience each of these states to varying degrees. First, affective commitment refers to how strongly the employee identifies with, is involved in, and enjoys membership in an organization. This dimension is closely related to Porter, Steers, Mowday and Boulian's [5] definition. Second, continuance commitment [11; 12] is the cost-related aspect of commitment. This form is the function of perceived cost based on the sacrifices and investments made by the employee. This view draws upon Becker's [13] early thoughts about the reasons behind commitment. The third component of the Meyer and Allen model [11; 12], normative commitment, sees commitment developing based on internalized loyalty norms, i.e. the feeling of obligation to remain with an organization.

Organizational commitment has been considered as a mediator variable in several causal models of employee behavior. Often it has been included as a mediator focusing on predicting other employee reactions or behaviors [14]. As a consequence, organizational commitment has been linked to several personal variables, role states, and aspects of the work environment, such as job characteristics or organizational structures. From an antecedent point of view, it has been related to employees' absenteeism, performance, turnover, and other behaviors. In addition, several other variables have been found to correlate with organizational commitment, such as job involvement and job satisfaction behaviors [14].

Additionally, DeCotiis and Summers [15] found that commitment had a direct positive influence on employees' work motivation and objective measures of job performance, as well as a direct negative influence on their intention to leave and actual turnover [14]. In other words, employees who identify with and are involved in their organization are committed, and presumably want to maintain membership in their organization and exert effort on its behalf [7]. Many extensive studies support this prediction [c.f. 14; 16]. Hence, Mowday et al. [7] argued that the strongest and most predictable behavioral consequence of organizational commitment is low turnover. Many extensive studies support this prediction [c.f. 14]. Meyer and Allen [17] emphasized the positive correlation between affective commitment and work attendance. A committed workforce will be more dedicated to their jobs and more motivated to give their time and effort to accomplish the required tasks. This can also lead to a more autonomous and self-controlling workforce [18]. Therefore, it is important to identify more clearly what drives employees to become committed to their organization and to understand how to influence and maintain commitment in the workforce.

1) External Organizational Commitment

McElroy, Morrow and Laczniak [19] extended the concept of commitment beyond the boundaries of one's employing organization to include commitment to another organization. They argued that an employee could develop commitment, in other words, a psychological attachment to a specific organization external to one's own employer. This is known as external organizational commitment (EOC), and is predicted to develop among those boundary spanning members of an organization (e.g. people working in purchasing, selling, consulting) who are in a position to develop long-term relationships with members of other organizations. However, whether EOC develops or not is influenced by the nature of the interaction between the individual and the external organization.

EOC can have both positive and negative effects for the employing organization, the external organization, and the individual [19]. For example, for employing organizations that depend heavily on customers and clients, high levels of EOC are beneficial as long as this loyalty does not come at the expense of the employing organization (e.g. if in-house duties are neglected, external agreements begin to favor the external organization). One of the positive effects of a high EOC is that employees who develop commitment to an external client organization are likely to exert more effort than required for that organization, which may lead to new and better business opportunities and relationships [19]. Taking EOC to the extreme, valued employees in boundary spanning roles may even terminate their employment and take a position with the external organization, which will lead to undesirable turnover and may lead to a potential loss or deterioration of business. However, it must be noted that commitment to one's own organization will have the greatest impact on the potential negative consequences of EOC. Specifically, because organizational commitment deals with the relationship between the individual and the employing organization, organizational commitment is likely to moderate the connection between EOC and the negative consequences to the employing organization and the individual [19].

2) Measuring Organizational Commitment

As the definitions of organizational commitment have been quite diverse [20], so the interest in commitment as an explanation of employee behavior and performance has led to the development of several attempts to measure it. However, they continue to draw criticism for a lack of precision and for concept redundancy [6]. Allen and Meyer [11] conclude that relatively little attention has been paid to the development of measures of commitment that conform closely to the researcher's particular definitions of commitment.

Perhaps the most widely used commitment scale, the Organizational Commitment Questionnaire (OCQ), was developed by Porter, Steers, Mowday and Boulian [5]. This scale was developed based on their definition of commitment and measures the affective dimensions of commitment, although it incorporates some 'continuance' and 'normative' elements. The OCQ is used to measure the state in which an individual identifies with a particular organization and its goals and wishes to maintain membership in order to facilitate those goals [7].

Meyer, Allen and Smith [21] argue that different components of commitment are differently related to variables such as antecedents and consequences. Therefore, Meyer and Allen developed independent scales to measure these three components of commitment, i.e. the Affective Commitment Scale, the Continuance Commitment Scale, and the Normative Commitment Scale. It is important for management to understand the relationships between these

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different components of commitment because of their differences in outcome variables. As Meyer and Herscovitch [9] argue, the different components of organizational commitment will have different effects on other variables such as attitudes and behaviors. However, various studies have shown that normative commitment overlaps with the other two types of commitment (e.g. [22; 23]). On the other hand, constructs of affective and continuance commitment have been well supported in the literature [14].

It is clear that there will always be employee turnover in organizations, and "total" commitment is not required from all employees. As Pierce and Dunham [24] contend, organizational commitment is more important in complex jobs that require adaptability and demand that employees take the initiative. Clearly, undesirable turnover can be extremely costly to organizations given the high costs incurred (e.g. losing productive employees, recruiting, selecting, and training costs, and the potential negative impact on current customer relationships). In contrast, turnover of undesirable employees can be healthy for organizations [c.f. 14]. For example, highly committed poorer performers may even decrease organizational effectiveness as a result of lower absenteeism and turnover. Based on these arguments, a better understanding concerning the factors affecting commitment is needed in order to manage the workforce effectively.

As a result of all these points, leaders need to have an understanding of how employee commitment develops and is maintained over time [25]. A deep understanding of the processes related to the causes and consequences of commitment will enable management to create better interventions. Management can, for example, adopt appropriate leadership behaviors in order to enhance the levels of job satisfaction, and in turn improve the levels of employee commitment to their organization and job performance, consequently increasing productivity and profitability [25]. Mathieu & Zajac [14] conclude that organizational commitment is a useful criterion for various organizational interventions designed to improve employees' attitudes and behaviors. At minimum, they suggest that it should be used to influence the employees' socialization processes, participation, ownership in the company, and reactions to job enrichment. However, before interventions can be effectively planned and executed, measurement of organizational commitment and other mediating factors should be conducted.

B. Human Aspects in Purchasing and Supply Chain Management

The purchasing function has evolved into an integral part of supply chain management [26]. It has increasingly assumed a more pivotal strategic role in supply chain management (SCM) [27]. It can be seen as a subset of SCM that deals primarily with managing all aspects related to the inputs to an organization (e.g. purchased goods, materials, and services). It can contribute both in quantitative and qualitative ways to improving the organization's bottom line [28]. Since performance in purchasing and materials-related activities can have a significant effect on the total performance of the organization [3], increased emphasis has naturally been placed on the function's efforts to maintain or rebuild organizational competitiveness [29]. Consequently, buyers entrusted with the expenditure of company funds are automatically placed in a more vulnerable position than most employees [29].

Many studies point out the fact that people working in supply chains have a major effect on the building of trust between organizations, which is one of the key factors in mutually beneficial business relationships. Trust is critical because, without trust, suppliers are unlikely to make long-term investments to support future business with the buyer [30]. The establishment and maintenance of a trusting relationship rely on the motivated individuals who regularly interact across organizational boundaries [30; 31]. In addition, the purchasing agent's communication skills, professional knowledge, decision-making autonomy, and ability to compromise have been found to influence the supplier's trust in purchasers significantly [32]. A supplier is more likely to develop trust in a purchasing agent, and consequently in the buying organization, when they perceive purchasing agents as being competent and able to keep their promises [30; 32]. Zhang, Viswanathan and Henke [32] concluded that, because of their position as boundary spanners, purchasing agents have an influence on the amount of trust outside organizations place in the company the purchasers represent.

In addition, the boundary spanning capabilities of purchasing agents are critical in establishing and maintaining supply chain relationships (e.g. [33; 30; 31]). Smith, Plowman, Duchon and Quinn [34] argue that these capabilities can be influenced by the intrinsic dispositional traits of the individual [32]. The relationships between individuals in boundary spanning positions provide a means for the development of wider communications between their employing organizations, which will create familiarity and trust between the parties.

In addition, Perrone, Zaheer and McEvily [30] argue that the purchasing agent's tenure, i.e. the length of time an individual has spent working within an organization, can significantly increase the supplier's trust in the purchasing agent. This finding is also important because of its direct link to organizational commitment. It is based on the assumption that individuals with long tenure have acquired informal power and knowledge over time [35; 30], making their knowledge more valuable and thus making them more powerful [30].

In their study of supply chain integration, Fawcett and Magnan [36] identified the main factors most likely to benefit from, hinder, and assist in successful Supply Chain Management. These factors are presented in Table 1.

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TABLE I. TOP TEN BENEFITS, BARRIERS, AND BRIDGES TO SUPPLY CHAIN MANAGEMENT [36]

Benefits	Barriers	Bridges
Increased customer responsiveness	Inadequate information sharing	Senior & functional managerial support
More consistent on-time delivery	Poor/conflicting measurement	Open & honest information sharing
Shorter order fulfillment lead times	Inconsistent operating goals	Accurate & comprehensive measures
Reduced inventory costs	Organizational culture & structure	Trust-based, synergistic alliances
Better asset utilization	Resistance to change—lack of trust	Supply chain alignment & rationalization
Lower cost of purchased items	Poor alliance management practices	Cross-experienced managers
Higher product quality	Lack of SC vision/understanding	Process documentation & ownership
Ability to handle unexpected events	Lack of managerial commitment	Supply chain education and training
Faster product innovation	Constrained resources	Use of supply chain advisory councils
Preferred & tailored relationships	No employee passion/empowerment	Effective use of pilot projects

As shown in Table 1, many of the barriers and bridges concern managerial practices, organizational culture, trust, passion, empowerment, managerial support, and information sharing, many of which have been repeatedly associated with motivation and job satisfaction, and in the long run affective organizational commitment.

Therefore, it can be reasoned that these commitment-related aspects of working life are one of the key factors to enhance when trying to improve the overall performance of the supply chain function and consequently the performance of the organization. Enabling organizations to improve these factors requires commitment from senior management. Saunders [3] argues that it is their responsibility to increase passion in the workplace by establishing adequate systems that help to nurture a work environment where participation is highly valued, where people are empowered to experiment, take risks, and solve problems, and where constant, life-long learning and knowledge sharing is carried out [3].

In their study of purchasing executives, Kelley and Dorsch [37] argue that purchasing executives' feelings of commitment to their organization have a tendency to reflect the extent to which they identify themselves as a corporate person. As individuals identify more strongly with their organization, their interpretations and reactions to events tend to be influenced by their definition of who they are, i.e. a committed employee [37].

As can be seen from the above, the commitment of those employed in the supply chain has a major importance on their organization. Successful operations and meeting customer and financial goals are in large part determined by the abilities and motivation of the employees. People working in purchasing and the supply chain must have the right motivation and abilities for strategic purchasing and supply chain management to be successful. Most importantly they must be committed to the objectives of the organization and dedicated to the long-term best interests of their employer. This emphasizes the ethical principles such as equity, trust, responsibility, and commitment that are required from employees in purchasing and supply management.

III. BUILDING AN EVALUATION INSTRUMENT

Our aim was to develop a tool that could be rapidly administered to a large number of employees to evaluate the various components of organizational commitment and their primary correlate constructs, such as job satisfaction and perceived organizational support. Our evaluation instrument was designed to incorporate these various constructs in order to unearth the primary factors that affect commitment and to be able to pinpoint their current state in a given organizational context. The evaluation of different components is important, because the various components of organizational commitment will lead to different effects on other variables such as attitudes and behaviors [9].

A. Evolute System

Evolute is an online system that supports specific-purpose fuzzy logic applications [38; 39]. Fuzzy logic is a conceptual system of reasoning, deduction, and computation that makes it possible to reason precisely with imperfect information. Imperfect information is information which in one or more respects is imprecise, uncertain, incomplete, unreliable, vague, or partially true [40].

The Evolute system allows researchers to develop a specific domain ontology and present it online to the target group through semantic entities, such as statements [39]. Each ontology and its propositions can be fine-tuned over time by adjusting the fuzzy set design and fuzzy rule design – this is the ontology lifecycle in ontology engineering [41]. Furthermore, the content of the ontology can be modified, i.e. variables can be added and removed as more about the domain is learned, thus making the ontology correspond better to the phenomenon in question. Evolute makes the examination of results possible both visually and numerically. In general, a fuzzy logic application resembles an expert's task of evaluating and reasoning based on linguistic information.

B. Evaluation Instrument

From the literature we identified a broad range of constructs related to organizational commitment as its antecedent, determinant or correlate factors [e.g. 2;11;14; 17;42;43]. We categorized these factors under relevant constructs, such as work motivation, job satisfaction, person-organization fit, perceptions of organizational support, and turnover intentions. All the identified categories were grouped under three main dimensions of organizational commitment — affective, continuance, and normative. As a result, 55 variables were identified in 15 categories under these three main dimensions. These 55 variables were described in the initial version of our instrument with an average of five linguistic indicative statements (indicators).

The statements used in our research application were developed based on various studies and models. For example, organizational commitment statements were adapted from the scales created by Meyer and Allen [12], and Porter, Steers, Mowday and Boulian [5]. Job satisfaction and the motivating potential of job measures were developed based on measurement tools devised by Hackman and Oldham [44] and Weiss, Dawis, England and Lofquist [45]. In addition, Thomas's [46] intrinsic motivation theory was used as a reference. Statements describing the components of organizational justice were adapted from the Niehoff and Moorman [47] scale. Role ambiguity and conflict were measured for items based on the Rizzo and Lirtzman [48] scale. Items relating to the psychological contract were adapted from studies by Raja, Johns and Ntalianis [49], and Rousseau [50;51]. In addition, role overload was measured

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with statements based on Pareek's [52] Organizational Role Stress Scale.

In general, commitment studies have utilized Likert-type scales. In this study, we propose to capture subjects' responses through a continuous graphic rating scale. The verbal limit values of the continuous scale can be set to be statement-specific. By using the continuous scale, the aim is to overcome some of the disadvantages that the conventionally used Likert-scale type measures may possess [c.f. 53]. Russell & Bobko [53] speculated that the Likert-scale requires subjects to somehow compress or otherwise reduce their latent response. They suggest that information loss due to the coarseness of the scale can cause false increases or decreases in moderated regression effect sizes, and propose that it could result in an unknown systematic error, which can have an enormous effect on the ability to detect true interaction effects.

On a practical level, respondents are asked to evaluate their current reality and vision for the future as they perceive it regarding statements describing the identified constructs. This evaluation results in the creation of a proactive vision, i.e. the gap between the current reality and future vision. The reasoning from the indicative statement evaluation to the visualized proactive vision is made with fuzzy logic; the statements are semantic entities and the ontology is the information resident in a knowledge base [c.f. 40; 54]. The aim of our research application is to help organizations to identify the prevailing nature of their employees' commitment by examining its related constructs and aspects of working life collectively at the team, workgroup, or organizational level.

DEMOGRAPHIC CHARACTERISTICS

Several demographic characteristics were also included in the study as descriptive statistical variables. We included age, gender, highest education level attained, job type, experience in current job, and overall tenure in the current organization. Nationality and total tenure in working life were also included. As Mathieu and Zajac [19] state, most of the researchers have included personal variables in commitment studies as descriptive statistics rather than explanatory variables.

C. Preliminary Research Instrument Testing

The first testing of the instrument was performed in the fall of 2012 with 18 Finnish industrial management M.Sc. program students with various engineering backgrounds. All the subjects were asked to answer the statements in relation to their own studies at the industrial management school. After the first test run, adjustments were made to some of the items. The second test run was made with 15 other M.Sc. students at the same institution in early 2013. After the second test runs, additional adjustments were made to the overall construction of the ontology behind the application and to its statements. The average age of participants in both studies was 31.5 years and 70 percent of them were male.

The third testing of the instrument was made in a Polish technical university in the spring of 2013 with 18 international students from various countries with an average age of 24.4 years and 65 percent of them were male. After the third test run some irregularities were detected and some major adjustments had to be made to the overall construct of the ontology and its statements. Based on these three test runs, the application evolved into a new version with 59 main variables in 18 categories. Development process led to the elimination of 26 statements based on their similarity with others. In addition, the wording of several statements was modified and made clearer.

Because the development of this application is still ongoing, only preliminary results from the testing of the instrument are presented. Figs. 1 and 2 illustrate examples of the category level results of the second instrument testing (n=15).

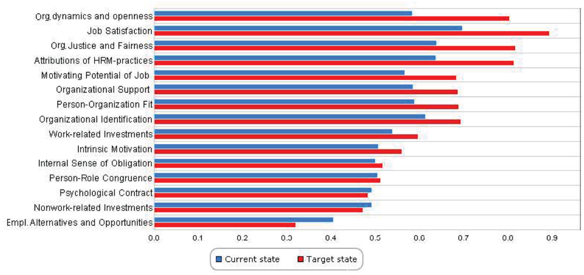

Fig. 1. Example of Category Level Results.

Fig. 1 represents an example of the category level results of the preliminary tests. The blue bars represent the group's collective perception of the current reality (perceived current state), and the red bars represent their vision for the future, and the difference is their collective proactive vision. The results have been sorted based on the highest proactive vision, i.e. the greatest collective feeling of tension between the current and envisioned future state.

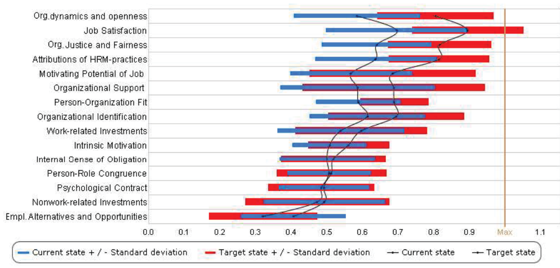

Fig. 2. Average and Standard Deviation of Category Level Results.

Fig. 2 presents the averages and standard deviations of the same category level results as in Fig. 1. The blue bars represent the current state results and their standard deviation in the research group. Likewise, the red bars represent the range of category level results and their standard deviation in the future target state of the research group. The lines represent the averages of these results.

In order to delve into what makes the category level results and to pinpoint the most appropriate targets for possible development activities, we must look at the variable level

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results. Fig. 3 shows the ten highest proactive vision results from the third instrument testing study (n=18).

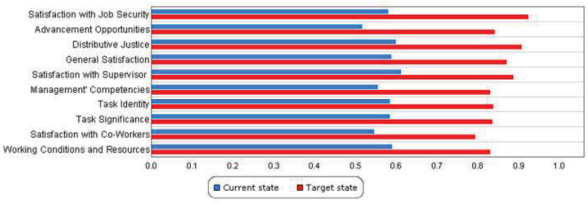

Fig. 3. Example of Variable Level Results of the third study.

Fig. 3 portrays ten variables with the highest proactive vision in the third study with a multicultural research group. For example, it can be seen that the highest tension between the current state and target state is in satisfaction with and need for job security, as well as in opportunities for advancement and management commitment to staff development. Furthermore, the fair distribution of pay and other work rewards is seen to be highly important for betterment. In addition, various aspects of job satisfaction and motivational characteristics of the job are indicated to be important and there is a desire for them to be improved.

Fig. 4 shows the ten highest proactive vision variable results in the Finnish sample in study 2. As can be seen, there are similarities between Fig. 3 and Fig. 4.

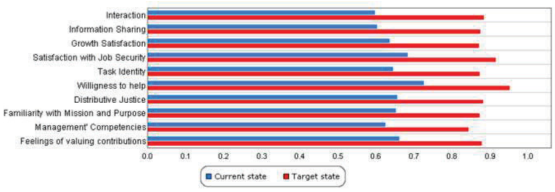

Fig. 4. Example of Variable Level Results of the second study.

This sample shows the highest tension in overall interaction and information sharing. Similarly, as in the multicultural group, the need for job security is evident. In addition, there is a gap between how much the work provides opportunities for professional growth and achievement and what is desired. Also, it can be seen that some of the motivational characteristics of the job e.g. task identity (identifiable, visible outcomes from work) is regarded as one of the variables most needing improvement. This sample also highlights the need for recognition from management for work and performance.

A comparison of these two studies shows that there are differences but also similarities. There are major similarities in job security needs and desired fairness in the distribution of work rewards. The biggest difference is in information sharing categories and the feeling of organizational support i.e. valued contributions. The Finnish research group shows the need for recognition from management and that the information sharing culture should be improved. These categories are not thought to be as important in the Polish test group. On the other hand, the Polish test group emphasized that it was more important to improve various features of job satisfaction.

The example above describes the ten categories with the highest proactive vision. Similar differences can be observed in the rest of the categories. There are various reasons for these differences, for example, they may stem from cultural differences or from the fact that the members in these groups have major differences in their overall length in working life. The reasons for the similarities or differences are not in the scope of this study are not analyzed any further.

Based on these preliminary results, it seems that understanding the nature of proactive vision is an important element of the process of developing these occupational factors. We believe that the categories that have the highest proactive vision are the targets that organizations should focus their development activities on in order to increase overall commitment in a specific organizational setting. The development of this instrument is ongoing and more empirical results are needed to improve its internal consistency, as well as its usability. In addition, these preliminary tests have shown some areas of the application that still need further development. However, these tests have shown that this application allows us to illustrate some trends that could be used to assist organizations in developing their HRM practices.

IV. CONCLUSIONS AND FUTURE RESEARCH

There are a wide variety of reasons why organizational commitment is important and why organizations want their key employees to be highly committed. Studies have demonstrated that higher commitment is related to factors such as greater levels of satisfaction, motivation, and pro-social behavior, while lower levels are related to a higher intent to quit, a higher turnover rate, and tardiness. In addition, high levels of organizational commitment have been associated with greater work attendance, extra role behaviors, and reduced levels of absenteeism.

The theoretical part of this paper dealt with the issue of organizational commitment among employees in the supply chain function, especially in purchasing. The focus was directed to employees in purchasing because, in their position, their work can have an enormous effect on company performance. The important personal qualities of employees in purchasing include the same qualities that are required from any employee in a responsible position, such as honesty, integrity, commitment, ambition, responsibility, and willingness to grow. However, many of these qualities have a special meaning for personnel in purchasing because of the higher trust their company has placed in them [29]. In addition, personnel in purchasing are in a position to develop external commitment towards their client organization, which emphasizes the importance of commitment to their own employer.

We believe that organizational performance can be achieved with employees who are motivated and committed to their work and to their organization. Therefore, it is important for management to be able to attain knowledge of the degree of their employees' commitment to their organization and the

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constructs affecting its development. In particular, retaining key employees and their commitment can be critical to the long-term success of the organization.

In this paper we also highlighted the basic principles of our newly developed application for commitment evaluation purposes. We developed this tool to make the factors affecting commitment clearer for management. Also, the visual nature of this instrument will enable management to gain a better understanding of this concept and quickly see the degree of the factors affecting it for a certain specific group. This information will also help management to compare results of various evaluated groups and plan specific actions. We believe that, in addition to scale validity and reliability, the measurement method and the results it provides must be useful with regard to the organization's goals and objectives and it must be possible to administer it cost-effectively and rapidly. The first test runs of our evaluation instrument have shown that our application allows the formation of a systemic view of an organization's commitment-related environment. We believe that our application can point out the areas where the organization should direct the focus of its HRM practices in order to enhance these commitment-related factors. With the combined collective information gathered, the organization will be able to provide interventions to improve its employees' working life and consequently the effectiveness of the whole organization. In addition, it will also be possible to monitor systematically how various commitment-related aspects will develop in the organization. However, more development is needed before we can implement our application in a real business context.

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RESEARCH PAPER

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Degree of Commitment Among Students at a Technological University – Testing a New Research Instrument

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ABSTRACT

Just as commitment in organizations is very important for long-term success, commitment to one's educational institute is important, too. Higher education provides the foundation for the social, economic and political growth of a country. Therefore, improving student retention by successfully delivering quality education, leading to student graduation and integration in the workforce, is crucial. It has been argued that students stay in their higher education institutes for similar reasons to those that make employees committed and engaged in organizations.

In our previous studies we have created a literature-based generic model of organizational commitment and engagement that could be used in conjunction with an Internet-based application to evaluate their various components and primary correlate constructs. In this study we took this evaluation model to the context of a higher educational institute to try to evaluate students' commitment to their university.

As a result, we identified several development needs in order to evaluate students' commitment with our application. Because the statements in our original instrument were aimed for use in the organizational domain, some of them were not suited to studies on commitment in an educational institute. Looking at the results of our study, we decided that the overall construct of our model and the wording of applicable statements should be modified in order to create an appropriate instrument for use in an academic institution. This was done based on Bean's Student Attrition Model. However, collective analysis of the test results clearly identified that even with the preliminary model it is possible to find where students see the needs for greatest development and how they view their current state of engagement.

Keywords: Academic, Commitment, Engagement, Evaluation, Application

INTRODUCTION

Employee commitment is argued to be critical to contemporary organizational success. One of the main sources of competitive advantage for today's organizations is the ability to retain talented employees. In other words, long-term sustained success and growth can be achieved by attracting and retaining the best talent (Heinen and O'Neill, 2004). Similarly, commitment to one's educational institute is important as well. Education is considered to be a critical contributor to economic competitiveness, growth, as well as social inclusion, among others. Student satisfaction and commitment to their studies is a significant issue for academic institutions. Therefore, improving student retention by successfully delivering quality education leading to student graduation and integration in the workforce is imperative.

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It has been argued that students stay in their higher education institutes for similar reasons to those of employees in organizations (Bean, 1980). Based on Bean (1980), student withdrawal can be regarded as being similar to employee turnover. Bean (1980) developed his model of student attrition based on organizational commitment literature focusing on turnover in work organizations. The presumed roles of organizational variables, personal variables, and environmental variables in shaping both attitudes and intents are largely supported by many studies. Focusing differently, Tinto (1982) argues that retention involves two different commitments from a student. The first one, known as goal commitment, is the students' commitment to obtain a degree, and the second one, institutional commitment, is their decision to obtain that degree at a particular institution. These commitments together are what affect students' commitment to a particular institution (DeShields et al. 2005). In addition, many studies have identified that students' overall satisfaction has a positive correlation to student retention (Cleary, 2001; DeShields et al. 2005). Therefore, DeShields et al. (2005) argued that the linkage between satisfaction and retention for students in higher education should be studied and carefully led and managed.

Measuring these kinds of concepts requires support from theory and methodology, so that the communication can be objective and the actions taken can be effective. In our previous research we created a literature-based generic online application to evaluate different concepts related to organizational commitment and engagement, to gain insights how employees see their membership in their organizations currently and what kind of proactive vision they have for the future. Organizational commitment refers to the extent to which an individual regards him or herself as an organizational person. In particular, organizational commitment refers to "the relative strength of an individual's identification with and involvement in a particular organization" (Porter et al. 1974).

In the fall of 2013, we tested our organizational commitment instrument with 40 Master's students at Tampere University of Technology in Finland. This study was a part of larger instrument development process. However, in this study we decided to test our instrument's usability in assessing students' commitment to their studies. Before evaluation, the participating students were asked to think of their university as their employing organization. Based on the results of our student research, we concluded that the instrument as a whole is not at its best in assessing student commitment. More specifically, the wording of applicable statements and the overall structure of our ontology model should be modified in order to create an appropriate instrument for use in an educational institution. To tackle the structure problem, we took variables from Bean's (1980; 1985) Student Attrition Model as the framework for building a new modified instrument. Statements for our new model were extracted from the existing statements in our organizational commitment model. They were chosen based on their suitability for assessing student commitment.

This paper is constructed as follows. After the introduction, the theoretical background on organizational and educational commitment is presented. The following section introduces the methodology, including the research instrument and research setting. After the methodology, a sample of the analysis and results of the research are presented. The last chapter concludes and summarizes our paper.

THEORETICAL BACKGROUND

Organizational Commitment

Organizational commitment refers to the extent to which an individual regards him or herself as an organizational person. In particular, organizational commitment refers to "the relative strength of an individual's identification with and involvement in a particular organization" (Porter et al. 1974). Reichers (1985) defines organizational commitment as a process of identification with the goals of an organization's multiple constituencies (1985), such as organization, occupation, job, supervisor, workgroup, or organizational goals. For more than 20 years the leading approach to organizational commitment research has been Meyer and Allen's (1984; 1997) three-component conceptualization of organizational commitment. They describe them as distinguishable components, rather than types of attitudinal commitment and denominate them as affective, continuance, and normative commitment. They argue that these components reflect distinct psychological states and employees can experience each of these states to varying degrees. According to this model, the affective component refers to employees' emotional attachment to, identification with, and involvement in the organization. It refers to how strongly the employee identifies with, is involved in, and enjoys being a member of an organization. This dimension is closely related to the definition of Porter et al. (1974). Second, continuance commitment (Allen and Meyer, 1990; Meyer and Allen, 1991) is the cost-related aspect of commitment. This refers to the commitment accumulated based on sacrifices and investments made

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by an employee which would be lost if the activity were discontinued (e.g. pay, pension, seniority). This view draws upon Becker's (1960) early thoughts about the reasons leading to commitment. Lastly, the normative component refers to employees' feeling of obligation to remain with the organization (Meyer and Allen, 1997). Normative commitment sees commitment developing based on internalized loyalty norms, i.e. the feeling of obligation to remain with an organization (Allen and Meyer, 1990; Meyer and Allen, 1991). They argued that each type of commitment ties the individual to the organization in different ways and will differently affect his/her behavior in the workplace.

Organizational commitment has been considered as a mediator variable in several causal models of employee behavior. Often it has been included as a mediator focusing on predicting other employee reactions or behaviors (Mathieu and Zajac, 1990). As a consequence, organizational commitment has been linked to several personal variables, role states, and aspects of the work environment, such as job characteristics or organizational structures. From an antecedent point of view, it has been related to employees' absenteeism, performance, turnover, and other behaviors. In addition, several other variables have been found to correlate with organizational commitment, such as job involvement and job satisfaction behaviors (Mathieu and Zajac, 1990). Additionally, DeCotiis and Summers (1987) found that commitment had a direct positive influence on employees' work motivation and objective measures of job performance, as well as a direct negative influence on their intention to leave and actual turnover (Mathieu and Zajac, 1990). In other words, employees who identify with and are involved in their organization are committed, and presumably want to maintain membership in their organization and exert effort on its behalf (Mowday, Steers and Porter, 1979). Many extensive studies support this prediction (c.f. Mathieu and Zajac, 1990; Cohen, 2000). Meyer and Allen (1997) emphasized the positive correlation between affective commitment and work attendance. A committed workforce will be more dedicated to their jobs and more motivated to give their time and effort to accomplish the required tasks.

Academic Commitment

Earlier studies on student retention focused on students' academic abilities in predicting their retention. However, research indicates that academic goals, self-confidence, institutional commitment, social support, and particular contextual influences like institutional selectivity and financial support, in addition to social involvement, all have a positive relationship to student retention. Students who cannot develop these factors are more inclined to drop out. Previous research has indicated that the strongest factors seem to be academic-related skills, academic self-confidence, and academic goals (Lotkowski et al. 2004). However, studies have shown that academic performance can only account for half of the variance in dropout rates (DeShields et al. 2005). In addition, a great deal of research has suggested that the social integration of students may be an important factor in predicting persistence. These studies argue that integration into the social environment plays a major role in commitment to a particular academic institution (Tinto 1975; DeShields et al. 2005).

Probably the two most dominant theories of student persistence and retention are Tinto's (1975, 1987) Student Integration Model and Bean's (1980, 1982) Student Attrition Model. Tinto's (1975) model emphasizes integration and commitment. Both of these models agree that commitment is a key factor in explaining persistence in educational institutes. Based on Tinto (1975), persistence occurs when a student successfully integrates into the institution academically and socially. A student's background characteristics (family background, individual attributes, and previous education experiences) influence their initial level of goal commitment and initial commitment to their educational institute. These commitments have an influence on academic integration. Goal and institutional commitment are also influenced by peer group and faculty interactions, and out-of-class room factors which contribute to social integration (Grossett, J. M. 1991). Habley (2004) argued that one of the main factors affecting academic retention is the quality of interaction a student has with other people on campus. This increased integration, both academically and socially, leads to greater goal commitment and institutional commitment, which leads to lower dropout rates and higher graduation rates. Based on Tinto's model, students who fail to successfully integrate academically or socially are likely to leave the educational institute. In his more recent paper, Tinto (2003) identified five conditions that promote student persistence: expectations, support, feedback, involvement, and learning. Based on Tinto, students are more likely to persist and graduate in a setting (1) that expects them to succeed, (2) that provides academic, social, and personal support, (3) that provides frequent and early feedback about their performance as they are trying to learn and persist, (4) that involves them as valued members of the institution (e.g. frequent and quality interaction with staff and other students), and (5) most importantly, students are more likely to persist and graduate in settings that foster learning. Students who are actively involved in learning, i.e. who spend more time on task especially with others, are more likely to learn and, in turn, more likely to stay (Tinto 2003).

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Bean's Student Attrition Model (1980, 1985) sees student withdrawal as being like employee turnover. He developed a model of student attrition based on organizational commitment literature focusing on turnover in work organizations. He defined student attrition as the cessation of individual membership in a particular higher educational institute. He argued that students stay in their higher educational institutes for similar reasons to employees in organizations, hence it is an analogue of organizational commitment. Based on the results of many studies of the Student Attrition Model, the presumed roles of organizational variables, personal variables, and environmental variables in shaping both attitudes and intents are largely supported. To further advance their research, Bean and Metzner (1985) attempted to create a conceptual model of the dropout process for non-traditional students. They argued that the main difference in the attrition process between traditional and non-traditional students is that non-traditional students are more affected by the external environment than by the social integration variables affecting traditional student attrition.

Non-traditional students are distinguished by the lessened intensity and duration of their interaction with the primary agents of socialization (e.g. faculty, peers) at the educational institute they are attending (Bean and Metzner, 1985). Typically, non-traditional students have to balance studies with employment. Usually, students are either full-time students, working part-time; or they are part-time students who are in full-time employment (Fleming 2009). In many cases, non-traditional students live quite far away from their educational institute, they attend only part time, for example, because of work, and have family responsibilities. Most have to balance their working lives and their academic studies. In addition, such students' participation in extracurricular activities is relatively minor compared to traditional students, as are the impacts of other social integration variables that are seen to have major influence on traditional students (Bean and Metzner, 1985). This pattern of participation characterizes higher education students in Europe now more and more (Fleming 2009).

As can be observed, the theoretical background has the same basic content. The problem is, however, gathering information so that it could easily produce general and specific information on the levels of commitment and engagement at collective and individual levels and show whether there are needs for significant improvement. We believe that this is a major management and leadership problem in universities. Therefore, there is a need to create simple tools so that academic organizations can collect information directly from the students. Our target is to create an Internet-based student commitment measurement system, using self-evaluation. Once self-evaluation has been conducted, students and academic staff will be more aware of possible development gaps and can base their objectives for improvement on concrete bottom-up results. The methods within the methodology are described in the next chapter.

METHODOLOGY

Evolute application environment

The evaluation method utilized in this study was developed on the generic, Internet-based, computer application environment called Evolute. Evolute is an online system that supports specific-purpose fuzzy logic applications (Kantola, 2005; Kantola, Vanharanta, Karwowski 2006). Fuzzy logic is a conceptual system of reasoning, deduction, and computation that makes it possible to reason precisely with imperfect information. Imperfect information is information which in one or more respects is imprecise, uncertain, incomplete, unreliable, vague, or partially true (Zadeh 2009). The Evolute system allows researchers to develop a specific domain ontology and present it online to the target group (Kantola., Vanharanta, Karwowski 2006). The application involves the use of self-evaluation in the assessment of different concepts in work role through semantic entities, such as statements (Kantola. Vanharanta, Karwowski 2006). The Evolute platform has been used in various studies in different countries, for example, in Finland (e.g. Kantola, Vanharanta, & Karwowski 2006; Kantola, Karwowski, & Vanharanta, 2011), in Poland, in the U.K. (e.g. Makatsoris, 2009), in South Korea (e.g. Chang, Kantola, & Vanharanta, 2007; Chang et al., 2009), and in Spain (e.g. Bikfalvi et al., 2007).

Research Instrument

Ontology

The disciplines needed to manage complex concepts like organizational commitment require a vast understanding of factors affecting it in many ways, as well as sound knowledge and mastery of actions that can assist its development.

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In order to classify and understand the concepts relating to this field of organizational study, we created an ontology. An ontology is a formal representation of a set of concepts within a domain and the relationships between those concepts. It is used to reason the properties of that domain and may be used to define the domain. According to Gruber (1993), an ontology is a "formal, explicit specification of a shared conceptualization" (Gruber 1993, p. 199). An ontology provides a shared vocabulary which can be used to model a domain – that is, the type of objects and/or concepts that exist, and their properties and relations (Arvidsson and Flycht-Eriksson, 2008). Therefore, an ontology is a way to explicitly define the concepts affecting commitment to organizational domain. In this context, the ontology is a classification of qualitative knowledge relating to personal feeling of attachment to organization. In other words, the ontology is a list of attributes that describe the meta-data (features affecting organizational commitment).

In our previous studies, we created a literature-based generic ontology model of organizational commitment (see e.g. Einolander and Vanharanta 2013). This model is intended to be used in conjunction with the Evolute (Kantola 2009) system to evaluate the various components of organizational commitment and their primary correlate constructs. The ontology is structured by three widely recognized psychological states affecting commitment to three categories: (1) Affect-related aspects, (2) Norm-related aspects, and (3) Cost-related aspects. This division, more specifically, affective, normative and continuance commitment was introduced by Meyer and Allen (e.g., Meyer and Allen 1984). It has been argued that one of these categories partially overlap with other ones (e.g. Angle and M. B. Lawson 1994; Brown 1996) but still have a distinct effect on employee behavior and consequently on an organization.

The Research Instrument in an Academic Context

Because the statements in our instrument are aimed at organizational commitment, some of them are not suited to commitment studies in an educational institute. Adapting the instrument for the academic context of the current research required a new grouping of concepts and their features. This was done in order to grasp the commitment and satisfaction better in a specific domain, i.e. students' commitment and satisfaction with their academic institution. We used variables from Bean's (1975) and Bean and Metzner's (1985) Student Attrition Model as a framework to do this. As a result, 15 concepts were identified along with 107 applicable statements or 'features' describing them. Figure 1 illustrates the concepts.

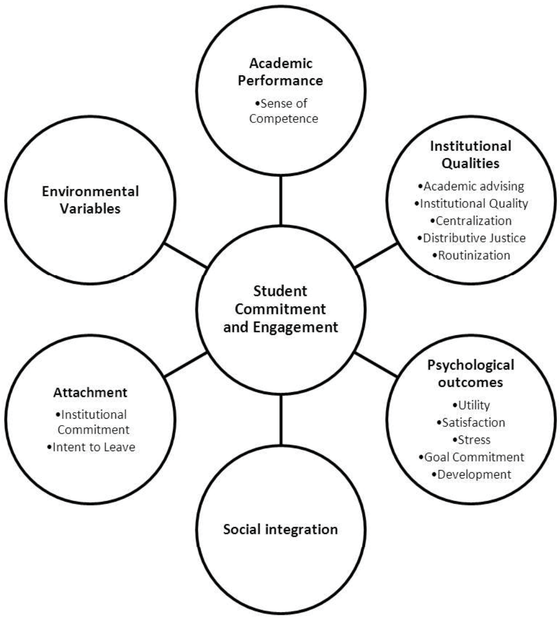

Figure 1. Evaluated concepts in our application

On a practical level, respondents are asked to evaluate the current state of the statement, how they feel about things at that moment in their organization. Also, the desired target or future state, how they want or see the situation to be in the future, is evaluated. This evaluation results in the creation of a proactive vision, i.e. the gap between the

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current reality and future vision. The gap between the actual and the desired states, often called creative tension or proactive vision, shows possible fields of improvement and intervention. The reasoning from the indicative statement evaluation to the visualized proactive vision is made with fuzzy logic; the statements are semantic entities and the ontology is the information resident in a knowledge base (c.f. Zadeh 2009; 1973).

Along with the statements, linguistic scale values are utilized. The scales vary according to the statements, for example, from "not at all" to "completely", or "highly unsatisfied" to "satisfied". The respondents provide their answers, both to current and desirable (target) states, by clicking on the two bars beside the scale. With this method, the respondent can choose from over 100 different values for each statement since the graphic bar offered a continuous scale of values. Responses to each statement are then transformed into a numerical form, a real value between 0 and 1. By using the continuous scale, the aim is to overcome some of the disadvantages that the conventionally used Likert-scale type measures may possess (c.f. Russell & Bobko 1992). Russell & Bobko (1992) speculated that the Likert-scale requires subjects to somehow compress or otherwise reduce their latent response. They suggest that information loss due to the coarseness of the scale can cause false increases or decreases in moderated regression effect sizes, and propose that it could result in an unknown systematic error, which could have a major effect on the ability to detect true interaction effects. Also, Blalock and Hubert argued that the advantage of continuous scale compared to, for example, the bi-polar Likert Scale (Blalock and Hubert, 1968) composed of five different values, is the better accuracy of answers.

Data Collection and Test Subject Characteristics

Evaluation took place in the fall of 2013 with Finnish M.Sc. program students with various backgrounds during a purchasing and supply chain management course. All of the students had a prior bachelor level degree in some field of engineering or business administration and had been in working life before attending their master's level studies. Before evaluation all participants were provided with written instructions describing the objective of the evaluation and a step-by-step guide for taking the evaluation.

Respondents were given a three-week time window to take the self-assessment at a time that suited them best. Once all the statements had been answered, the participants were asked to give feedback on the usability of the instrument and their initial views of overall accuracy of the report that was automatically provided. This report consisted of graphs on the whole instrument assessing organizational commitment.

Altogether, 60 individuals were asked to participate in this research study. Students were asked to consider their university as their organization, and relate their responses to that. Students were encouraged to participate in this study by rewarding them with extra credit points. In the end, 40 useable results were obtained. The sample consisted of 24 males and 16 females. The average age of the participants was 34 years old with an average of 10 years in working life. Several demographic characteristics were included in the study as descriptive statistical variables. We included age, gender, highest education level attained, job type, experience in current job, and overall tenure in the current organization. Nationality and total tenure in working life were also included.

ANALYSIS AND RESULTS

As a result, we identified 108 applicable statements for assessing student commitment from the overall ontology. Data based on these 108 statements were analyzed using Cronbach's Alpha Reliability Analysis. The coefficients for 19 identified subscales ranged from .89 to .59 and their average was .75. Nunnally (1978) offered a rule of thumb of 0.7 for an acceptable alpha. In most of the subscales, the coefficient alphas exceed the conventional minimum value. However, because the sample size was relatively limited, more testing is required before any conclusions can be made about the scale's reliability. Nevertheless, comments given by the sample students seem to validate the results to some extent.

In the following figures the data obtained in our study were treated as in quantitative research. A large amount of data was visually analyzed in different types of graphs. Figure 2 shows the current state of academic advising as the respondents see it. This figure was made by drawing an ascending trend line from a single statement, where each respondent's answer was a single plot. By drawing them into a single graph, their difference becomes immediately visible. However, this sort of analysis makes it impossible to track a single respondent's answers. The vertical axis indicates the qualitative linguistic value converted to the numeric scale from 0 to 1. For example, for statement number 1, the linguistic value 'never' has been assigned to the numerical value of 0 and 'always' has been assigned

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to the numerical value of 1. Between the values of 0 to 1, there is a continuous sliding scale of responses. The horizontal axis indicates all 40 respondents.

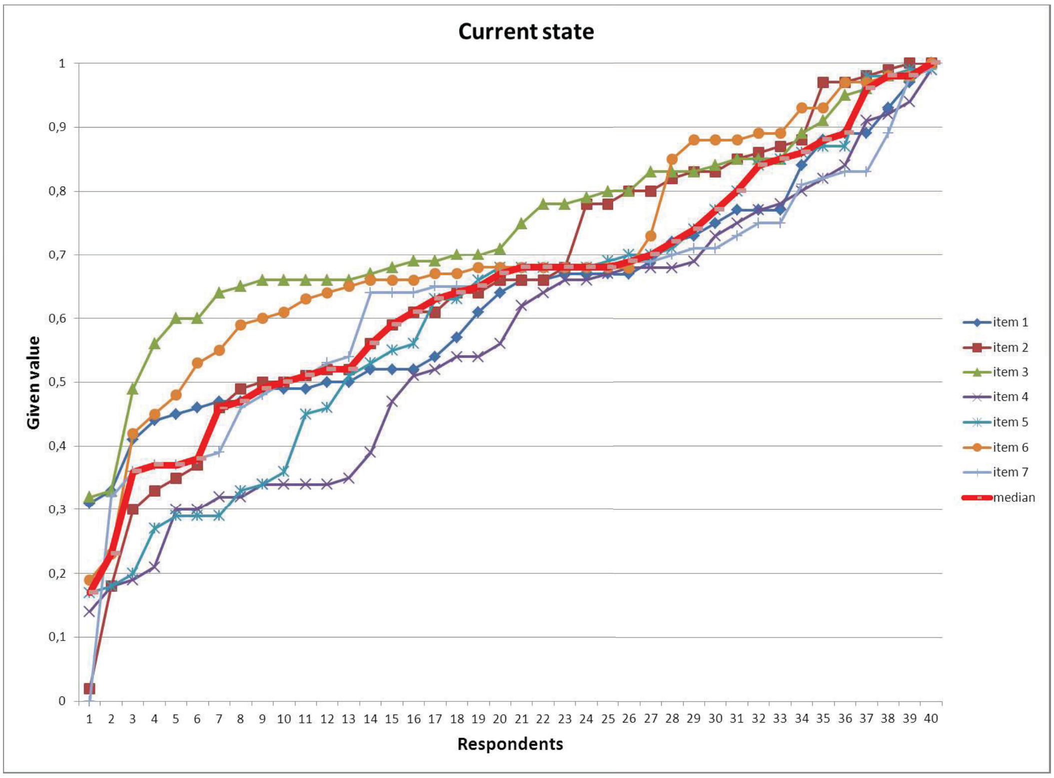

Figure 2. Current state of academic advising.

In Figure 2, there is a median curve. A median is statistically valid method for an average when the data is of ordinal scale. All respondents have given current and target state values for each of the seven statements. The median separates the data into two groups: above the median and below the median. The median value shows the significance of the curve. If the curve goes constantly over the median, it has been valued more by the respondents than the curve that goes partly or totally under the median.

In Figure 2, the following statements are constantly over the median curve:

- Senior management is good at communicating with the rest of the organization;
- My manager shares information adequately;
- My organization or manager provides support when needed.

This graph shows that the respondents value information sharing very highly in academic advising. Item 3 (My manager shares information adequately) and Item 4 (I receive useful and constructive feedback that helps to improve my performance) are the two statements that have the most different views about their current state. About 30 percent of the respondents see the biggest gap between the current states in these statements. This shows that most of the respondents feel that information is shared adequately but this information lacks concrete feedback that helps to improve their performance. This figure also shows that about as many respondents, i.e. a significant portion of the whole group, stay constantly below 0.65 in their answers, which signifies that they do not consider academic advising as being top quality.

In order to assess social integration, 12 statements were extracted from the whole ontology model, such as (1) I am satisfied with the way I get to know other people while at work, (2) I like the people I talk to and work with at work (3) This organization respects its employees, and (4) I would not like to lose the friends or work group I have at

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work. Figure 3 is an example of a proactive vision, i.e. the tension between the current and target states of respondents. These curves illustrate the collective view of the direction in which respondents wish these factors to evolve.

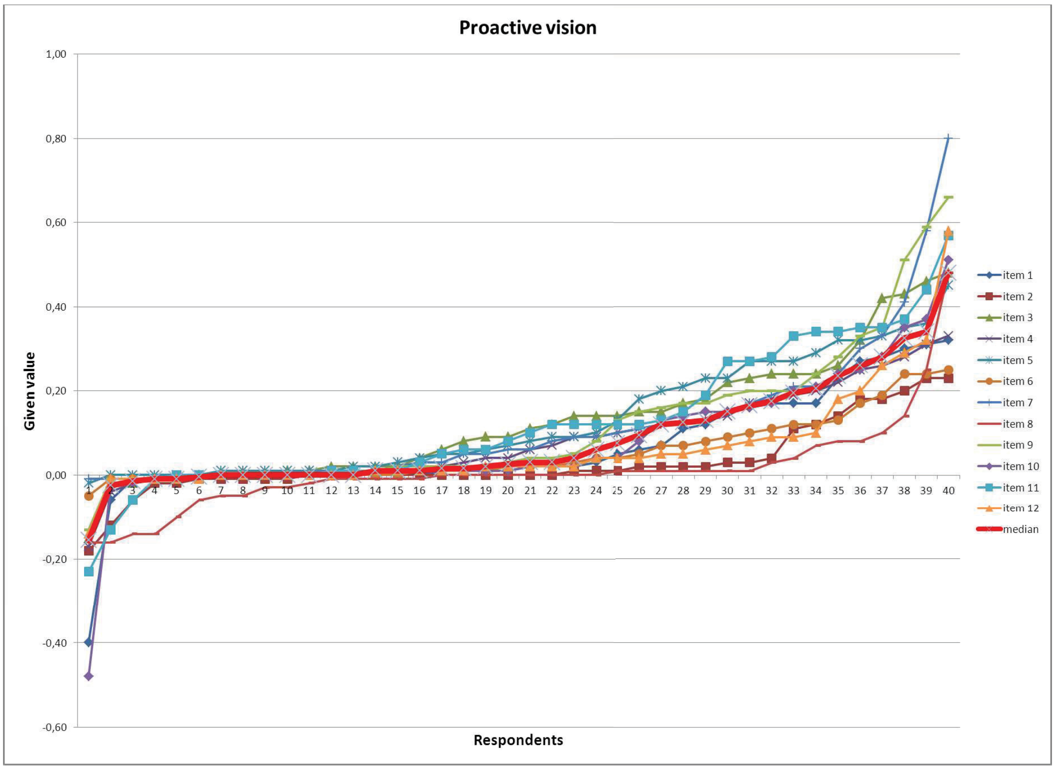

Figure 3. Proactive vision of social integration

This figure shows that most of the respondents feel that the statements concerning social integration are on the level they feel they should be in the future or the level should improve relatively slightly (value near zero). However, there are a small number of respondents that answered at opposite ends of the scale. This shows that there are also respondents who see a great gap between current and future, both negative and positive. There are only one to three respondents who have a negative proactive vision, which could result from misinterpretation of the statements or some other unknown reason.

Figure 4 represents each respondent's answers to statements assessing the institutional quality of their organization, which in this case is the university where they are studying. The horizontal axis shows their answer to the current state and vertical axis their target (or future) state concerning each statement. Each data point in the chart represents one individual's answer to one particular statement. The bigger data point marker represents the median of all the statements of all respondents.

The upper left part of the figure shows that there are single respondents that consider the quality of their institution to be relatively low and at the same time they see there is a significant need for improvement. However, as it can be seen from the top right part of the figure, most of the respondents consider the quality of their institution high and wish that it would stay that way or show a little more improvement. An interesting group of respondents are those who wish the target state to be lower than the current state. This might be because they had not really understood the statement or they had not completely been able to think of their university as their organization. The median of all the statements shows the collective view of all the respondents on the matter in hand. This figure shows that within the research group there is a very high congruent view and feeling about the statements measuring the quality characteristics of their institution.

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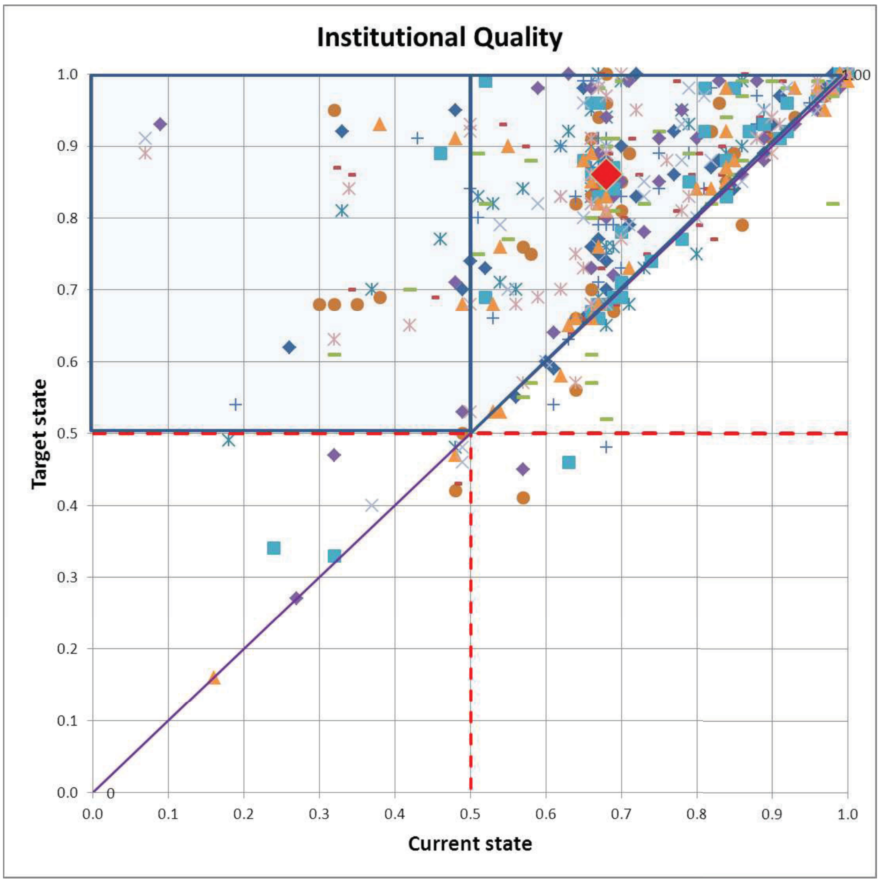

Figure 4. Current and target state responses to institutional quality.

Figure 5 on the other hand shows a very different result to Figure 4. In Figure 5 answers are plotted for the statements concerning institutional commitment. These include statements such as (1) Deciding to work for this organization was a definite mistake, (2) I am proud to tell others who I work for, (3) I do not feel a strong sense of belonging to my organization, and (4) I am personally committed to this organization. Again the median value indicates that collectively people would like these characteristics to be enhanced.

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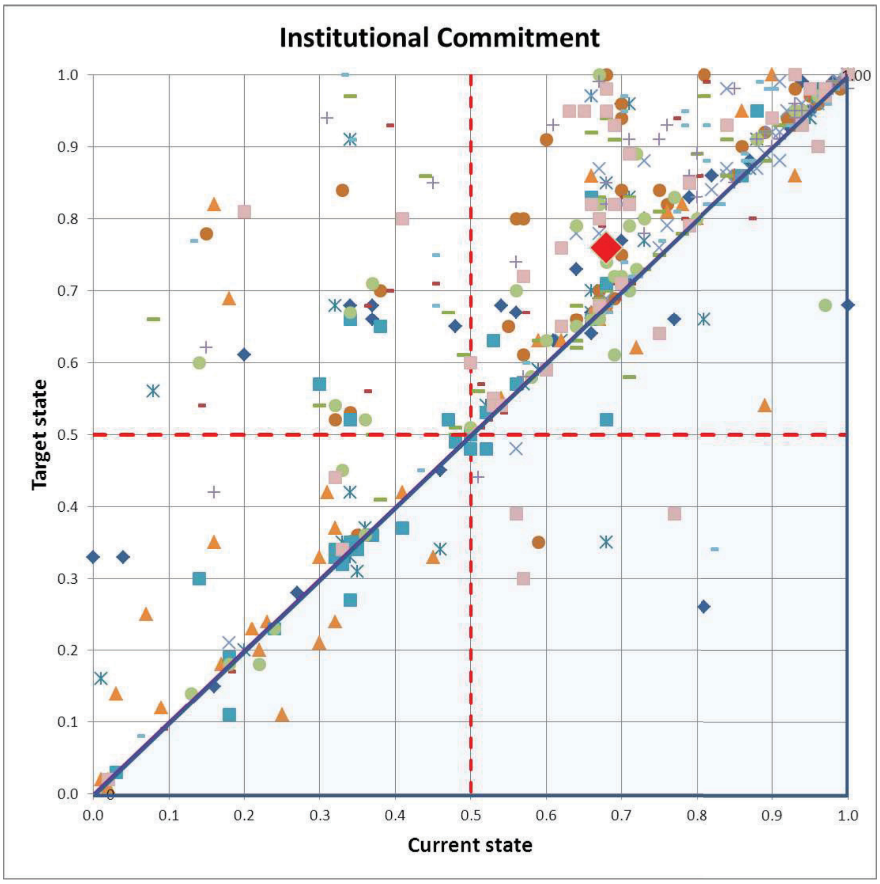

Figure 5. Current and target state responses to institutional commitment.

However, in this figure it can be seen quite clearly that the answers are very scattered across the whole response scale. This indicates that there is a lot of disagreement among the survey respondents. This high level of disagreement may indicate that it is necessary to dig deeper into the results of these items, or they may simply indicate inconclusive findings. In this case, the respondents have different views on whether they would like to see themselves more committed to their university. However, again most respondents see that the current state is adequate or that they would like it to be slightly better. This figure also shows that there are many respondents who grade these statements very low, both the current and future, and also the future lower than the current state. This may indicate that these people do not want to consider themselves committed to that particular educational institute.

With the methods presented, it is quite easy to analyze a large amount of data in a visual form. This kind of visual analysis is easy to use and informative for management and leadership purposes, especially for people who are not very familiar with different statistical analysis methods. Collective data gathered with a statistically sufficient sample size are able to provide insights to the reasons behind academic dropout. It also provides knowledge on how academic dropout can be managed so that it becomes a downward trend in the future.

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CONCLUSIONS AND LIMITATIONS

The aim of this study was to test our organizational commitment and engagement instrument for investigating university students. It should be emphasized that this study was also used as a pilot test for our organizational commitment instrument and served as one step towards finalizing the instrument for a large-scale business study. Hence, the sample size was relatively limited and its suitability for this study was somewhat questionable.

The overall ontology was created to be a generic model of organizational commitment and engagement. This implies that the ontology and self-evaluation created based on it can be used to evaluate these constructs in multiple domains. In this research, we proposed to make the evaluation of organizational commitment to academic educational institutes. However, in different domains or case settings, different characteristics may or should be emphasized. In addition, evaluating a specific characteristic or a statement relating to a characteristic may prove to be unsuitable for one domain although it is suitable in other domains. This was clearly the case in this research, as a great deal of the statements designed for use in an organizational setting could not be seen as relevant or even suitable when assessing commitment and engagement related to educational institutes and individual studies.

Both the overall instrument and the extracted version contain over one hundred unique statements to assess factors related to commitment and engagement. It has to be acknowledged that longer questionnaires may lead to lower completion rates and frustration and fatigue from respondents. This may lower the quality of the responses as respondents become tired of thinking carefully and answering statements. However, at this point we anticipate the concept in hand to be so multidimensional and complex that significantly fewer statements could not cover it completely. Therefore, the Evolute system utilized in this study was developed in such a way that a respondent's evaluation could be left unfinished and continued at another time, which hopefully reduced possible fatigue.

Looking at the results of our sample group, we extracted applicable statements and created a completely new hierarchical ontology model for them based on previous theoretical findings in this field of research. It can be clearly seen from the answers that the respondents could not perceive their university as their "employing" organization. To correct this problem, all the statements have to be modified in relation to the educational domain. In addition, more specific statements have to be added that cover different specific aspects of studying. In so doing, we would be able to produce a more suitable instrument to be used in educational institutes. However, the results and feedback from respondents indicate that a self-evaluation based on linguistic variables is challenging but also rewarding for the individuals that performed the evaluation.

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RESEARCH PAPER

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Assessment of student retention using the Evolute approach, an overview

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Abstract

This paper describes an overview of an approach to discover the engagement of university students regarding their studies, educational institute, and the sources of the engagement using Evolute methodology. The developed instrument contains 124 unique statements, which the respondents assess regarding their current situation and vision for the future. Based on these responses, a proactive vision is created for each respondent and group collectively. The empirical evidence originates from over 200 academic responses from students of various nationalities at Finnish and South Korean universities.

Peer-review under responsibility of AHFE Conference

Keywords: Academic; Commitment; Engagement; Assessment

1. Introduction

Student retention is a major concern for educational institutions around the world. It is not only a problem for universities but has a direct link to the social, economic and political growth of a country, for which higher education provides strong foundations. Without commitment and passion for learning, there is a high risk of dropping out. People who are determined to follow through on whatever they put their mind to are likely to succeed. In this case, people who commit themselves to their studies are likely to complete them. This sort of commitment and hard work might well follow a person into working life. Consequently, he or she will also be effective in completing future

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work tasks, which will be valuable to the employer. Thus, the improvement of student retention by delivering quality education in a setting that fosters commitment, leading to student graduation and integration into the workforce, is crucial. Therefore, universities should stay attuned to students and find out about their feelings effectively. The collective information gathered can be used to form effective strategies to support the students and to help them become more engaged and integrated into academic life, leading to the prevention of drop-out problems.

Earlier studies on student retention focused on students' academic abilities to predict their retention. However, research indicates that academic goals, self-confidence, institutional commitment, social support, and particular contextual influences like institutional selectivity and financial support, in addition to social involvement, all have a positive relationship on student retention. Students who cannot develop these factors are more inclined to drop out. Previous research has indicated that the strongest factors seem to be academic-related skills, academic self-confidence, and academic goals [3]. However, studies have shown that academic performance can only account for half of the variance in dropout rates [4]. In addition, a great deal of research has suggested that the social integration of students may be an important factor in predicting persistence. These studies argue that integration into the social environment plays a major role in commitment to a particular academic institution [1,4]. Also, an important factor concerning commitment is the students' level of motivation toward their studies.

There are different types of motivation (i.e. intrinsic and extrinsic), which can be on different levels. Intrinsic motivation where the students show interest and inner acceptance of the value or utility of their studies and tasks is important because it enables high-quality learning and creativity [5]. However, because many tasks students have to do in order to achieve their degree are not inherently interesting or enjoyable, teachers have to be able to promote more active and volitional (versus passive and controlling) forms of extrinsic motivation [5]. Understanding these different types of motivation and what fosters each of them is an important issue for universities in order to create a supportive and commitment enhancing responsive environment.

Probably the two most dominant theories of student persistence and retention are Tinto's [1,6] Student Integration Model and Bean's [7,8] Student Attrition Model. Tinto's [1] model emphasizes integration and commitment. Both of these models agree that commitment is a key factor in explaining persistence in educational institutes. Based on Tinto [1], persistence occurs when a student successfully integrates into the institution academically and socially. A student's background characteristics (family background, individual attributes, and previous education experiences) influence their initial level of goal commitment and initial commitment to their educational institute. These commitments have an influence on academic integration. Goal and institutional commitment are also influenced by peer group and faculty interactions, and out-of-class room factors which contribute to social integration [9]. Habley [10] argued that one of the main factors affecting academic retention is the quality of interaction a student has with other people on campus. This increased integration, both academically and socially, leads to greater goal commitment and institutional commitment, which leads to lower dropout rates and higher graduation rates. Based on Tinto's model, students who fail to successfully integrate academically or socially are likely to leave the educational institute. In his more recent paper, Tinto [11] identified five conditions that promote student persistence: expectations, support, feedback, involvement, and learning. According to Tinto, students are more likely to persist and graduate in a setting (1) that expects them to succeed, (2) that provides academic, social, and personal support, (3) that provides frequent and early feedback about their performance as they are trying to learn and persist, (4) that involves them as valued members of the institution (e.g. frequent and quality interaction with staff and other students), and (5) most importantly, students are more likely to persist and graduate in settings that foster learning. Students who are actively involved in learning, i.e. who spend more time on a task especially with others, are more likely to learn and, in turn, more likely to stay [11].

Bean's Student Attrition Model [7,12] sees student withdrawal as being like employee turnover. He developed a model of student attrition based on organizational commitment literature focusing on turnover in work organizations. He defined student attrition as the cessation of individual membership in a particular higher educational institute. He argued that students stay in their higher educational institutes for similar reasons to employees in organizations, hence it is analogous to organizational commitment. Based on the results of many studies of the Student Attrition Model, the presumed roles of organizational variables, personal variables, and environmental variables in shaping both attitudes and intents are largely supported.

We believe that there is a need to gather information from students, so that it could easily produce general and specific information on the levels and degree of commitment and engagement at collective and individual levels and show whether there are needs for significant improvement. We believe that this is a major management and leadership problem in universities. Therefore, there is a need to create simple tools so that academic organizations can collect information directly from the students. Our target was to create an Internet-based application for evaluating student commitment, using self-evaluation. Once self-evaluation has been conducted, students and academic staff will be more aware of possible development gaps and can base their objectives for improvement on concrete bottom-up results. The methods within the methodology are described in the next chapter.

2. Evaluation of student commitment

The disciplines needed to manage complex concepts like commitment toward ones studies and educational institute require a vast understanding of factors affecting them, as well as the sound knowledge and mastery of actions that can assist their enhancement.

The evaluation method utilized in this study was developed on the generic, Internet-based, computer application environment called Evolute. Evolute is an online system that supports specific-purpose fuzzy logic applications [15,16]. Fuzzy logic is a conceptual system of reasoning, deduction, and computation that makes it possible to reason precisely with imperfect information. Imperfect information is information which is imprecise, uncertain, incomplete, unreliable, vague, or partially true in one or more respects [17]. The Evolute system allows researchers to develop a specific domain ontology and present it online to the target group [16]. An ontology provides a shared vocabulary which can be used to model a domain – i.e., the type of objects and/or concepts that exist, and their properties and relations [14]. In this context, the ontology is a classification of qualitative knowledge relating to a personal feeling of attachment to one's studies and educational institute.

The application involves the use of self-evaluation in the assessment of different concepts in work role through semantic entities, in this case through statements [16]. The Evolute platform has been used in various studies in different countries, for example, in Finland [16,18], in Poland, in the U.K. (e.g. [19], in South Korea [20,21], and in Spain [22–24].

ACADEMIC PERFORMANCE	
Sense of Competence	Feelings about performance and competencies to study effectively
INSTITUTIONAL QUALITIES	
Academic Advising	Feeling of adequateness of advising and feedback received and how supportive the learning environment is
Institutional Quality	How well the institution is able to provide quality in regards of teaching, people, environment and information
Centralization	The degree of freedom and own initiative in decision making
Distributive Justice	The degree of fair treatment, recognition, performance and respect
Routinization	Amount of challenge and development in studies
EXPERIENCED OUTCOMES	
Utility	Feelings of external usability of studies and their results
Satisfaction	Feelings of satisfaction towards the university as a whole (teaching, personnel, courses, performance etc.)
Stress	Feeling of potential stress based on various stressors (amount of work, vagueness of objectives, people, treatment, time etc.)
Goal Commitment	Feeling of taking responsibility for own studies and committing to goals of the courses leading to graduation
Development	Feelings of accomplishment and personal development
SOCIAL INTEGRATION	
Social Integration	Degree of integration to a social group related to studies
ATTACHMENT	
Institutional Commitment	Emotional commitment and attachment to this particular university
Intent to Stay	Intent to graduate from this particular university
ENVIRONMENTAL VARIABLES	
External Factors	Binding variables outside of study environment (obligations, family, community etc.)

Fig. 1. Evaluated categories and concepts.

2.1. The research instrument

The basic idea for the instrument was modified resulting from our previous research [25]. We used variables from Bean's [2,12,26], the Student Attrition Model, as a framework to build the ontology and the statements for the instrument. As a result, 15 concepts were identified along with 113 applicable statements or 'features' describing them in six main categories. Figure 1 describes the evaluated categories and their concepts in more detail.

On a hands-on level, respondents are asked to assess the current state of the statement, how they feel about things at that moment in their university. Also, the desired target or future state, how they want or see the situation to be in the future, is evaluated. This evaluation results in the creation of a proactive vision, i.e. the gap between the current reality and future vision. Objectively speaking, the gap between personal vision and current reality forms an individual's creative tension [27] which identifies the possible fields of improvement and intervention.

Along with the statements, linguistic scale values are utilized. The scales vary according to the statements, for example, from "not at all" to "completely", or "highly unsatisfied" to "satisfied". The respondents provide their answers, both to current and desirable (target) states, by clicking on the two bars beside the scale. By using the continuous scale, the aim is to overcome some of the disadvantages that the conventionally used Likert-scale type measures may possess [29]. Russell [29] speculated that the Likert-scale requires subjects to somehow compress or otherwise reduce their latent response. They suggest that information loss due to the coarseness of the scale can cause false increases or decreases in moderated regression effect sizes, and propose that it could result in an unknown systematic error, which could have a major effect on the ability to detect true interaction effects. Also, Blalock and Hubert argued that the advantage of a continuous scale compared to, for example, the bi-polar Likert Scale composed of five different values, is the better accuracy of answers [30].

2.2. Sample outcomes of assessment

The main goal of the assessment is to provide university management with new tools and information to help them in their leadership. The results may be viewed individually or as a group (collective results). Individual results are visually unique, with unique creative tensions and these can be aggregated to create collective results. By using information gathered from bottom-up about the feelings of their students, management can make effective development plans in order to improve, for example, student satisfaction and retention.

Next, in Figure 2, an example of collective results is shown on the feature (15 items) level. This is done in order to show the kind of output figure the application can produce.

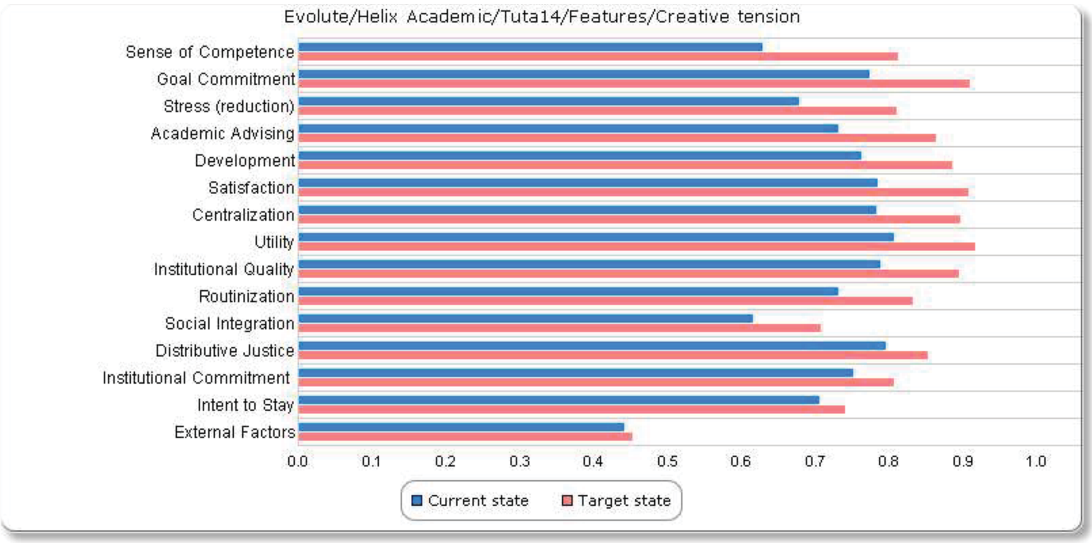

Fig. 2. Sample feature level results (n=67).

Figure 2 demonstrates feature level results of one case study from a Finnish technological university. In this case, 67 students answered the survey application. The categories are sorted based on the highest creative tension. In the figure the blue color illustrates the current state and red the target state. In this particular case, the students had just started university, which might explain why they feel the biggest improvement would be in their performance and competencies to study. This feature is assessed using six statements, such as "I am satisfied with my performance with my studies" and "I feel competent regarding the courses I am taking."

The second highest creative tension is in the feature of goal commitment. This is assessed by six statements including: "I complete my assignments and projects on time" and "I feel a high degree of personal responsibility for my studies." However, even if the respondents see that there is a lot to be improved in this feature, they see the current state as being on a very high level. Therefore, when examining the result, one should not only focus on the amount of creative tension. In addition, by looking more deeply at the unique statement level even more information can be uncovered from the respondents.

3. Conclusions

The creative tension of each student is unique, as has been shown in earlier studies. However, creative tension is not the only important thing to look at. The level of the current state shows how the respondents feel at the current time. This is important for management, since it also gives a baseline to compare the effectiveness of development activities. By looking at the target state results, it is possible to see how the respondents value each of the features, in other words, which ones they feel to be the most important.

The method presented in this paper is already in use at five different university units in three different countries, i.e., Finland, South Korea and in Poland. Altogether, more than 200 responses have been acquired using the method and the results have been made available to the professors on the degree programs concerned.

This method of evaluation can also be used for comparing different collectives. Comparing different universities or groups within one university is meaningful when carrying out benchmarking. Benchmarking gives valuable information for management and provides a reference point for implementing and managing change and shows how the students are feeling compared to other groups.

It is important not only to measure the students' commitment and their feelings but also those of the teaching staff because they have a major impact on the students, their commitment and success in school. Based on the Ostroff's [31] study, there are significant correlations between aggregated teacher job satisfaction and organizational commitment and many indicators of school performance (student test scores, drop-out rate, vandalism costs, student satisfaction, teacher turnover). These should be taken into account in future research if the aim is to reveal the development of students' commitment in more detail.

In addition, in future research, the results should be broken down into different demographic groups and within these groups, statistical methods should be utilized for a deeper analysis. However, with the method presented, it is quite easy to analyze a large amount of data in a visual form. This kind of visual analysis is easy to use and informative for management and leadership purposes, especially for people who are not very familiar with different statistical analysis methods. The collective data gathered with a statistically sufficient sample size are able to provide insights into possible reasons behind academic dropout and satisfaction in a particular educational institute. It also provides knowledge on how these issues can be managed and improved in the future.

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RESEARCH PAPER

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New tools to help in the recruitment process

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Abstract

The recruitment process is demanding, especially when there are many good candidates. Failure in this process can be expensive. Typically interviews and different psychological tests are used to help in the selection. The problem is that interviews and tests are costly. Here a new, partly automated approach is presented. The new approach was tested in the Tenure Track process at the Tampere University of Technology. The new approach consisted of two parts. Firstly, the candidates used the on-line Evolute Helix application [1]. They responded to 237 claims and gave their degree of agreement with each claim. This part produced data measuring commitment. Secondly, the gathered data, i.e. profiles of commitment, were analyzed to find clusters of similar candidates. These clusters were checked against the desired profile. These two parts were automated. The test data were based on the Tenure Track process at the Tampere University of Technology. Recruitment to universities nowadays largely follows the same principles as the normal recruitment process in companies and other organizations. Universities have started to play a global game in their recruitment and try to find the best possible candidates internationally for their universities. In this case example we show how an organizational commitment application that has been developed could help the recruitment process, in which 55 candidates were applying for two tenure track positions. The application used, Evolute Helix, was useful in the recruitment process and helped in the interviews as well as the selection of applicants for the shortlist. The shortlist consisted of six candidates, who were finally interviewed. The two winners were selected from among these candidates. Commitment can reveal many personal characteristics and also the future aspirations and motivations of applicants. The tested application can also be used afterwards, as the tenure track of the chosen person continues in the university. Automatic preprocessing is a great aid when sifting out desired candidates from multiple applicants.

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Keywords: Recruitment; Assessment; Commitment; SOM

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1. Background

The recruitment process is a demanding task. Typically, there are a lot of candidates and many good candidates. Failure in this process is expensive. There are not many parameters to control the recruitment process. Typically, one uses the design of the advertisements, interviews and different psychological tests in the selection process. The problem is that interviews and tests are time-consuming and expensive. The manual processing of applications is also expensive. The applications are scanned through and summaries are produced to make comparisons easier.

There are commercial software systems to take care of recruiting and staffing processes, like Zoho, Financial Force Human Capital Management, Artist, Tribe HR, but these programs only deal with the documentation of applications. Better tools are needed. Psychometric tests in job interviews are not new. The first modern personality test was the Woodworth Personal Data Sheet, which was first used in 1919 by the United States Army [9]. It was designed to help screen out recruits who might be susceptible to shell shock. The techniques were then developed further [6]. Attempts to profile people have also been made for a long time. Criminal profiling is a process now known in the Federal Bureau of Investigation (FBI) as criminal investigative analysis. Profilers, or criminal investigative analysts, are trained and experienced law enforcement officers who study every behavioral aspect and detail of an unsolved violent crime scene in which a certain amount of psychopathology has been left at the scene [7,8]. The term profiling is defined by the Merriam-Webster dictionary [5] as “the act or process of learning information about someone based on what is already known” or “the act or practice of regarding particular people as more likely to commit crimes because of their appearance, race, etc.” or more generally as “the act or process of extrapolating information about a person based on known traits or tendencies <consumer *profiling*>; *specifically*: the act of suspecting or targeting a person on the basis of observed characteristics or behavior <racial *profiling*>”.

In computer science, profiling has a slightly different meaning [2]. Data collection, preparation and mining all belong to the phase in which the profile is under construction. Profiling also refers to the application of profiles, meaning the usage of profiles for the identification of individual persons, or categorization of groups. There is a feedback loop between the construction and the application of profiles. The interpretation of profiles can lead to the iterative fine-tuning of specific previous steps in the profiling process. The application of profiles to people whose data were not used to construct the profile is based on data matching, which provides new data that allow for further adjustments. The process of profiling is both dynamic and adaptive.

The hypothesis of this work is to find out if it is possible to use new techniques to improve the recruitment process.

2. The techniques used

We used the Artist software system to gather and document the applications. First, summaries of all the applicants were collected. Finally, a board consisting of six professors went through all the applicants, concentrated on the shortlist and made the decisions.

It was quite a hard task to consider 55 applications in a way that was fair to all 55. The applications consisted of a list of publications, curriculum vitae, research plan, and motivation letter. To make the comparison easier we decided to use a two-stage approach. The first stage comprised a commitment test based on Helix software [1]. If somebody considered this test unsuitable, it was a personal choice and the applicant was rejected. The idea was to create a profile measuring the commitment of each applicant. Commitment is a very important feature and we were looking for candidates that were willing to commit to our organisation. An example of a hypothetical profile can be seen in Figure 1. There were a large number of claims, 237. Based on the applicants’ degree of agreement and the reliability, the claims were visualised. After all the applicants had answered, it was possible to calculate a mean profile and the variation. Knowledge of the variation used together with the profile of the applicant characterised the applicant very well. Another illustration of a profile was a star diagram [3]; see Figure 2, which was extremely useful when comparing two candidates. This piece of information together with the list of publications, curriculum vitae, research plan, and motivation letter made it possible to draw up a shortlist.

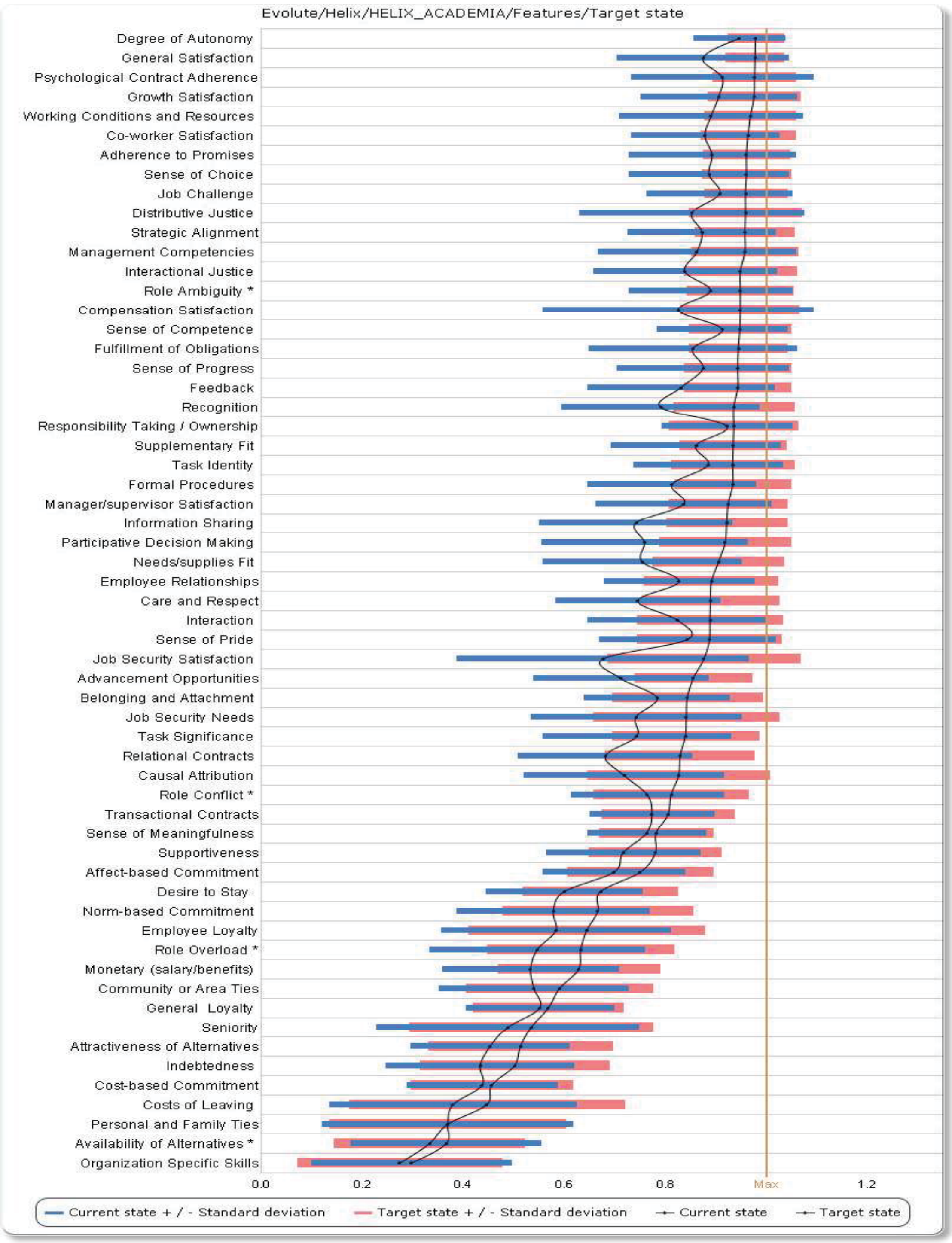

Fig. 1. An example of a hypothetical profile from Evolute Helix software.

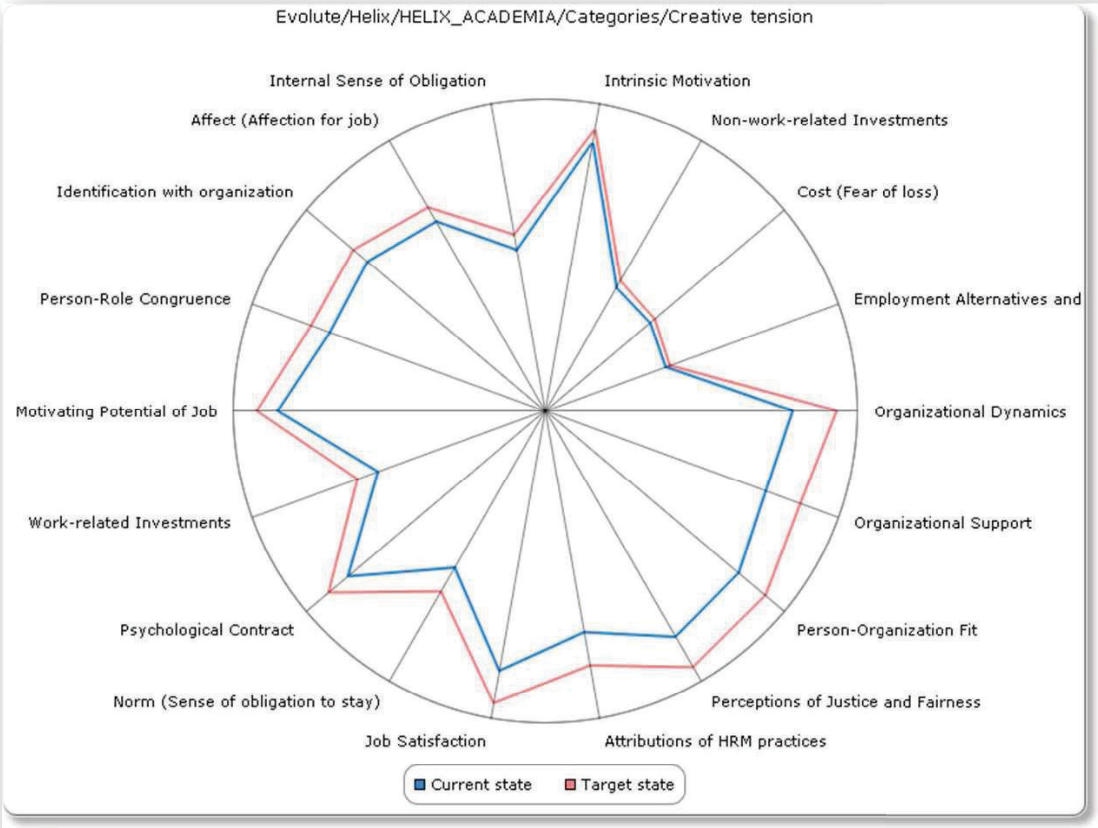

Fig. 2. A star diagram of selected items in a profile. A star diagram makes it easy to compare different applicants.

Secondly, we visualised the profiles of the applicants and used this piece of information to study the applicants. We used visualisation techniques to obtain an idea about the applicants in general and the applicant's position within the distribution of the applicants, see Figure 3. These illustrations were used as a tool to find interesting candidates and to focus on the most interesting ones. To make the comparisons between the candidates fair we also used SOM-based illustrations [4] to indicate similar candidates. On the basis of these tools, 41 applicants were ruled out. The remaining 13 applicants were interviewed by the board. Based on the interviews, five applicants were finally selected for psychometric tests and external evaluation by three referees.

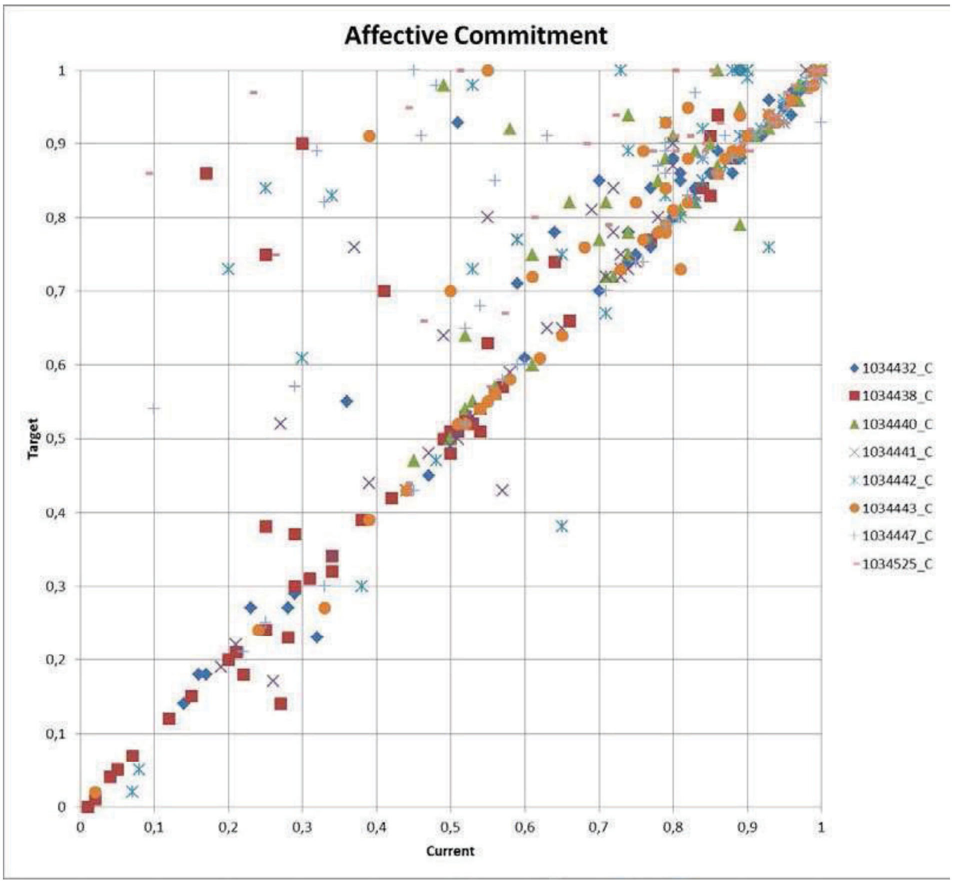

Fig. 3. An example of a scatter diagram that was used to study the distribution of the applicants.

3. Results

As one step in the process we decided to use profiles. One example of a profile is shown in Figure 1. This kind of profile provides a lot of information about an applicant. It also makes it possible to compare the applicant with the mean profile. To compare two applicants, we used star diagrams [3], see Figure 2. To obtain more information about relations between different applicants we used different scatter plots [3], see Figure 3. The scatter plots made it possible to find the applicant's position within the distribution of the applicants. This was a very convenient visualization, as the interpretation of lists of publications and curricula vitae was made much easier.

Finally, SOM maps were used to check out the shortlist and make pairwise comparisons, see Figure 4. As one can see, SOM clusters some applicants directly in certain prototypes.

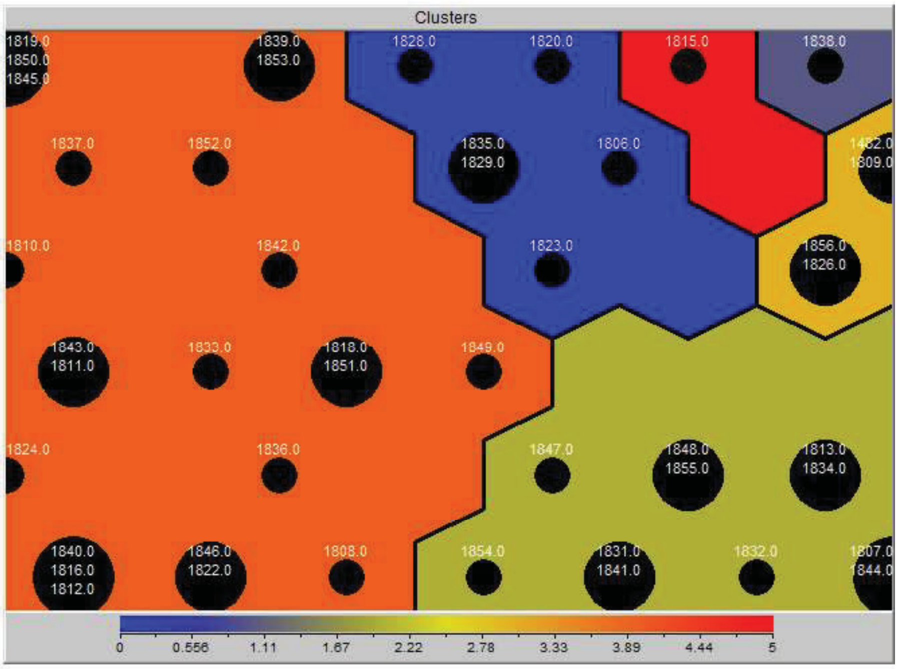

Fig. 4. A self-organized feature map (SOM) visualization of the applicants. Different colors represent clusters. The applicants are indicated as numbers on the map.

4. Discussion

The topic is interesting but unfortunately it is not allowed to show very detailed results to safeguard the integrity of the applicants. This is also a problem considering comparisons between applicants.

The selection process cannot be made totally automatic. Some human judgements are always needed. The described techniques provide the greatest help in the preselection phase, when creating a shortlist of suitable candidates. We calculated that it would take a secretary about 110 hours to make summaries of 55 applicants. The expected time spent by the board was estimated at six times 110 hours, i.e. 660 hours. By using the described tools the time spent by the board was cut down by 30 minutes per applicant, which means 165 hours, saving a considerable amount of time and money. It is essential not to spend too many calendar months in evaluation. At the same time one should minimize the risk that promising candidates are dropped from the shortlist. This was the reason why SOM maps were used during the second phase. SOM maps work in a slightly different way than statistics. SOM maps consider the whole profile as a vector. There are some correlations between dimensions and SOM benefits from this. When both techniques agreed on the elimination of an applicant, the decisions were easy. If the techniques produced different opinions, the board considered those cases carefully. To avoid unintentional eliminations we decided to select 13 applicants for the shortlist, which means that they were interviewed. Without these new tools the length of the shortlist would have been 10 applicants. The price was negligible in comparison with the gain in preselection.

One of the key issues is of course the commitment test. The quality of the commitment test is crucial. There should be enough claims and versions of the claims to avoid manipulation of the test.

Finally, one could ask if there is any experience based on the selected applicants. We can say that the selections have been successful. This is based on the experience of six months. It could well be that the selected applicants would have been the same using the old methods but the new tools helped to save time in calendar months and money in man months.

5. Conclusions

A new and interesting approach to speed up the recruitment process is described. The hypothesis of this work was to find out if it is possible to use new techniques to improve the recruitment process. The answer is yes. The new tools helped to save time in calendar months and money in man months.

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RESEARCH PAPER

6 Einolander, J. (2016). Organizational commitment and engagement in two Finnish energy sector organizations. Human Factors and Ergonomics in Manufacturing, 26, 3, 408-423. Wiley Periodicals.

Organizational Commitment and Engagement in Two Finnish Energy Sector Organizations

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Abstract

This study was conducted to show a novel way to analyze organizational commitment and engagement levels in organizations and to compare the results of two Finnish organizations operating in the energy sector. Employees estimate the truth value of statements with regard to their own organization at a given moment in time. The employees also specify how they would like the situation represented by the statements to be in the future. In this study, we requested participation from a total of 90 senior salaried employees from two companies in the spring of 2014. In the end, we obtained 54 responses in total, giving us a response rate of 88% for Company A and 25% for Company B. On the basis of the responses, a collective understanding of each organization was first defined, and then a comparison was made between these two organizations. The results of these comparisons show that there are similarities between the companies, even though the degree of affective commitment was significantly higher in one of the companies. However, both companies had similar focus points and priorities in the current state, target state, and proactive vision. On the other hand, the study also discovered that there were major differences regarding some of the evaluated features, as expected. As a result of the analysis, important areas of development were observed in both companies. © 2016 Wiley Periodicals, Inc.

Keywords: Organization; Engagement; Commitment; Evaluation; Decision support system

1. INTRODUCTION

In today's competitive environment, the role of the human factors and the levels of employee commitment and involvement to the organization are unquestionably important (García-Almeida, Fernández-Monroy, & De Saá-Pérez, 2015). According to de Geus (1997), the world of business has shifted more from being "dominated by capital" to being "dominated by knowledge." A considerable amount of companies' knowledge resides with their employees (Vermeylen, 2014). As organizations become increasingly complex, the importance of retaining the best employees and the knowledge they have spent years acquiring becomes evident. Organizations need to have people who actively and passionately engage in their work tasks, who really believe that their work makes a difference, and who believe they can be part of something significant. This kind of engagement is important, especially in tasks that require vast knowledge, such as in expert organizations. Therefore, to succeed in today's hard competition, organizations must be able to retain their best talent and try to motivate them even further to make them more engaged. This should be one of the most important goals for managers and leaders in today's organizations.

Clearly, identifying employees' level of engagement and commitment is important for business organizations. By first evaluating the degree of commitment and engagement, and their types and sources, it is possible

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to create appropriate policies and practices to foster them in the workforce. It is vital to identify this because only committed employees who are engaged in their work and committed to their organization are the people who really enable the organization to grow and flourish by providing competitive advantage, including higher productivity and lower employee turnover. As every organization has different business objectives, it is the responsibility of senior management to create human resources (HR) practices that foster engagement and commitment to support the organization's particular business objectives in the right way. Some organizations may need to foster more engagement and only short-term commitment, while others may need to achieve greater engagement and long-term commitment from their employees. For example, an organization needing to reduce costs by using temporary workers may want to instill great engagement but only short-term commitment from these employees (Vance, 2006).

Because organizational commitment reduces the likelihood of employees leaving the company, it is an important factor to retain knowledge and to strengthen the sustainability of organizations' competitive advantages (García-Almeida et al., 2015). Actual bottom-up evaluation is important because there is evidence that aggregated employee opinions relate fairly strongly to important business outcomes, such as performance (Ostroff, 1992; Schneider, Hanges, Smith, & Salvaggio, 2003; Vance, 2006). and only by evaluating and identifying what matters most to the employees, it is possible to find out which policies and HR practices are likely to bring the most return for the investment needed from the organization. The process of gaining more commitment and engagement from the employees starts with employer practices (Ogilvie, 1986; e.g., job and task design, recruitment, selection, training, compensation, performance management, and career development), which have an effect on employees' level of engagement as well as job performance.

This paper describes the decision support system (DSS) that was created based on an ontological framework for evaluating factors that have an effect on employees' commitment and engagement. The developed ontology and instrument will help management to assess the organization's HR environment regarding its commitment and engaging factors. The ontological framework can help managers in planning development activities when building up an engaged workforce committed to their work and workplace. The framework provides tools and concepts, which can be used to start the development process. The goal of the DSS is to capture the collective view of commitment at the team, workgroup, or organizational level. In addition, a method for comparison analysis is presented in the form of two separate business case studies on expert organizations from the Finnish energy sector. Using the demonstrated ranking-based comparison method, we can create results that are directly and statistically comparable with one another in two separate research groups.

2. LITERATURE REVIEW

One of the main sources of competitive advantage for today's organizations is the ability to retain the brightest and most-talented employees. In other words, long-term sustained success and growth can be achieved by attracting and retaining the best talent (Heinen & O'Neill, 2004). Nowadays, as the trend is toward leaner organizations, the importance of engaged and committed employees is emphasized further because organizations have to rely more on fewer employees to do what is needed for the organization to survive and be successful. Therefore, creating a stable, highly motivated workforce is essential. Without a committed and engaged workforce, absenteeism and tardiness can lead to serious problems, and even undesirable staff turnover, which can be critical and extremely costly (e.g., losing productive employees, recruiting, selecting, and training costs, and the potential negative impact on current customer relationships). Consequently, behaviors that foster employee engagement and commitment can be argued to be critical to contemporary organizational success in most fields of business, such as knowledge-intensive organizations.

Organizational commitment (OC) has been studied for decades, and it is arguably one of the most important concepts in organizational research. Meyer, Allen, and Smith (1993) argue that it is a leading factor that affects the level of achievement in many organizations. OC describes the link between employee and organization. It can be defined as a psychological state that binds an individual to an organization (Meyer & Herscovitch, 2001) and influences individuals to act in ways that are consistent with the interests of the organization (Mowday & McDade,1979; Porter, Steers, Mowday, & Boulian, 1974). Rusbult and Farrell (1983) similarly define OC as the willingness to deploy extra effort, the desire to remain, and the acceptance of the goals and values of the organization. Wiener (1982), on the other hand, views commitment as the totality of internalized normative pressures to act in a way that meets organizational goals and interests. Vance (2006) argues that there are emotional and rational components in organizational commitment. He describes the emotional component as a positive feeling toward an entity or an individual and the rational component as conscious and thoughtful planning and carrying out the action to fulfill commitments (Vance, 2006).

According to Meyer and Allen's (1991, 1997) widely recognized model, OC is a construct that can be divided into three distinct components. Their model proposes that employees experience organizational commitment in three simultaneous mind-sets. They explain that commitment to an organization is a psychological state and that each one of these three components affects differently how employees feel about the organization that they work for (Meyer, Stanley, Herscovitch, & Topolnytsky, 2002). Their three-component model of OC comprises 1) affective commitment, 2) normative commitment, and 3) continuance commitment. According to their model, affective commitment refers to the mind-set that an employee feels based on emotional ties that mainly develop as a result of positive work experiences. Normative commitment, on the other hand, reflects the obligations employees feel toward the organization, for example, based on feelings of reciprocity. Last, continuance commitment reflects commitment based on perceived costs of leaving the organization, both economic and social. Meyer and Allen's model of commitment has been widely used to predict employee outcomes, such as turnover and extra citizenship behaviors, job performance, absenteeism, and tardiness (Meyer & Allen, 1991; Meyer et al., 2002). An important rationale for their model is that all three forms of commitment are related negatively to turnover; however, they relate differently to measures of other work-related behaviors (e.g., attendance, in-role performance, and organizational citizenship behavior, or OCB). More specifically, affective commitment is expected to have the strongest positive relation, followed by normative commitment. Continuance commitment is presumed to be unrelated or to have a negative effect on these desirable work behaviors (Meyer et al., 2002).

As there are many different definitions for organizational commitment, so has employee engagement been defined in various ways. However, the definitions are often similar to other constructs, such as OC and OCB, which has resulted in the argument that there is a great deal of overlapping between these constructs. Engagement is believed to be "one step up" from commitment. It has been shown to have an impact on business outcomes, as well as also being linked to the increased intention to stay with the organization; as engagement increases, employee turnover decreases (Robinson, Perryman, & Hayday, 2004). Definitions of engagement usually encompass several positive behaviors for organizations. These include the degree to which employees involve themselves in their work, as well as the strength of their commitment to the employer and their role. Usually common themes in engagement definitions reflect concepts such as job satisfaction, recognition, pride in the employer, organizational supportiveness, effort to go the extra mile, and understanding the linkage between one's job and the mission of the organization (Vance, 2006). Moreover, engagement is seen to go beyond job satisfaction, referring to an employee's personal state of involvement, contribution, and ownership (Robinson et al., 2004). Many have claimed that employee engagement predicts employee outcomes, organizational success, and financial performance, for example, total shareholder return (Saks, 2006).

For example, Kahn (1990, p. 694) defined personal engagement as "the harnessing of organization members' selves to their work roles; in engagement, people employ and express themselves physically, cognitively, and emotionally during role performances." Harter, Schmidt, and Hayes (2002, p. 269) defined employee engagement as "the individual's involvement and satisfaction with as well as enthusiasm for work." More broadly, Robinson et al. (2004, p. 9) defined engagement as "a positive attitude held by the employee towards the organization and its values. An engaged employee is aware of business context, and works with colleagues to improve performance within the job for the benefit of the organization. The organization must work to develop and nurture engagement, which requires a two-way relationship between employer and employee." Klein (2004, p. 5) defined employee engagement as the "the extent to which employees commit to something or someone in their organization, how hard they work, and how long they stay as a result of that commitment."

According to Kahn (1990), engagement focuses on how one commits oneself while performing the job. Employees express themselves cognitively, physically, and emotionally while performing their work roles. He argues that to be engaged, three conditions must be met in the work environment, that is, 1) meaningfulness (when people feel worthwhile, useful, and valuable), 2) safety (when people feel that they can show and employ themselves without fear of negative consequences to self-image, status, or career, in other words, an environment with trust and supportiveness), and 3) availability (people feel the sense of having the physical, emotional, or psychological means to engage in their job tasks at any moment; Kahn, 1990).

As it can be seen, there is a great similarity and overlapping between the concepts of OC and engagement, and their definitions have been used interchangeably many times. By definition, the closest type of commitment with engagement can be seen to be affective commitment, as this type of commitment emphasizes the satisfaction people get from their jobs and from their working environment and the willingness of employees to go beyond their immediate job requirements for the sake of the organization. Affective commitment also goes some way toward capturing the two-way nature of the engaging relationship, as employers are expected to provide a supportive working environment (Robinson et al., 2004). Even though Robinson et al. (2004) argue that engagement overlaps with many of the elements of both commitment and OCB, they also see differences between them. In particular, neither commitment nor OCB reflect sufficiently the two-way nature of engagement, and the extent to which engaged employees are expected to have an element of business awareness. This means that organizations must work to engage their employees, who in turn will offer their engagement to their employer. Saks (2006) also states that OC differs from engagement in the respect that it refers to a person's attitude and attachment toward the organization. Engagement is not an attitude, but it is the degree to which individuals are attentive and absorbed in the performance of their occupational roles (Saks, 2006).

In light of all these points, and the fact that both engagement and commitment arguably have an important positive effect for organizations, it therefore makes sense for organizations to evaluate the engagement and commitment of their employees, and to take action to improve them. On the basis of the reviewed literature, our goal was to identify the bases of the internal process of commitment within organizations and to build up an ontology from them to use as a starting point for evaluation application.

3. RESEARCH INSTRUMENT

3.1. General Framework

For the evaluation, we used the previously created (Einolander & Vanharanta, 2011, 2013; Einolander, Vanharanta, & Kantola, 2011) computer application called Helix. For this research, the ontology of the instrument was translated into Finnish, and other minor improvements were made to its structure. The application uses the Internet-based Evolute system (Kantola, 2005; Kantola, Vanharanta, & Karwowski, 2006), in which the respondent compares the statement to linguistic labels on a continuous scale, meaning that there is a nonnumeric scale for answering each statement. The evaluation is made anonymously. Visual linguistic scales are preferred because they enable a minimal loss of the tacit knowledge that people tend to lose when they make the conversion from a numeric to linguistic domain. The respondents give their opinion about their current state and their vision for the target state on a scale from 0 to 1. With this method, the respondents choose from more than 100 different values for each statement. These inputs are converted into fuzzy sets using fuzzy logic (Kantola, 2005; Kantola et al., 2006; Lin & Lee, 1996; Zadeh, 1965). The advantage compared to, for example, the bipolar Likert scale of five different values is the greater accuracy of the answers (Blalock & Blalock, 1968).

The application gives a systematic approach to gathering information about the state of the employees' commitment and factors affecting their engagement for management analytically from bottom-up instead of the individual perceptions of different managers, thus making the information available in the same manner for everybody and ensuring it cannot have been influenced by different supervisors' own judgments of their employees.

All decisions should be based on real, holistic knowledge (situational knowledge of the whole object rather than knowledge of individual components of the object), instead of on educated guesses, intuitive feelings, or limited information (Kantola, 2009). It has been argued that, by using a professionally developed assessment tool, on average management will be more effective at making employment-related decisions than by simply observing the employees (Rivkin, 2000).

The collective results of the evaluation can be used as a basis for opening up discussion when creating development activities for the organization and to educate and learn about these concepts, as well as to see whether the investments that may have been made in engagement initiatives are paying off.

The ontology behind the application contains features ($n = 59$) and categories ($n = 20$). These are assessed with 237 statements, which the employees evaluate, regarding how engaged they are in their work and how committed they are to their organization. With the help of these statements, employees evaluate their current reality and their wish or target for the future in their current organization. The bigger the gap between the current and future state, the higher the proactive vision for that feature, and the greater the potential to improve. The statements were developed based on various studies and models in this field of research. About 20% of the answering scales of the statements were reversed, that is, a "positive" value was intentionally changed to reduce the response set bias (Hubbard, 2010). This was done to encourage respondents to read each statement carefully and to respond to it accordingly, rather than answering always in a particular direction regardless of the content of the statement. In the next section, each of the evaluated categories is described briefly. The categories were selected based on an extensive literature study. According to the teachings of Heidegger (1927/2000), we tried to uncover the content as widely as possible for the first ontology and then progress to narrowing it down to a more condensed form to create the structure for the DSS instrument. From the literature, we identified a broad range of constructs that are related to OC as its antecedent, determinant, or correlate factors. These factors were categorized under relevant constructs, such as work motivation, job satisfaction, person-organization fit, perceptions of organizational support, and turnover intentions. All the identified categories were grouped under the three main dimensions of organizational commitment—affective, continuance, and normative.

3.2. Evaluated Categories

Twenty categories were evaluated in this study:

1. Affective Commitment refers to the employee's emotional attachment to, identification with, and involvement in the organization (Meyer & Allen, 1991). Employees with a strong affective commitment remain with the organization because they want to do so. Affective commitment is believed to develop based on various antecedent characteristics, including personal characteristics, structural characteristics, job-related characteristics, and work experiences (Meyer et al., 1993).
2. Normative commitment is a feeling of obligation to continue employment (Meyer & Allen, 1991, 1997). These employees have internal normative pressures to act in a way that satisfies the organization's goals and interests. Normative committed employees have developed a moral obligation based on possible investments the organization has made in them (Meyer & Allen, 1991) or partly from the socialization practices of the organization (Wiener, 1982). Socialization refers to the process by which the values, norms, and beliefs of members are brought into line with those of the organization (Wiener, 1982). Normative committed employees remain with the organization because they feel they ought to do so.
3. Continuance commitment is the awareness of the costs associated with leaving the organization. It refers to employees' decision to stay with the organization because they feel it would be too costly, in other words a high sacrifice (HiSac), to leave the organization (Meyer & Allen, 1991). Neither investments nor lack of employment alternatives (LoAlt) have an influence on continuance commitment unless or until the employee is aware of them and the implications of losing them (Meyer & Allen, 1997).
4. Low Alternatives (LoAlt) describes belief about limited alternative employment opportunities to their present employment. Meyer and Allen (1997) suggest that employees who think they have other potential employment alternatives have weaker continuance commitment than employees who think their alternatives are limited.
5. High Sacrifice (HiSac) describes commitment based on losable side bets, such as an accumulation of seniority privileges, vesting of pension benefits, and retention bonuses (Powell & Meyer, 2004). These losable side-bets i.e. investments, can be either work or non-work related.
6. Intrinsic motivation contains features that describe intrinsic,or internal, rewards that drive employee engagement. On the basis of intrinsic

motivation, employees do things just because it is enjoyable or because they believe it is the good or right thing to do (Thomas 2000).

7. Motivating potential of job contains features that are believed to motivate employees intrinsically, leading to an increase in satisfaction and motivation. These include challenging and motivating work tasks that have visible outcomes, tasks that seem significant and can have impact on others, as well as whether the job provides substantial freedom or independence and clear information about its effectiveness and performance (Hackman, 1980; Hackman & Oldham, 1976, 1980, p. 330).
8. Job satisfaction is a positive emotional feeling, resulting from people's evaluation of their job or job experiences. Job satisfaction comprises various facets such as working conditions, coworkers and management, pay, and job security (Judge & Klinger, 2008).
9. Organizational support contains features that assess the degree to which employees believe that their organization values their contributions and cares about their well-being (Eisenberger, Jones, Aselage, & Sucharski, 2004; Hutchison, Sowa, Eisenberger, & Huntington, 1986).
10. Attributions of Human Resource Management (HRM) practices address the perceived cause of others' behaviors (e.g., compliance with law, out of habit, genuine concern for employees). It is believed that the impact of HRM practices on commitment is moderated by employees' perceptions of the motives behind these practices (Koys, 1988, 1991).
11. Organizational dynamics includes features that describe open communication, information sharing, and participative decision making in the organization between employees and employers (Choudhury, 2011) and strategic alignment describing familiarity with the organization's strategy and how employees' actions contribute to its fulfillment and whether they direct their effort in the right direction.
12. Person-role congruence represents sets of behaviors that are expected of employees and their congruence with the individual. Features assessing person-role congruence include role ambiguity, role conflict, and overload (Rizzo, House, & Lirtzman, 1970).
13. Person-organization fit contains features that describe the compatibility between a person and the organization. These features emphasize the extent to which the person and the organization have similar characteristics and/or meet each other's needs. These characteristics traditionally include culture, climate, values, goals, and norms (Kristof, 1996).
14. Identification with organization describes a person's sense of belonging to an organization and perceived oneness with an organization and experiences the organization's successes and failures as one's own (Mael & Ashforth, 1992). It describes how employees link their organizational membership to their self-concept, either cognitively (e.g., feeling a part of the organization; internalizing organizational values), emotionally (pride in membership), or both (Riketta, 2005).
15. Perceptions of justice and fairness contain features that describes how employees perceive that they have been treated fairly in their jobs. Employee perceptions of both distributive and procedural justice influence OCBs. If employees perceive that they are treated fairly or they perceive the process by which outcome allocation decisions are made to be fair, they are likely to reciprocate by doing actions beneficial to the organization that go beyond the normal performance requirements of their jobs (Niehoff & Moorman, 1993).
16. Psychological contracts are composed of an individual's perception of the mutual obligations that exist in the exchange with their employer, and these are sustained through the norm of reciprocity. These obligations arise out of the belief that a promise has been made either explicitly or implicitly and that the fulfillment of these obligations is contingent on the fulfillment of obligations by the other party (Conway & Briner, 2005; Coyle-Shapiro & Parzefall, 2008; Rousseau, 2000). In employment, arrangements can be transactional, relational, or hybrid forms (Rousseau, 2000).
17. Work-related investments refer to any actions that would result in considerable potential loss should the individual decide to leave the organization (Allen & Meyer, 1990). Once employees realize that moving to a new organization would result in the loss of benefits, they

might decide to stay within the current organization rather than lose the investments. Work-related investments include time, effort, or money spent on acquiring skills or training that are nontransferable to another organization, the potential loss of benefits, and giving up a senior position and its associated rewards, such as retirement money, status, or job security (Allen & Meyer, 1990; Romzek, 1990). Because investments tend to accumulate over time, the impact of investments on commitment should similarly increase over time (Rusbult & Farrell, 1983).

18. Internal sense of obligation includes features that assess feelings of loyalty generally and toward the current employing organization, as well as feelings of indebtedness. General feelings can develop based on early socialization experiences (e.g., from family or culture), which can give a sense of appropriateness to particular attitudes or behaviors (Meyer & Allen, 1997). Organizational socialization experiences as a newcomer to an organization can influence employees' feelings of loyalty, as well as the feeling of whether employees feel that employers care about them (Meyer & Allen, 1997). Feelings of indebtedness can result, for example, because the organization makes investments in an employee that seem difficult for the employee to reciprocate (Meyer & Allen, 1997).

19. Non-work-related investments include such features that describe the disruption of personal obligations or relationships, for example, from the expense and human cost of relocating a family to another city, that is, the family is unable to relocate (Meyer & Allen, 1991).

20. Employment alternatives and opportunities assess employees perception of the availability of alternative employment placements. Perceptions of available alternative jobs may stem, for example, from scanning the external environment (economic climate, etc.) or from the perception of the marketability of their skills or based on previous job search attempts. Also, the attractiveness of other employment opportunities is related to continuance commitment. Employees evaluate other opportunities based on not only their availability but also their suitability for them personally (Meyer & Allen, 1997).

4. EMPIRICAL RESEARCH AND SAMPLE

The empirical study of this paper was carried out within two companies in the Finnish energy industry in the spring of 2014. The sample in this study consists of two different business cases. Case Company A is a large Finnish electricity producer with approximately 890 employees, and case Company B is a Finnish utility company operating in the energy production and district heating market with approximately 280 employees.

Before taking the survey, all participants were told the reasons behind this study and its purpose; that is, the results would be used for research purposes and for development of organization-specific HR practices. The actual uses of the results were stressed to obtain a good response rate. In Company A, evaluations were made in three different sessions and in Company B, the participants were given a 2-week time period to make the evaluation. After the initial 2 weeks, two more weeks were given to raise the response rate. All together, 44 usable answers were received from Company A and 10 from Company B.

4.1. Case A

Fifty employees were asked to participate in this research. They were selected randomly from the organization's research and development unit, which employs 150 people. In the end, 44 employees completed the evaluation, which gives a response rate of 88%, thus giving a representative sample. In addition, two questionnaire evaluations were started but left unfinished. Seventy-seven percent of respondents were men and 23% were women. The mean age of the respondents was 40.6 years old with a standard deviation of 10.6 years. All of the respondents in this sample were senior salaried staff, three of whom were in supervisory positions. Five respondents (11%) decided not to answer the questions describing demographics. The respondents had been in their current jobs for an average of 6.3 years (*SD* 6.6), in their organization for an average of 8.4 years (*SD* 8.5), and had an average of 17.5 years of work experience (*SD* 10.8).

TABLE 1. Demographic Characteristics of Case Groups

Characteristic	Case A	Case B
Respondents, *n*	44	10
Male respondents, %	77	40
Female respondents, %	23	30
Response rate, %	88	25
Age, mean years	40.6	41.6
Current job, mean years	6.3	4.9
Tenure in current job, mean years	8.4	8.9
Work experience, mean years	17.5	18.9

4.2. Case B

In Company B, we asked for participation from all of the organization's senior salaried staff and management team, including the CEO. The respondents were from different business units, such as electricity production, sales, and construction services. Forty employees were asked to participate in the research, and in the end, we received 10 completed surveys, thus giving a response rate of a mere 25%. Forty percent of the respondents who answered the demographic questions were men with a mean age of 47.2 years, and 30% were women, with a mean age of 39 years. Three respondents did not answer the demographics questions. The respondents had been in their current jobs for an average of 4.9 years (*SD* 3.8), in their organization for an average of 8.9 years (*SD* 6.0), and had an average of 18.9 years of work experience (*SD* 10.3). Comparison of the demographic characteristics of the two groups is illustrated in Table 1.

5. METHOD FOR DATA ANALYSIS

The analysis in this paper focuses on comparing the results from the two case companies. The first phase of the analysis was to calculate the sum variables for each feature ($n = 59$) and category ($n = 20$). Both features and categories are built up with statements that are assessed by the respondent from the current as well as the target point of view. Assessment of these linguistic variables is always personal and nonparametric. Personal in this case means that respondents literally speak only for themselves. Consequently, the answers from different people are not directly comparable with one another. Two different respondents giving the answer "good" to the same statement do not necessarily mean the same with their answers. The meaning of the response is dependent on the respondent's own personal scale. If the respondent is negative-oriented, the answer "good" may be the highest and if the respondent is overly positive, the answer "good" may be the lowest. In this study, for example, respondents who feel connected to their organization may reflect their positive feelings in their responses and may start their own value scale at a higher level.

Because of the use of linguistic variables, from the statistics point of view, the data are measured on an ordinal scale. The ordinal scale means that the values can be used merely as a means of separating the answers into different classes or categories (Conover, 1999). From the data, we can conclude that only the ranks of a single respondent and the different answers with only a single respondent are comparable. Therefore, from a statistical point of view, use of traditional statistical functions (sums, means, etc.) is not suitable for creating statistically valid comparable group-level results; instead, ranking must be used (Porkka & Paajanen, 2014). Although there are no major differences compared to rankings when calculating group-level results using traditional mean values, their suitability can be questioned. However, there are several valid and suitable statistical methods for this kind of nonparametric data. All these methods use data rankings instead of actual input values. The transformation of data into rankings is straightforward. Original values are sorted into ascending (or descending) order, and the values are substituted with rankings. With the use of rankings, the personal degrees of scale of the respondents are removed, and the results (and the group results calculated from these values) become comparable (Porkka & Paajanen, 2014; Porkka, Salo-Pihlajamäki, & Vanharanta 2010).

In this study, there are several related samples in the data. The most potent test for several related samples, in which the number of different variables is more than six, is the Friedman test (Conover, 1999). In this analysis, the responses of each respondent are converted into rankings. Group results are created by calculating the average of the rankings for each category. Table 2 shows the ranked category (sum) variables for both case companies based on their current state, target state, and proactive vision. Each of these states can be looked at separately or together to gain a more comprehensive view of the situation, especially when choosing the most important categories for organization-specific interventions. The Friedman test also has one extra benefit compared with sums and averages. Using Conover's (1999) post hoc analysis of the Friedman

TABLE 2. Mean Rankings of the Two Companies Sorted according to the Highest Proactive Vision

	Current State		Target State		Proactive Vision	
	Company A	Company B	Company A	Company B	Company A	Company B
Category	Mean rank, $n = 44$, $\alpha = 0.05$, min.diff. 1.87	Mean rank, $n = 10$, $\alpha = 0.05$, min.diff. 3.83	Mean rank, $n = 44$, $\alpha = 0.05$, min.diff. 1.17	Mean rank, $n = 10$, $\alpha = 0.05$, min.diff. 2.33	Mean rank, $n = 44$, $\alpha = 0.05$, min.diff. 1.57	Mean rank, $n = 10$, $\alpha = 0.05$, min.diff. 3.66
Perceptions of Justice and Fairness	11.73	9.30	16.27	14.80	**(HI) 17.33**	**(HI) 18.50**
Attributions of HRM practices	8.45	9.70	14.34	12.80	(HI) 17.05	(HI) 15.20
Organizational Support	12.48	11.80	15.00	14.00	(HI) 16.14	(HI) 15.60
Job Satisfaction	(HI) 16.26	(HI) 15.30	**(HI) 18.70**	**(HI) 18.80**	15.39	(HI) 15.60
Organizational Dynamics	13.68	(HI) 14.50	14.86	(HI) 18.60	14.91	(HI) 15.40
Person-Role Congruence	11.32	(LO) 7.10	12.55	9.50	14.36	14.60
Person-Organization Fit	(HI) 14.68	(HI) 14.10	15.16	14.00	12.95	12.90
Motivating Potential of Job	(HI) 15.55	(HI) 15.70	15.86	15.90	12.70	12.90
Psychological Contracts	(HI) 15.50	(HI) 16.40	14.66	14.60	12.39	10.90
Intrinsic Motivation	**(HI) 16.43**	**(HI) 16.90**	14.91	16.00	10.93	11.10
Identification with Organization	11.83	(HI) 13.60	10.25	11.50	9.89	8.50
Work-related Investments	7.49	(LO) 7.20	7.84	7.00	9.59	10.80
Affective Commitment	8.85	(HI) 13.30	8.39	11.40	8.78	8.50
Normative Commitment	6.97	7.80	6.17	6.90	7.28	(LO) 6.65
Internal Sense of Obligation	(LO) 5.64	(LO) 5.20	5.45	4.80	7.05	(LO) 6.45
Continuance Commitment:HiSac	(LO) 4.14	(LO) 6.50	(LO) 4.41	5.10	7.05	(LO) 6.50
Non-work-related Investments	6.65	10.50	(LO) 3.70	5.50	5.34	(LO) 3.60
Continuance Commitment	(LO) 5.49	(LO) 5.70	(LO) 3.85	(LO) 3.30	4.74	(LO) 5.20
Employment Alternatives and Opportunities	8.34	(LO) 3.40	(LO) 4.11	(LO) 3.10	(LO) 3.34	(LO) 5.90
Continuance Commitment:LoAlt	8.53	(LO) 6.00	(LO) 3.50	(LO) 2.40	(LO) 2.80	(LO) 5.20
Sum of Rankings	210.00	210.00	210.00	210.00	210.00	210.00

Note: min.diff. = minimum statistical difference.

test, one can calculate the minimum statistical difference (MSD) the sums must have, after which they are regarded as unequal (Porkka et al., 2010). This difference may be calculated with different significance levels. In this analysis, a significance level of .05 was used.

6. RESULTS

In Table 2, all the features with a value within the MSD, marked with "(HI)," are considered statistically equal with the highest (bolded and underlined) value. These have been calculated by subtracting the MSD value from the highest rank value. For example, in the proactive vision for case Company A, all the categories with a value over 15.76 (based on the calculation: 17.33 – 1.57 = 15.76) belong to the highest group. The line for the bottom group is gained correspondingly by adding the MSD to the minimum value (2.80 + 1.57 = 4.37). By using this kind of analysis, we can find categories that are valued collectively in similar strength and group them in statistically valid classes (Conover, 1999; Porkka & Paajanen, 2014). This was done to find the highest-ranked categories for both companies and to see whether there were similarities between these two companies based on the proactive vision.

When examining the current state figures in Table 2, the categories related to motivation, organization fit, job satisfaction, and psychological contracts are valued at the highest level in both companies. Also, these categories are evaluated as the statistically most significant, based on the Conover (1999) post hoc analysis of Friedman's test. Company B also values the category of "affective commitment" and "identification with organization" significantly high, which Company A does not. This might indicate that the respondents from Company B feel collectively better at work and value organizational identification and affective organizational commitment at a higher level than respondents in Company A and are thus more affectively committed to their organization. This feeling could have its roots in the organization's structure and history. As Company B is a municipal energy company with a long history as a stable employer with high job security, this may give a sense of valuing the organization back with high affective feelings, whereas Company A might not be regarded with that much affection. Similarly, the categories clustered with the lowest-ranked category in the current state are mostly related to continuance commitment for both companies. This indicates that the collective feeling among the respondents is that the lack of alternatives or high feelings of sacrifice do not greatly tie them to their current organizations.

On the target level, both companies evaluate "job satisfaction" at the highest level. In addition, Company B values "organizational dynamics" in the statistically highest group. This category consists of participation in decision making, information sharing, and interest in the organization's mission and strategy. These results are to be expected because job satisfaction is one of the basic needs employees have at work. People spend a large part of their time at work, so it is quite predictable that people wish all facets of their conditions to be as satisfying as possible.

Conover's (1999) post hoc analysis gives interesting results when looking at the proactive vision (the greatest gap between the current and target state) in Table 2. On the basis of the proactive vision, there are no major differences between the companies. Out of 20 categories, there are three corresponding categories that are clustered with the highest-ranked category (i.e., "perceptions of justice and fairness," "organizational support," and "attributions of HRM practices"). These categories have the greatest proactive vision in both companies. In addition, Company B has a statistically equally, high proactive vision in the category of "job satisfaction" and "organizational dynamics," although both of these categories also have a relatively strong proactive vision in Company A. On the basis of Friedman's test, both test groups feel that these categories are those that require most improvement or change. Similarly, there are two categories that are clustered with the lowest-ranked proactive vision ("employment alternatives and opportunities" and "continuance commitment: low alternatives"). These categories are seen by the respondents as being at the right level, or they do not see any major need for them to be any different, based on the definitions of the features themselves.

When looking at the figures in Table 2, there seem to be great similarities between the case companies. It seems that these two groups of respondents feel quite similarly about their organizations and value the same things in the current state, in the target state, and in the proactive vision. However, there are some interesting differences to be noted. The differences are discussed in more detail in Figures 1 and 2.

Figures 1 and 2 illustrate the differences in evaluations between these two companies in a way that is easy to understand. Figure 1 illustrates the differences in the current state and Figure 2 in the proactive vision, using the rankings in Table 2. Column A contains data from Company A and column B data from Company B. The third column A-B shows the difference between the companies. The marking "(HI)" in the cells indicates that the corresponding category is among the highest ranked in the company and "(LO)" means that it is among the lowest-ranked categories. Here the MSD is used to decide which features form a class in the same way as in Table 2 (Porkka et al., 2010). This graph does not show the overall evaluation of a certain category; it can only be used to show similarities and differences between the two companies. The similarities can be found in the middle of the graph. The upper part of the graph shows categories that are valued more highly by Company A, and the lower part categories that are valued more by Company B. The difference shows which categories were valued more highly in these companies.

In Figure 1, the highest positive differences for Company A between the valuations are in the categories of "employment alternatives and opportunities" and "person-role congruence." Company A values these

A	B	A-B
8.34	3.40 (LO)	4.94
11.32	7.10 (LO)	4.22
8.53	6.00 (LO)	2.53
11.73	9.30	2.43
16.26 (HI)	15.30 (HI)	0.96
12.48	11.80 (HI)	0.68
14.68 (HI)	14.10 (HI)	0.58
5.64 (LO)	5.20 (LO)	0.44
7.49	7.20 (LO)	0.29
15.55 (HI)	15.70 (HI)	-0.15
5.49 (LO)	5.70 (LO)	-0.21
16.43 (HI)	**16.90 (HI)**	-0.47
13.68	14.50	-0.82
6.97	7.80	-0.83
15.50 (HI)	16.40 (HI)	-0.90
8.45	9.70	-1.25
11.83	13.60 (HI)	-1.77
4.14 (LO)	6.50 (LO)	-2.36
6.65	10.50	-3.85
8.85	13.30 (HI)	-4.45

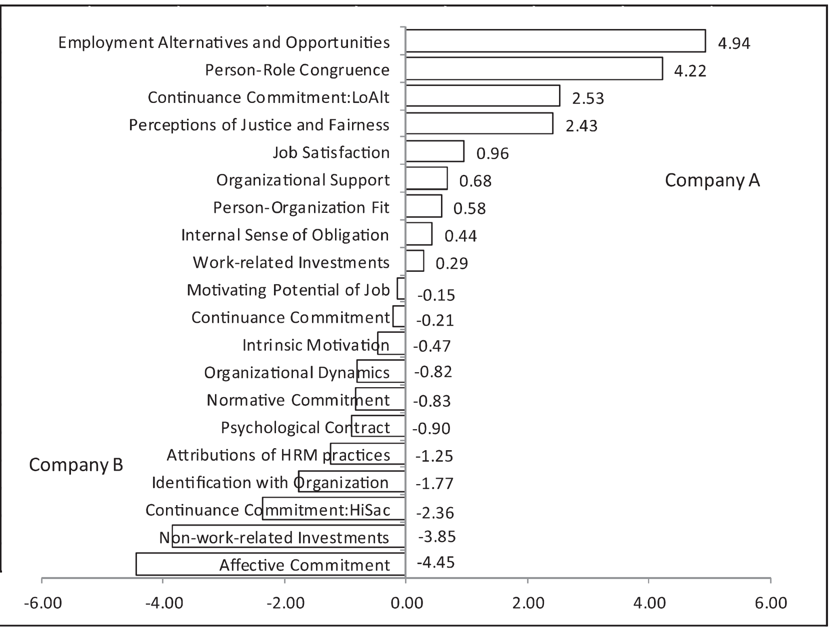

Figure 1 Differences in current state.

A	B	A-B
17.5 (HI)	15.20 (HI)	1.85
5.34	3.60 (LO)	1.74
12.39	10.90	1.49
9.89	8.50	1.39
7.28	6.65 (LO)	0.63
7.05	6.45 (LO)	0.60
7.05	6.50 (LO)	0.55
16.14 (HI)	15.60 (HI)	0.54
8.78	8.50	0.28
12.95	12.90	0.05
10.93	11.10	-0.17
12.70	12.90	-0.20
15.39	15.60 (HI)	-0.21
14.36	14.60	-0.24
4.74	5.20 (LO)	-0.46
14.91	15.40 (HI)	-0.49
17.33 (HI)	**18.50 (HI)**	-1.17
9.59	10.80	-1.21
2.80 (LO)	5.20 (LO)	-2.40
3.34 (LO)	5.90 (LO)	-2.56

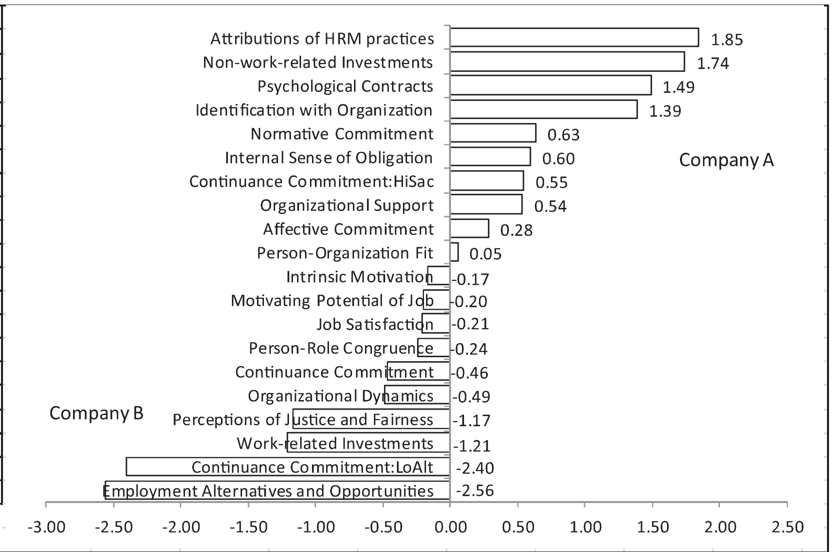

Figure 2 Differences in proactive vision.

categories more highly in the current state than in Company B. On the other hand, Company B values the categories of "affective commitment" and "non-work-related investments" at a relatively higher level than in Company A. These differences show how differently the two groups of respondents value each category collectively. This result is interesting because there is a considerable difference between the rankings, which indicates greatly dissimilar feelings toward these concepts. However, only the category of "affective commitment"was among the statistically highest-valued group for Company B.

The category of "employment alternatives and opportunities" might indicate that the employees in Company A feel more tied to their current employer based on the availability and attractiveness of alternative employment possibilities than respondents in Company B. This could be analyzed further to see whether it is the perception of a lack of possible alternatives or whether they are not attracted to these possibilities.

The difference in "person-role congruence" could be explained by the wider job descriptions of employees in Company B, which might cause some confusion (e.g., quality engineer), whereas respondents in Company A have more specific duties (e.g., electrician). In addition, Company A has specified strict guidelines for almost every task because it is working in a highly standardized and regulated industry. Therefore, the respondents might feel less ambiguity and consequently that the person-role congruence is at the higher level.

The difference in the category of affective commitment in favor of Company B could give a significant advantage as people who are high in affective commitment tend to exert more effort into doing tasks and go beyond their immediate work requirements and formally specified job roles. There is also a high degree of difference in the category of "non-work-related investments," which, when examined more closely, revealed the fact that respondents in Company B feel they have a lot more at stake if they have to leave their current employer. These issues are mostly related to family factors and the location where they live. The employees in Company B are mostly from the city they are currently working in, which might make them more tied to their current location and therefore their organization.

In Figure 2, there are averages of rankings of proactive vision for both companies. Proactive vision is an interesting concept to assess if there are plans to make some kind of intervention in the company. Proactive vision shows exactly what features and categories the respondents perceive as having then most room for improvement and show the desired direction of improvement with a collective voice. In proactive vision, the higher the value, the more change is desired.

Figure 2 shows that especially "attributions of HRM practices," "non-work-related investments," and "psychological contracts," in addition to "identification with organization" were valued more highly by Company A with regard to proactive vision. The respondents from Company A feel collectively that there is more to be improved in these categories than do the respondents in Company B. However, only "attributions of HRM practices" was among the statistically highest valued categories based on MSD analysis. It seems that Company B respondents value the need for change more in the categories of "employment alternatives and opportunities" and the similar commitment category of "continuance commitment: low alternatives," and "work-related investments" in addition to "perceptions of justice and fairness," thus there is a more proactive vision than in Company A. In Company B, the proactive vision in "employment alternatives and opportunities" was valued more than in Company A, indicating that the respondents in Company A value other employment opportunities more than do the respondents in Company B. In addition, it also seems that Company A respondents value the need for change in most categories related to affective commitment higher than in Company B.

From Figure 2, we can conclude that the participants from Company A value the need for change more in categories related to personnel and their well-being and that the main reason for doing specific HRM actions should be based more on employee needs. They also feel that the proactive vision in factors that increase feelings of attachment is rated more highly and that the organization should put more efforts into adhering to their promises and obligations. In addition, participants from Company A put more value on non-work-related investments, more specifically family factors, and think that they will not have much influence on whether they stay with their current organization in the future. The most influential category valued more highly by respondents in Company B than in Company A is perception of justice and fairness. This indicates that there is more discrepancy in how the respondents regard fairness in organizational procedures and in distribution of rewards.

This sort of comparative analysis of different organizations is meaningful when benchmarking one organization with other similar organizations or top performers. Benchmarking with another organization gives valuable information for management and provides a reference point for implementing and managing change. This benchmarking shows how the employees are feeling compared to other organizations. In addition, comparing results between, for example, two different business units of the same organization or two different personnel groups could uncover meaningful information for discussion and development action planning.

7. CONCLUSIONS

It is hard to measure concepts such as the commitment or engagement of employees because it requires the assessment of complex feelings and emotions. The factors affecting each person's feelings and emotions vary from one person to the next, for example, based on personality, situation in life, values, or goals. When assessing an organization or employee group within one organization, for example, there will probably be a different set of factors affecting engagement and commitment. The purpose of this paper was to show a method and sample analysis to compare results of data from a linguistic survey in a statistically valid way. This paper described a computer application that was designed to tackle this problem. Two different case studies were described and compared to show how to assess and analyze these factors in a real-life organizational setting.

The assessments were able to show the collective feeling among the respondents, how they felt right at that moment, and where they felt there was most room for improvement. In addition, the organization-specific differences revealed between the case companies validate the suitability of the application for this kind of research. These results can be used to plan organization-specific development actions or benchmark organizations against each other.

From Company B, we only received responses from 10 respondents (25%), which might in itself give some indication of their engagement to their organization and its development. This might convey that these respondents are those who are engaged in their organization and interested in their organization's affairs, whereas in company A, in which 88% completed the survey, thus giving more reliable overall scores, the responses were not as congruent. The respondents who feel connected to their organization may reflect their positive feelings in their responses and start their own value scale at a higher level. However, if respondents feel too disengaged, they might not see the benefit in answering employee surveys even if the surveys are being used to develop their working conditions and to make them more engaged in their organization's affairs.

In this research, the instrument was applied as a first market test to see whether the instrument could be used in a real business context to evaluate actual organizational needs. The number of respondents in Company B was relatively small, but there is a large amount of data behind the results. However, in both test cases, the respondent groups were familiar to the researchers and the results were validated using discussions with the employees; therefore, the validity of the data is higher than would have been the case if the instrument had been used alone.

Considering the overall results, or results for a large subgroup, will give the best indication of the engagement of the employees collectively and the factors or problems affecting it. On the basis of the survey, the key factors that were seen to have the greatest gap in development (proactive vision) were almost the same in both organizations. This can be seen in Table 2. One must keep in mind that, when talking about proactive vision, a higher value means that employees believe more change is required. Factors such as the feeling of justice and fairness, attributions of HR practices, and the supportiveness of the organization were identified collectively as the most important aspects to focus on. These were clearly the most significant features requiring change. The results also show that there are wide-ranging views about these factors among the respondents. Further analysis could be directed to finding smaller categories of employees for planning guidance proposals or specific actions. This kind of analysis provides the management of these companies with practical knowledge and new awareness. There were major differences in the current and target states in factors relating to organizational dynamics, including participation in decision making and information sharing. Also, Company B displayed far greater affective commitment than Company A.

When planning actions for an organization-specific intervention, the categories should be analyzed even further to find which features give these categories so much proactive vision. To obtain more practical results for management, Friedman's test based MSD analysis should also be conducted at feature level. The deepest analysis could be made by looking at each statement and its responses individually. Statement-level analysis shows whether there are high levels of agreement between the respondents. A high level of agreement among respondents indicates clear, consistent, and more reliable group-level results, whereas a high level of disagreement, in which responses are scattered across the scale, may indicate that the item itself should be looked at more closely.

When using a self-reported survey method like the one presented in this paper, some limitations must be addressed. Questionnaires have certain limits such as the psychometric properties (validity and reliability) and possible systematic biases associated with self-reported measures such as response distortions, method variance, and mono-method bias. These must be taken into account before making interpretations of the survey results.

It is clear that a workforce that is engaged and committed in the right way can be a major competitive advantage for an organization, because this is more than only job satisfaction and high retention. Completely engaged employees feel energized, emotionally attached, and focused on the organization's best interests and goals and therefore are willing to put in great effort to achieve them by committing the necessary emotional and personal energy. Therefore, it can arguably lead to valuable business results for the organization.

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Comparing university students' commitment – a multicultural case study

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ABSTRACT

The aim of this research was to evaluate and compare the creative tension of university students in three different universities in South Korea and Finland. The creative tension, or the gap between a person's feeling of current reality and target for future, was analysed according to features describing their committing factors related to their universities and studies. Data for this study were collected from 41 university students through self-evaluation using internet-based survey instrument. The application was able to identify the creative tension in each group of university students, and the results show differences in creative tension across the universities and also between countries. This type of in-depth analysis into the cultural perceptions of attributes offers valuable new information for academia and businesses.

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Academic; commitment; engagement; evaluation; application; leadership

Relevance to human factors/ergonomics theory

This paper describes a method for helping university management in their leadership of students. People who go to university have their own expectations and requirements for their individual growth. It is of great importance to know people's performance in their study environment and to focus on their individual growth. Teachers, lecturers, and professors must support them in their studies, leading to higher commitment, which will eventually lead to better results. With the research method described here, we can access the human factors that have an influence on the degree of students' commitment and engagement towards their studies and their place of study. This new type of statement-based instrument produces an image of individual and collective cognitive human factors, which can be used to enhance students' academic life and to prevent potential drop-out problems.

Introduction

It has been stated that students stay in their higher education institutes for similar reasons to those of employees in organisations (Bean 1980). According to Bean (1980), student withdrawal can be regarded as being similar to employee turnover. Bean (1980) developed his model of student attrition based on organisational commitment literature focusing on

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turnover in work organisations. The presumed roles of organisational variables, personal variables, and environmental variables in shaping both attitudes and intents are largely supported by many studies. Taking a different focus, Tinto (1982) argues that retention involves two different commitments from a student. The first one, known as goal commitment, is the students' commitment to obtain a degree, and the second one, institutional commitment, is their decision to obtain that degree at a particular institution. These commitments together are what affect students' commitment to a particular institution (DeShields, Kara, and Kaynak 2005). In addition, many studies have identified that students' overall satisfaction has a positive correlation to student retention (DeShields, Kara, and Kaynak 2005; Schreiner 2009). Therefore, DeShields, Kara, and Kaynak (2005) argued that the linkage between satisfaction and retention for students in higher education should be studied and carefully led and managed.

Measuring these kinds of concepts requires support from theory and methodology, so that the communication can be objective and the actions taken can be effective. After the introduction, this paper describes the theoretical background on educational commitment. The following section introduces the methodology, including the research instrument and research setting. Following this, a sample of the analysis and results of the research are presented. The last chapter concludes and summarises our paper.

Academic commitment

Earlier studies on student retention focused on students' academic abilities for predicting their retention. However, research indicates that academic goals, self-confidence, institutional commitment, social support, and particular contextual influences like institutional selectivity and financial support, in addition to social involvement, all have a positive relationship to student retention. Students who cannot develop these factors are more inclined to drop out. Previous research has indicated that the strongest factors seem to be academic-related skills, academic self-confidence, and academic goals (Lotkowski, Robbins, and Noeth 2004). However, studies have shown that academic performance can only account for half of the variance in dropout rates (DeShields, Kara, and Kaynak 2005). In addition, a great deal of research has suggested that the social integration of students may be an important factor in predicting persistence. These studies argue that integration into the social environment plays a major role in commitment to a particular academic institution (DeShields, Kara, and Kaynak 2005; Tinto 1975). Also, an important factor concerning commitment is the students' level of motivation toward their studies. There are different types of motivation (i.e. intrinsic and extrinsic), which can be on different levels. Intrinsic motivation, where the students show interest and inner acceptance of the value or utility of their studies and tasks, is important because it enables high-quality learning and creativity (Ryan and Deci 2000). However, because many tasks students have to do in order to achieve their degree are not inherently interesting or enjoyable, teachers have to be able to promote more active and volitional (versus passive and controlling) forms of extrinsic motivation (Ryan and Deci 2000). Understanding these different types of motivations and what fosters each of them is an important issue for universities in order to create a supportive and commitment that enhances a responsive environment.

Probably the two most dominant theories of student persistence and retention are the Tinto (1975, 1987) Student Integration Model and the Bean (1980, 1982) Student Attrition Model. The Tinto (1975) model emphasises integration and commitment. Both of these models agree that commitment is a key factor in explaining persistence in educational institutes. According to Tinto (1975), persistence occurs when a student successfully integrates into the institution academically and socially. A student's background characteristics (family background, individual attributes, and previous education experiences) influence their initial level of goal commitment and initial commitment to their educational institute. These commitments have an influence on academic integration. Goal and institutional commitment are also influenced by peer group and faculty interactions, and out-of-classroom factors which contribute to social integration (Grosset 1991). Habley (2004) argued that one of the main factors affecting academic retention is the quality of interaction a student has with other people on campus. This increased integration, both academically and socially, leads to greater goal commitment and institutional commitment, which leads to lower dropout rates and higher graduation rates. According to Tinto's model, students who fail to successfully integrate academically or socially are likely to leave the educational institute. In his more recent paper, Tinto (2003) identified five conditions that promote student persistence: expectations, support, feedback, involvement, and learning. Tinto states that students are more likely to persist and graduate in a setting (1) that expects them to succeed, (2) that provides academic, social, and personal support, (3) that provides frequent and early feedback about their performance as they are trying to learn and persist, (4) that involves them as valued members of the institution (e.g. frequent and quality interaction with staff and other students), and (5) most importantly, students are more likely to persist and graduate in settings that foster learning. Students who are actively involved in learning, i.e. who spend more time on tasks especially with others, are more likely to learn and, in turn, more likely to stay (Tinto 2003).

Bean's Student Attrition Model (Bean and Metzner 1985; Bean 1980) sees student withdrawal as being like employee turnover. He defined student attrition as the cessation of individual membership in a particular higher educational institute. He argued that students stay in their higher educational institutes for similar reasons to employees in organisations, hence it is analogous with organisational commitment. The results of many studies of the Student Attrition Model largely support the presumed roles of organisational variables, personal variables, and environmental variables in shaping both attitudes and intent. To further advance their research, Bean and Metzner (1985) attempted to create a conceptual model of the dropout process for non-traditional students. They argued that the main difference in the attrition process between traditional and non-traditional students is that non-traditional students are more affected by the external environment than by the social integration variables affecting traditional student attrition.

Non-traditional students are distinguished by the lessened intensity and duration of their interaction with the primary agents of socialisation (e.g. faculty, peers) at the educational institute they are attending (Bean and Metzner 1985). Typically, non-traditional students have to balance studies with employment. Usually, students are either full-time students working part-time or they are part-time students who are in full-time employment (Fleming 2009). In many cases, non-traditional students live quite far away from their educational institute, they attend only part time, for example, because of work, and have family responsibilities. Most have to balance their working lives and their academic studies. In addition, such students' participation in extracurricular activities is relatively minor compared to traditional students, as are the impacts of other social integration variables that are seen to have major influence on traditional students (Bean and Metzner 1985). This pattern of participation is characterising higher education students in Europe more and more (Fleming 2009).

As can be observed, the theoretical background has the same basic content. The problem is, however, gathering information so that it could easily produce general and specific information on the levels and degree of commitment and engagement at collective and individual levels and show whether there are needs for significant improvement. We believe that this is a major management and leadership problem in universities. Therefore, there is a need to create simple tools so that academic organisations can collect information directly from the students. Our target was to create an Internet-based application for evaluating student commitment, using self-evaluation. Once the self-evaluation has been conducted, students and academic staff will be more aware of possible development gaps and can base their objectives for improvement on concrete bottom-up results. The methods within the methodology are described in the next chapter.

Methodology

The disciplines needed to manage complex concepts like commitment toward one's studies and educational institute require a vast understanding of the factors affecting them, as well as sound knowledge and mastery of actions that can assist their enhancement. In order to classify and understand the concepts, an ontology was created. An ontology is a formal representation of a set of concepts within a domain and the relationships between those concepts. It is used to reason the properties of that domain and may be used to define the domain. According to Gruber (1993), an ontology is a 'formal, explicit specification of a shared conceptualization' (Gruber 1993). An ontology provides a shared vocabulary that can be used to model a domain – that is, the type of objects and/or concepts that exist, and their properties and relations (Arvidsson and Flycht-Eriksson 2008). In this context, the ontology is a classification of qualitative knowledge relating to a personal feeling of attachment to one's studies and educational institute. In other words, the ontology is a list of attributes that describe the meta-data (features and determinants affecting commitment).

Evolute application environment

The evaluation method utilised in this study was developed on the generic, Internet-based, computer application environment called Evolute. Evolute is an online system that supports specific-purpose fuzzy logic applications (Kantola, Vanharanta, and Karwowski 2006; Kantola 2005). Fuzzy logic is a conceptual system of reasoning, deduction, and computation that makes it possible to reason precisely with imperfect information. Imperfect information is information that in one or more respects is imprecise, uncertain, incomplete, unreliable, vague, or partially true (Zadeh 2009). The Evolute system allows researchers to develop a specific domain ontology and present it online to the target group (Kantola, Vanharanta, and Karwowski 2006). The application involves the use of anonymous self-evaluation in the assessment of different concepts in a study role through semantic entities, such as statements (Kantola, Vanharanta, and Karwowski 2006). The Evolute platform has been used in various studies in different countries, for example, in Finland (Kantola, Karwowski, and Vanharanta 2011; Kantola, Vanharanta, and Karwowski 2006), in Poland, in the UK (Makatsoris 2009), in South Korea (Chang et al. 2009; Chang, Kantola, and Vanharanta 2007), and in Spain (Bikfalvi, Jussila, et al. 2010; Bikfalvi, Porkka, et al. 2010; Bikfalvi, Rafart, and Mancebo 2013).

The research instrument

The basic idea for the instrument was modified based on result of previous research by Einolander and Vanharanta (2014). We used variables from the Bean and Metzner (1985) (Bean 1980, 1981) Student Attrition Model as a framework to build the ontology and the statements for the instrument. This was done in order to grasp commitment and satisfaction better in a specific domain, i.e. students' commitment and satisfaction with their academic institution. As a result, 15 concepts were identified along with 113 applicable statements or 'features' describing them in six main categories. Table 1 describes the evaluated categories and their concepts in more detail.

On a practical level, respondents are asked to evaluate the current state of the statement, how they feel about things at that moment at their institute. Also, the desired target or future state is evaluated, i.e. how they would like or envisage the situation to be in the future. This evaluation results in the creation of a proactive vision, i.e. the gap between

Table 1. Evaluated categories and concepts.

Academic performance	
Sense of competence	Feelings about performance and competencies to study effectively
Institutional qualities	
Academic advising	Feeling of adequateness of advising and feedback received and how supportive the learning environment is
Institutional quality	How well the institution is able to provide quality in regards of teaching, people, environment and information
Centralisation	The degree of freedom and own initiative in decision-making
Distributive justice	The degree of fair treatment, recognition, performance and respect
Routinisation	Amount of challenge and development in studies
Experienced outcomes	
Utility	Feelings of external usability of studies and their results
Satisfaction	Feelings of satisfaction towards the university as a whole (teaching, personnel, courses, performance, etc.)
Stress	Feeling of potential stress based on various stressors (amount of work, vagueness of objectives, people, treatment, time, etc.)
Goal commitment	Feeling of taking responsibility for own studies and committing to goals of the courses leading to graduation
Development	Feelings of accomplishment and personal development
Social integration	
Social integration	Degree of integration to a social group related to studies
Attachment	
Institutional commitment	Emotional commitment and attachment to this particular university
Intent to stay	Intent to graduate from this particular university
Environmental variables	
External factors	Binding variables outside of study environment (obligations, family, community, etc.)

the current reality and future vision. Objectively speaking, the gap between personal vision and current reality forms an individual's creative tension (Senge 1990). The gap between the actual and the desired states, often called creative tension or proactive vision, shows possible fields of improvement and intervention. The reasoning from the indicative statement evaluation to the visualised proactive vision is made with fuzzy logic; the statements are semantic entities and the ontology is the information resident in a knowledge base (Zadeh 1973, 2009).

Along with the statements, linguistic scale values are utilised. The scales vary according to the statements, for example, from 'not at all' to 'completely' or 'highly unsatisfied' to 'satisfied'. The respondents provide their answers, both to current and desirable (target) states, by clicking on the two bars beside the scale. With this method, the respondent can choose from over 100 different values for each statement, since the graphic bar offers a continuous scale of values. Responses to each statement are then transformed into a numerical form, a real value between 0 and 1. By using the continuous scale, the aim is to overcome some of the disadvantages that the conventionally used Likert-type scales may possess (Russell and Bobko 1992). They speculated that the Likert scale requires subjects to somehow compress or otherwise reduce their latent response. They suggest that information loss due to the coarseness of the scale can cause false increases or decreases in moderated regression effect sizes, and propose that it could result in an unknown systematic error, which could in turn have a major effect on the ability to detect true interaction effects. Also, Blalock and Hubert argued that the advantage of a continuous scale compared to, for example, the bi-polar Likert scale composed of five different values, is the better accuracy of the answers (Blalock and Blalock 1968).

International case study

The aim of this research was to study the commitment factors of students in three different universities. One of the universities was in South Korea and two were in Finland; one with all Finnish students and the other with students of different nationalities. The following universities participated in this study: (1) Korea Aerospace University (KAU), Republic of Korea; (2) Tampere University of Technology (TUT), Department of Industrial Management and Engineering, Pori, Finland; and (3) the University of Vaasa (UV), Department of Industrial Management, Vaasa, Finland.

In South Korea, the students were either seniors at the undergraduate level or students taking graduate-level courses. In TUT and UV, the participants were industrial management graduate students attending strategic management and product development courses, respectively. The age of the South Korean students ($n = 8$) ranged between 24 and 30 years (mean 26 years), and the age of the Finnish students from TUT ($n = 17$) was between 23 and 49 years (mean 33 years) and those from UV ($n = 16$), between 21 and 50 years (mean 29). All of the students from Finland had a prior Bachelor-level degree in some field of engineering or business administration and at least two years of prior work experience, while only half of the students from Korea had any work experience.

An application called Helix Academic was used to collect and analyse the data. The data were collected online through self-evaluations in the fall of 2014. Before evaluation, all participants were provided with written instructions describing the objective of the evaluation and a step-by-step guide for taking the evaluation. It was emphasised that individual results would be made available only to the respondents themselves. The combined results would be used for assessing the group as a whole and would be made available to students and the professor conducting the study in each university. The students completed the survey by responding to 113 statements concerning factors affecting their motivation, satisfaction, and commitment, providing both current and target levels in their answers. The answers were given on a fuzzy continuous scale. A total of 41 students had completed the self-evaluation by the deadline. Several demographic characteristics were included in the study as descriptive statistical variables. These included age, gender, highest education level attained, job type, experience in current job, and overall tenure in the current organisation. Nationality and total time in working life were also inquired about.

Results

The results may be viewed individually or as a group (summary). Individual results are visually unique, with unique creative tensions. In the following sections, the results are viewed by feature and category level, one university group at a time. Then the results of the groups are compared by feature and category group.

KAU, South Korea

Figure 1 shows the group results of the eight students at KAU. The features of the application have been sorted according to the relative creative tension: target competence level (red)/current competence level (blue).

The largest relative creative tension at KAU is evident in the institutional quality, satisfaction, academic advising, distributive justice, and utility. The lowest relative creative tension is found in the features of external factors, intent to stay and sense of competence. The collective results indicate that these students believe institutional quality can help them to be successful in their future. Compared to Finnish students, routinisation was not ranked as high since KAU students believe that their programme is quite unique and has been well established (i.e. all students from KAU majored in logistics and the logistics program at KAU has a nationwide reputation and is unique). Another interesting point is distributive justice. KAU students have pride in their major and a strong desire to be treated much better than they are (university-wise, KAU has a very focused programme that is very small in size and is a relatively unknown university). In terms of utility, students have a strong desire for their degrees (or their studies) to be useful once they graduate.

TUT, Finland

In this group, 17 students completed the self-evaluation. The students at TUT differ from those at KAU in that they are graduate students (continuing from their Bachelor's degree to get an M.Sc. in Engineering), who are usually older and have previous work experience.

The results show that the students at TUT have the largest relative creative tension in the features of academic advising, routinisation, centralisation, institutional quality, and satisfaction. In contrast, they have the lowest relative creative tension in external factors (negative tension), intent to stay, and utility (see Figure 2).

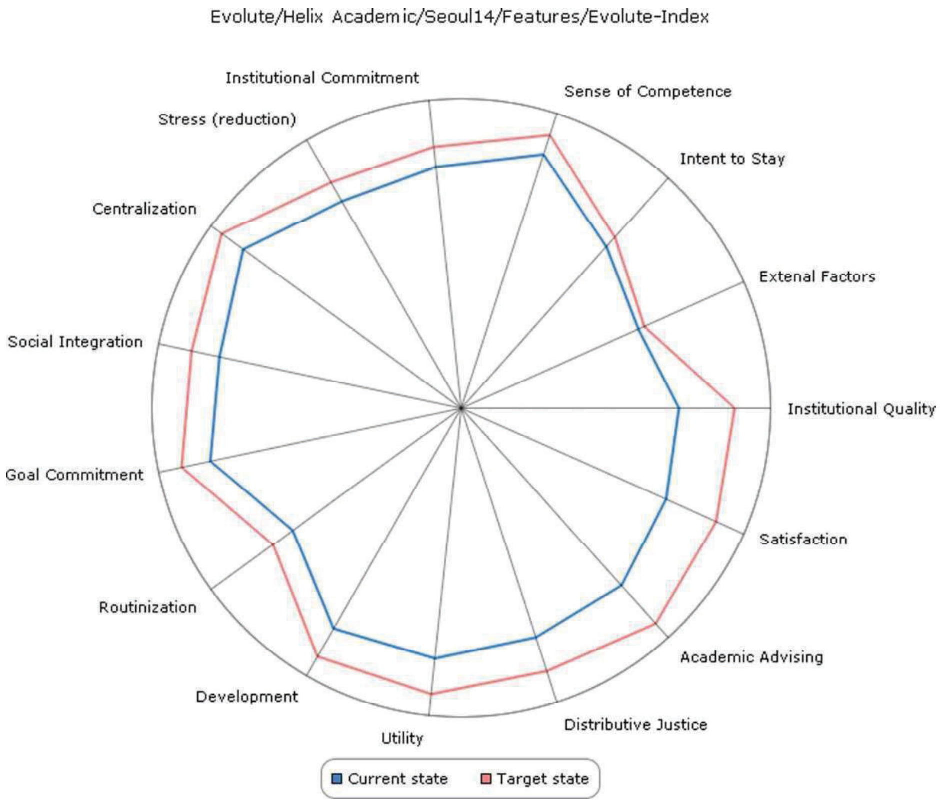

Figure 1. Results of the eight students at KAU according to relative creative tension.

The collective results are consistent with the perception that the degree programme professor holds about the students. The respondents are older non-traditional students with earlier degrees who are furthering their education. Many of the respondents are working part-time and have other engagements beyond studies. The results show that there is a need for more advising and new teaching methods, which are consistent with the perception that methods like distance teaching should be utilised more and that there should be more variety and freedom in choosing courses. In addition, the respondents have great commitment to their university and to achieving their goals, which is to be expected for this kind of student. These special characteristics should be taken into more consideration when developing the training programme. In addition, the high level of institutional commitment might stem from the fact that there are only a few universities in Finland providing this sort of 'upgrade' studies.

UV, Finland

At UV, 16 students completed the self-evaluation. Six different nationalities were represented in the research group, of which about half were from Finland. The results for the respondents from UV are shown in Figure 3.

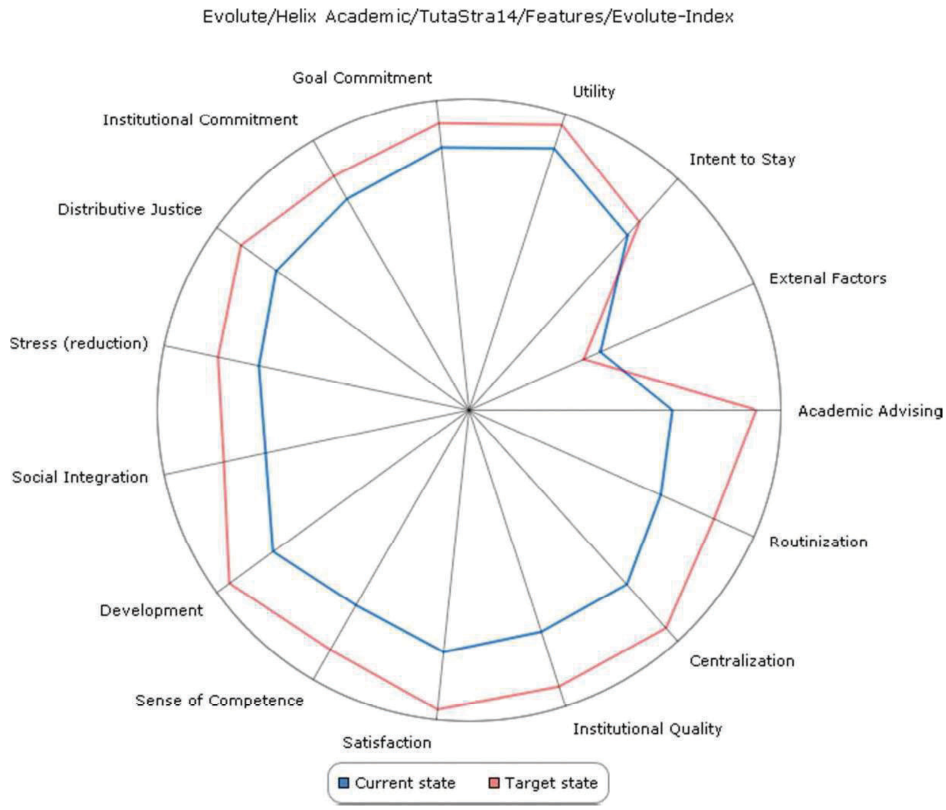

Figure 2. Results of the 17 students at TUT according to relative creative tension.

According to the results, the students at UV have the largest relative creative tension in the features of academic advising, routinisation, institutional quality, development, and centralisation. The group has the lowest relative creative tension in external factors (negative tension), intent to stay, and institutional commitment.

The collective results indicate that these students are uncertain about their future in Finland. For foreign students, it might be more difficult to find work in Finland even with a university degree because of the scarcity of possible employment opportunities due to the recession and because there might be some tendency in Finnish companies to avoid employing foreign people, in addition to a lack of close contacts with Finnish companies. However, in the Vaasa region, the situation might be a little better, perhaps due to the fact that it is a bilingual area and therefore accustomed to different cultures.

The university unit in question is a small unit that is not yet accredited, which might be reflected in the perceptions of quality of teaching. The students might believe that the quality of teaching is not as good as it would be in larger universities, which they consider especially important. Also, because they are foreign, they encounter more difficulties than Finnish students, which makes them need more support from the university regarding not only education but living in a foreign culture as well. However, due to these challenges, they tend to be more active in their studies than their Finnish counterparts.

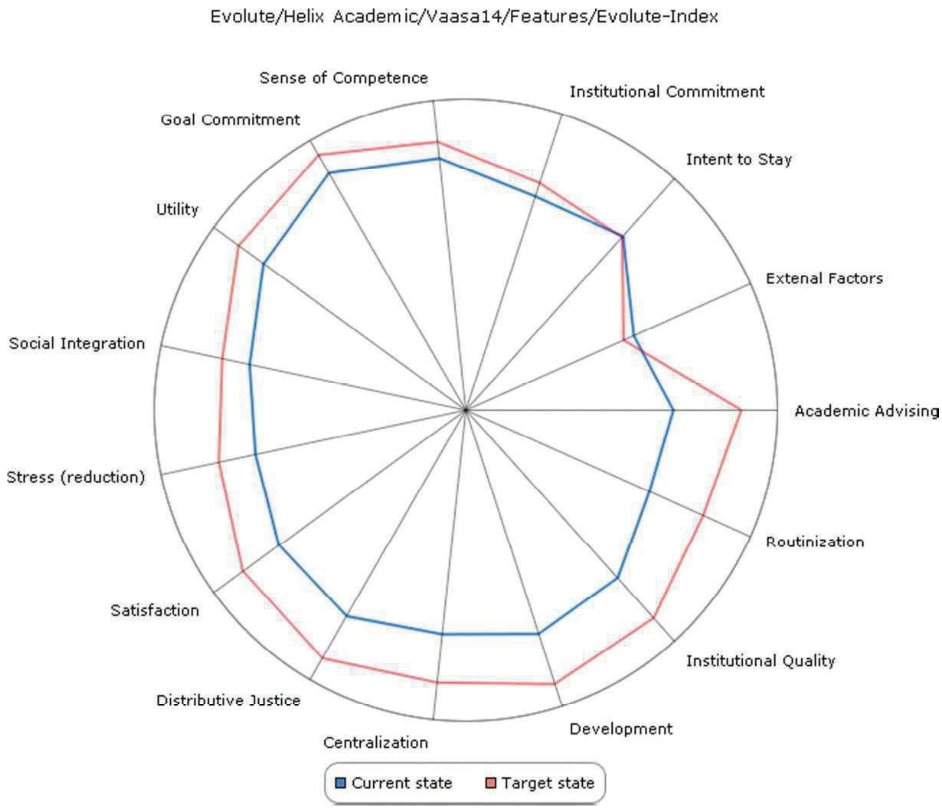

Figure 3. Results of the 16 students at UV according to relative creative tension.

Comparison of creative tensions

The results reveal that each group has a different profile. On average, the KAU group has the highest perceived current and target levels in general, and also has the lowest relative creative tension. KAU also has the lowest average standard deviation between features. TUT has the lowest current state on average and the middle value in the target state among the different groups of respondents. TUT also has the highest creative tension on average and highest standard deviation in both the current and target states. UV has the lowest target state on average but the middle value in the current state. On average, the creative tension is higher than in KAU but lower than in TUT. The standard deviation is also in the middle ground. These results are listed in Table 2.

Table 2. Comparison of category level averages.

Group	Current (Avg.)	Target (Avg.)	Rank Current	Rank Target	Current (Avg. STD)	Target (Avg. STD)	Rank current	Rank target	Creative tension (Avg.)	Rank
KAU	0.767	0.865	1	1	0.068	0.085	3	3	0.098	3
TUT	0.729	0.863	3	2	0.095	0.134	1	1	0.133	1
UV	0.730	0.839	2	3	0.068	0.095	2	2	0.109	2

Table 3. Match between perceived development needs.

	KAU	TUT	UV
1.	Institutional quality	Academic advising	Academic advising
2.	Satisfaction	Routinisation	Routinisation
3.	Academic advising	Centralisation	Institutional quality
4.	Distributive justice	Institutional quality	Development
5.	Utility	Satisfaction	Centralisation
6.	Development	Sense of competence	Distributive justice
7.	Routinisation	Development	Satisfaction
8.	Goal commitment	Social integration	Stress (reduction)

Table 3 shows that students at KAU, TUT, and UV have similar features they wish to develop, but that they also have differences. Sixty-three per cent of the eight most emphasised features are common to all three groups, and 88% were common to at least two groups. In other words, each group clearly has a different kind of creative tension, but they also have the same kind of focus points.

Table 4 gives a more detailed comparison of the groups, listing the differences between groups and providing observations concerning these differences. The figures

Table 4. Differences in results between groups.

Feature	TUT	KAU	UV	Category	Comments
Sense of competence	7	12	12	Academic performance	TUT emphasises the need for feeling more competent in the future
Academic advising	1	3	1	Institutional qualities	All three groups think that there is much to improve in the advising they receive
Institutional quality	5	1	3	Institutional qualities	Improvement in institutional qualities are valued highly by all groups
Centralisation	2	9	5	Institutional qualities	TUT emphasises that there should be more room to make decisions by themselves
Distributive justice	8	5	5	Institutional qualities	KAU and VAU emphasise change in recognition and fair treatment more than TUT
Routinisation	3	10	2	Institutional qualities	TUT and VAU feel that the studies and study methods should provide more variety
Utility	12	4	9	Experienced outcomes	KAU emphasises the improved feeling of the utility of their studies
Satisfaction	4	2	7	Experienced outcomes	KAU greatly emphasises the need for improvement in experienced satisfaction toward different aspects of their studies
Stress (reduction)	10	11	8	Experienced outcomes	VAU feels the most that there are stress-inducing factors in place
Goal commitment	13	7	11	Experienced outcomes	KAU feels the most amount that they should take more responsibility for achieving their goals
Development	6	6	4	Experienced outcomes	Respondents feel quite similarly about whether they should have more feelings of development from their studies
Social integration	9	8	10	Social integration	Increasing the social integration is rated relatively low in all groups
Institutional commitment	11	13	13	Attachment	Increasing the commitment towards their particular university is rated low in all groups
Intent to stay	14	14	14	Attachment	None of the three groups require almost any change in the feeling of whether they should stay or not
External factors	15	15	15	Environmental variables	All three groups feel this feature requires the least change

Table 5. Percentage of features in different categories (top 8).

	KAU	TUT	UV
Academic performance	0%	13%	0%
Institutional qualities	50%	50%	63%
Experienced outcomes	50%	25%	38%
Social integration	0%	13%	0%
Attachment	0%	0%	0%
Environmental variables	0%	0%	0%

in the columns for KAU, TUT, and UV indicate the rank of the feature in terms of creative tension.

Table 5 shows how many of the features included in Table 2 belong to each category. It appears that for all groups the institutional qualities and experienced outcomes are considered the most important categories to improve and emphasise. However, TUT also emphasises academic performance and social integration.

Figures 4 and 5 provide alternative views of the results. Figure 4 shows the current and target levels according to features assessing direct commitment and intent to stay at a particular university and Figure 5 the current and target levels of other features affecting them and their development.

From Figure 4, it can be seen that students at UV value goal commitment highest, although all three groups of respondents feel attaining goals and graduation are very important (target state). At the current level, goal commitment is highest in UV and lowest in KAU; however, KAU students see the most room for improvement there.

Institutional commitment is at the highest level in TUT. This might be because they are continuing their studies from earlier Bachelor's degrees, which is not possible in all universities, thus making them more tied to their particular university. In the current state, institutional commitment is at the lowest level in UV and about the same level in TUT and KAU.

Intention to stay at a particular university is significantly the highest in TUT. This might be explained by the same reason as for institutional commitment. All the other groups have intent to stay at almost the same low level. Currently, the intent to stay is the lowest in KAU and about the same level in UV and TUT.

Figure 5 highlights the differences between the three groups of respondents. KAU students value sense of competence, academic advising, centralisation, social integration, and stress reduction, in addition to placing external factors higher than the other groups. TUT students, on the other hand, value institutional quality, utility, satisfaction, development,

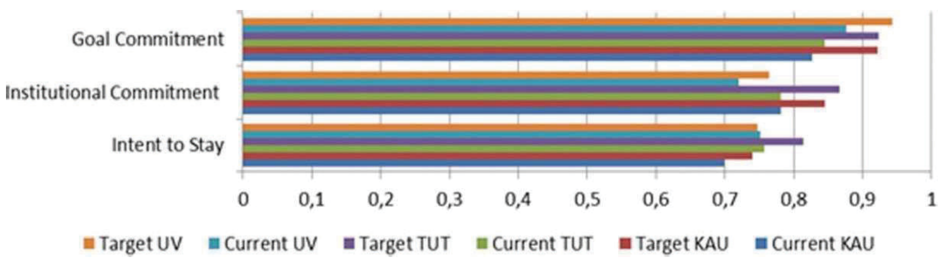

Figure 4. Commitment features (current and target state).

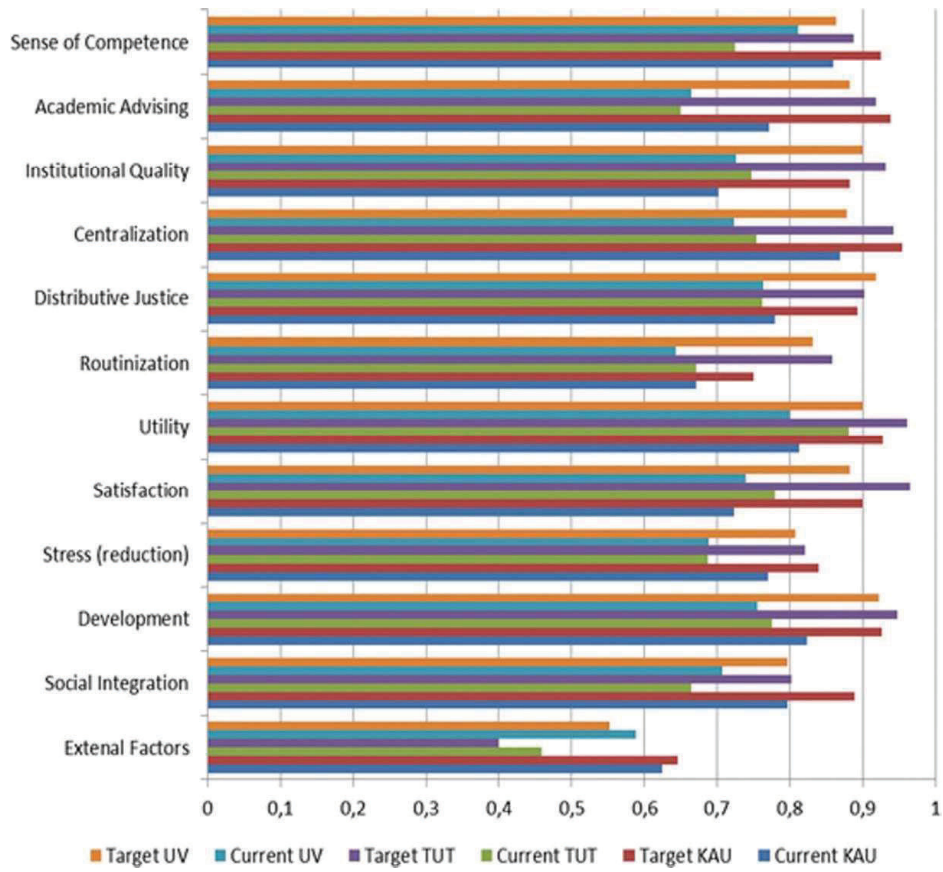

Figure 5. Feature level results (current and target state).

and routinisation at the highest level. UV students value distributive justice as more important than the other two groups of respondents do.

Currently, TUT students feel the sense of competence to be at the lowest level compared to the others and KAU at the highest level. TUT and UV students feel that academic advising is at a significantly lower level than KAU students. Institutional quality is almost at the same level for all three groups in the current state. However, there is a big difference in centralisation between the groups. KAU students regard centralisation as being at a significantly higher level than the students at UV and TUT. Distributive justice in the current state is at almost the same level for all groups, as is routinisation. Currently, TUT students feel utility is at a much higher level than UV or KAU.

Satisfaction is at the highest level in TUT and UV, and KAU students rate it at a slightly lower level. KAU students feel stress is at the highest level compared to TUT and UV. KAU students also feel development is at the highest level. In the current state, KAU students feel social integration is at the highest state and TUT students rate it at the lowest state. This might stem from the fact that the students in the TUT group are adult students, who have other personal engagements than studying, like family. However, they do not rate the external factors as high as those in KAU.

Discussion

In view of the results, some interesting observations can be made concerning the different groups of students. As expected, there are similarities across the groups but also differences. It seems that the differences stem from different cultural backgrounds and from different situations in life. From the institutions' viewpoint, the information gathered in this research may help the universities to better support their students in managing their studies.

The main goal of the assessment is to give the management of universities new tools and information to help them in their leadership. By using information gathered about their students' feelings from the bottom up, they can make effective development plans in order to improve, for example, their satisfaction and retention. However, this sort of comparative analysis of different universities is also meaningful when benchmarking with other groups. Benchmarking provides valuable information for management and a reference point for implementing and managing change. This benchmarking shows how the students are feeling compared to other groups. In addition, comparing results between institutions, for example, could uncover meaningful information for discussion and development action planning.

KAU is a highly competitive, individualistic environment in which innovativeness is emphasised. It seems that KAU students rate most features in the current state higher than the two other groups of respondents; in other words, they feel that these features are currently at a better level. They also value more features as the most important to focus on in the future. Most differences between KAU and the two groups from Finnish universities are seen in the aspects of sense of competence, routinisation, social integration, and external factors. For example, even though Korean school society can be thought of as highly individualistic because of great competition, this group seems to value social integration at a very high level.

At the TUT unit in question, students with a previous degree in engineering are furthering their education to M.Sc. level. Many of the students have previously worked in industry. This kind of continuation of studies is not possible in all universities, which might make them more committed to their particular university. Also their prior engagements such as family-related matters or working at the same time distinguish them from the other groups in this study. These 'non-traditional' students might have completely different motives for studying and also other higher priorities in life, which can make them a challenging group for universities.

The creative tension of each student is unique, as has been shown in earlier studies (Kantola 2005). However, creative tension is not the only important aspect to look at. The level of the current state shows how respondents feel at the current time. This is also important for management since it gives a baseline on which to compare the effectiveness of development activities. By looking at the target state results, one can see how the respondents value each of the features; in other words, which ones they feel to be the most important. It must be noted that these results only concern these particular groups of respondents and cannot be generalised to any larger group. Any generalisation would require a much larger subject group.

It is important not only to measure students' commitment and their feelings but also those of the teaching staff because they have a major impact on the students, their commitment, and success in school. According to Ostroff's (1992) study, there are significant correlations between aggregated teachers' job satisfaction and organisational commitment and many indicators of school performance (student test scores, dropout rate, vandalism costs, student satisfaction, teacher turnover).

With the methods presented, it is quite easy to analyse a large amount of data in a visual form. This kind of visual analysis is easy to use and informative for management and leadership purposes, especially for people who are not very familiar with different statistical analysis methods. Collective data gathered with a statistically sufficient sample size are able to provide insights into the possible reasons behind academic dropout and satisfaction regarding a particular educational institute. These datasets also provide knowledge on how these issues can be managed and improved in the future.

In our future research, our goal is to gather longitudinal data to be used to study whether there is a relation between study results and the actual withdrawal in the universities. However, this sort of analysis requires more data to be gathered. It would also be interesting to compare these results with a post-withdrawal questionnaire analysing the most significant factors influencing the students' decisions to leave. In addition, comparing the differences behind the actual reasons for withdrawal would be interesting to investigate.

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Master's Students' Commitment and Engagement in Their Course Behavior

Jarno Einolander, Hannu Vanharanta and Ari Visa

Abstract Student commitment is a major concern for universities around the world. Research has indicated that students' psychological attachment to their university, in other words commitment, can be a major predictor of student retention, as well as affecting many other attitudes and types of behavior. This makes university commitment critical to university success. The present study seeks to find out whether there is a relation between students' grades and the degree of their engagement and commitment, using the Evolute approach. The research group in this study consisted of master's degree students studying in faculties of Business and Built Environment and Computing and Electrical Engineering. In the newly developed instrument, respondents assessed 124 unique statements regarding their current situation and their vision for the future. This score and its sub-scores are compared in relation to individual course grades.

Keywords Commitment · Engagement · Master students · Fuzzy logic · Human resource management · Leadership

1 Introduction

According to Ostroff [1], there are significant correlations between aggregated teachers' job satisfaction and organizational commitment and many indicators of school performance (student test scores, dropout rate, vandalism costs, student satisfaction, teacher turnover). The problem has been how to study this issue. Here

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one approach based on the Helix Student Application package and statistical methods is described. The following sections deal with engagement and commitment, the Helix Student Application, and the experiment itself.

2 Engagement and Commitment

Student engagement is a major concern for universities around the world. Research has shown that students' psychological attachment to their university, in other words, their commitment, can be a significant predictor of retention, as well as affecting many other attitudes and behaviors. Moreover, it is not only an important matter for universities, because it also has a direct link to the social, economic, and political growth of the country concerned.

Previous studies about student retention have concentrated on students' academic abilities to predict their retention. However, research has indicated that academic goals, institutional commitment, self-confidence, social support, and, for example, institutional selectivity and financial support, in addition to social involvement, have positive correlations with student retention. Students who cannot develop these factors are more prone to drop out. Previous studies have shown that the strongest factors seem to be related to academic skills, academic self-confidence, and academic goals [2]. However, studies have shown that academic performance can only account for half of the variance in the number of dropouts [3]. Additionally, earlier research has shown that students who are committed to a specific university are more likely to graduate than those who have the goal of graduating but feel no commitment to any specific educational institution.

According to Tinto [4], students are more likely to stay and graduate in a setting (1) that expects them to succeed, (2) that provides academic, social, and personal support, (3) that provides frequent and early feedback about their performance as they are trying to learn and persist, (4) that involves them as valued members of the institution (e.g. frequent and quality interaction with staff and other students), and (5) most importantly, students are more likely to persist and graduate in settings that foster learning.

Also, an important factor concerning student commitment is the level of motivation toward their studies. Motivation has been shown to have a positive influence on students' academic performance, study strategy, adjustment, and well-being. It has been reported in primary, secondary, and college education to influence academic performance through study effort [5].

Students can have different types of motivation (i.e. intrinsic and extrinsic). Intrinsic motivation is when students express interest in and inner acceptance of the value or utility of their studies and think the tasks are important because they enable high-quality learning and creativity [6]. Nevertheless, since many tasks students have to do in order to achieve their degree are not inherently interesting or enjoyable, teachers have to be able to promote more active and volitional (versus passive and controlling) forms of extrinsic motivation [6]. Understanding these different types of motivation and what promotes them is a significant issue for universities in order to create a supportive and commitment-enhancing responsive environment. Therefore, universities need effective measures to evaluate student commitment and engagement.

3 Helix Student Application

Probably the two leading models of student persistence and retention are Tinto's [7, 8] Student Integration Model and Bean's [9] Student Attrition Model. Both of these models are based on the idea that commitment is a main factor in explaining persistence in educational institutes. According to Tinto [7], persistence occurs when a student successfully integrates into the institution academically and socially. Students' background characteristics (family background, individual attributes, and previous education experiences) influence their initial levels of goal commitment and initial commitment to their educational institute. These commitments influence their academic integration. Goals and institutional commitment are also influenced by peer group and faculty interactions, and out-of-classroom factors, which affect social integration [10].

Bean's Student Attrition Model [9, 11] regards student withdrawal as being comparable to employee turnover. He defined student attrition as the cessation of individual membership in a particular higher educational institute. Bean argued that students stay in their places of study for similar reasons to employees in organizations. Many studies regarding the Student Attrition Model largely support the presumed roles of organizational variables, personal variables, and environmental variables in shaping both attitudes and intents.

The evaluation method utilized in this study uses an Internet-based application environment called Evolute that supports different ontology-based applications [12, 13]. The Evolute approach is a modular process involving individuals and stakeholders where their perception and understanding of organizational resources are sought and collected with the help of statements. The Evolute system [14] computes and visualizes the meaning of the knowledge input collected from stakeholders. The basic idea for the instrument came from our previous research [15]. We used variables from the Bean and Metzner [11, 16, 17] Student Attrition Model as a framework to build the ontology and the statements for the instrument. As a result, 15 concepts were identified along with 113 applicable statements or 'features' describing them in six main categories. University management can use the computed current and future state of the resources to make a development analysis at their educational institution. This analysis can be made for the whole target group or sub groups under study.

4 Case Study A

The first research study, case A, was carried out with 19 students from Tampere University of Technology who were participating in a course on organizational behavior and leadership. The main characteristics of the course were the following: (1) the course contained both theoretical and practical parts, (2) the lectures were 80 % compulsory, (3) the teacher motivated students to learn during the lectures, (4) the course contained several self-development and human growth exercises, (5) the students ran the Helix Student Application (HAS) during the course.

The results of these test runs are reported in the following three figures. After the examination, the student grades were compared with three different main categories of the commitment and engagement test results, i.e., the goal commitment, institutional commitment, and intent to stay features (Fig. 1).

The commitment and engagement test results show a high current rate in the 5 main categories and relatively low results with the Environmental as well as Participative Decision Making categories. The results show clearly how students feel about their possibilities to affect the external variables as well as the decision making inside the university. The figures also clearly illustrate the main areas where their own impact is possible and where they can make improvements (Fig. 2).

The detailed analysis also shows the areas where students can improve their commitment and engagement. It can be noted that each of the features, apart from External Factors, give a proactive vision of the current state. External Factors describe binding variables that are external to the study environment such as family obligations. Therefore, little creative tension in this feature can be expected. The highest current states in this case are Goal Commitment, Distributive Justice, and Satisfaction.

From Fig. 3 we can conclude that there is a large variation in terms of commitment and engagement. These test results show clearly how each person views his or her situation in the academic world. The results can be used for management and leadership purposes (Fig. 4).

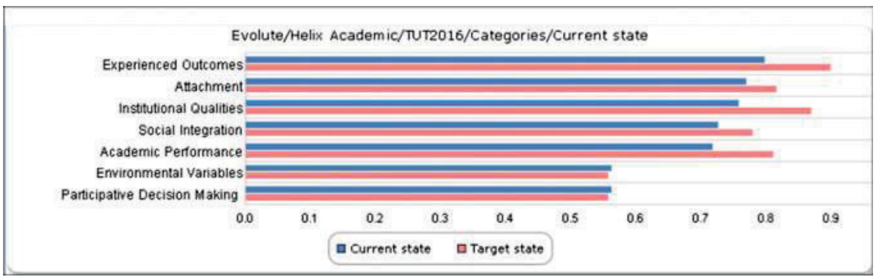

Fig. 1 Current and future state analysis with the main commitment and engagement categories

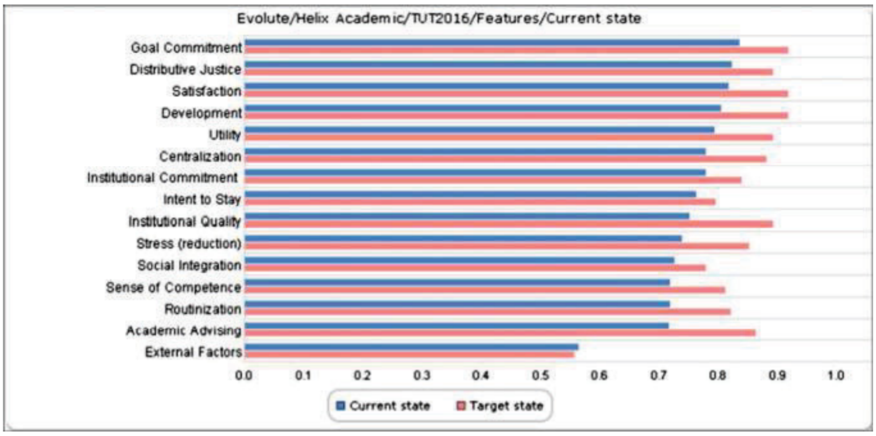

Fig. 2 Detailed analysis of the commitment and engagement features

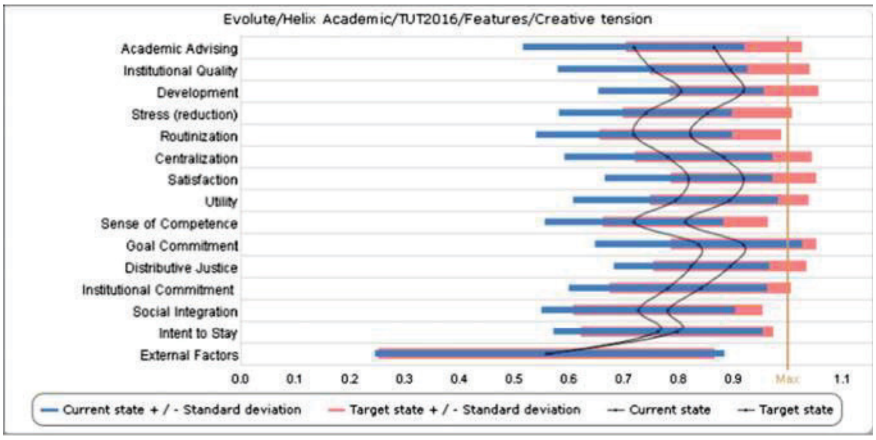

Fig. 3 Variation analysis of the commitment and engagement test runs

The degree of goal commitment and examination grades were analyzed after the course.

From this relationship, we can conclude that students' internal goal commitment correlates very well with the examination grades. The figure also shows very clearly how important it is for the students to pass the examination and often with high grades. The students who select this course are willing to learn organizational behavior and leadership and they were genuinely interested in the course (Fig. 5).

The test results show a larger variation compared with the previous test results. We can see that institutional commitment is not so important, but nevertheless the

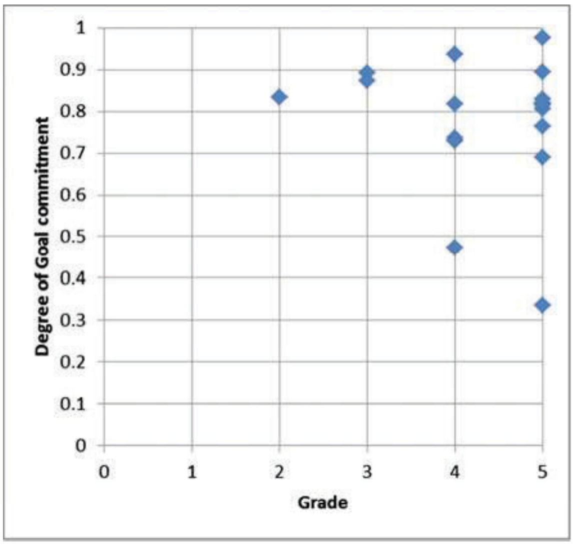

Fig. 4 The relationship between the degree of goal commitment and student's examination grades

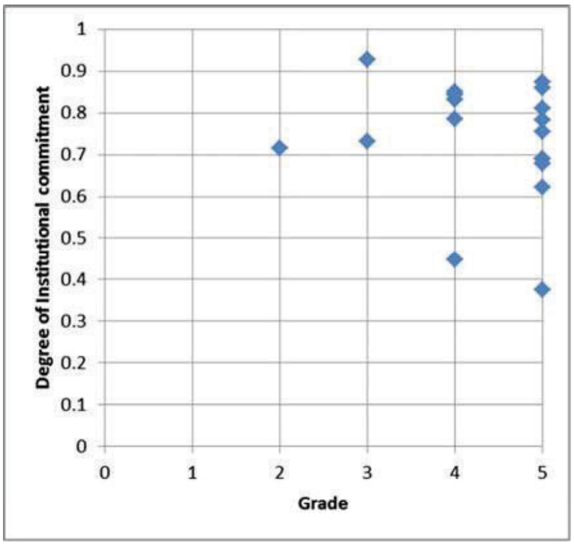

Fig. 5 Relationship between the degree of institutional commitment and examination grades

test results show a clear relationship between these two factors. The test results can be used in university management by creating an atmosphere where students better understand the institute itself and also the educational aspirations of the personnel, etc. (Fig. 6.)

The trend is the same as in the previous figures. Students are eager to stay at the institute and have expressed it relatively strongly.

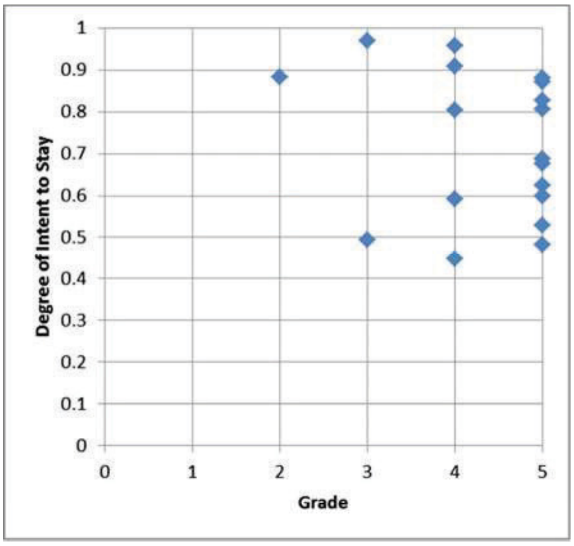

Fig. 6 Relationship between the intent to stay and examination grades

5 Case Study B

Research case study B was conducted with 50 students from Tampere University of Technology. The course on machine learning was selected based on three factors, namely (1) the course was a more demanding, theoretical course, (2) the students were international, and (3) there had usually been a great variation in learning results for this course. The students ran the Helix Student Application and the results achieved are reported below.

First, the complete profiles of the students were considered. Each profile was a 254 dimensional vector. The profiles were produced by the Helix Student Application. The students, in this case 42, were ranked with grades from zero to five. The profile of each student was considered. The Euclidean distance was calculated pairwise for each student, which is usually the basis for different clustering methods.

Table 1 A confusion matrix type presentation of the obtained grades and the number of grades of the closest profiles

Grade obtained	The number of grade obtained of the closest profile					
	0	1	2	3	4	5
0	1	3	1	0	1	0
1	0	2	2	0	4	0
2	0	0	1	1	2	4
3	0	0	0	2	1	4
4	0	0	0	0	6	3
5	0	0	0	0	0	5

Then the closest profiles were replaced with the corresponding grades. The results are shown in Table 1. Please note that in the ideal case there should be a diagonal matrix. The numbers on the diagonal are the same as the number of students with the respective grade. The total sum is the number of students minus one.

It is interesting to note that the grades four and five are more homogeneous than the others. It is also interesting to note that the students with grades two, three, and four have students with grade four as closest neighbors.

The aggregate results are shown in Fig. 7 and detailed results by topic in Fig. 8, while Fig. 1 shows the summary by category.

In Figs. 7, 8 and 9 the features have been sorted by the highest current state.

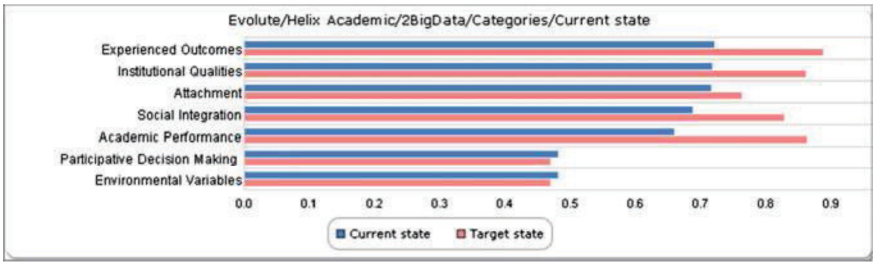

Fig. 7 Summary results by main category

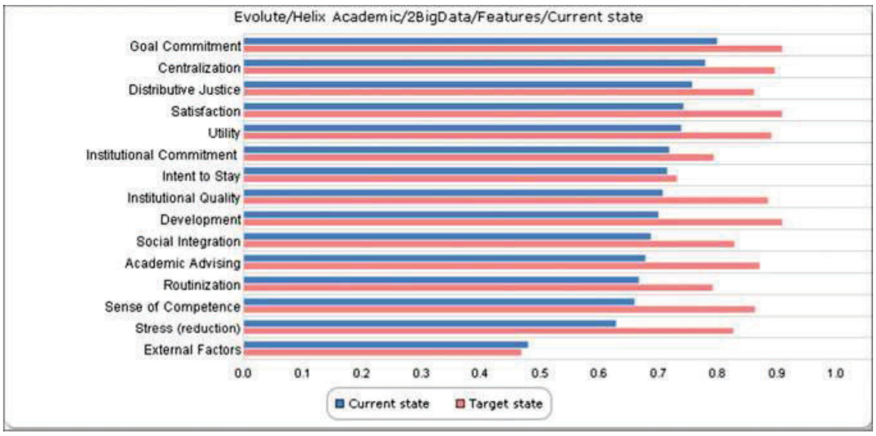

Fig. 8 Feature state results

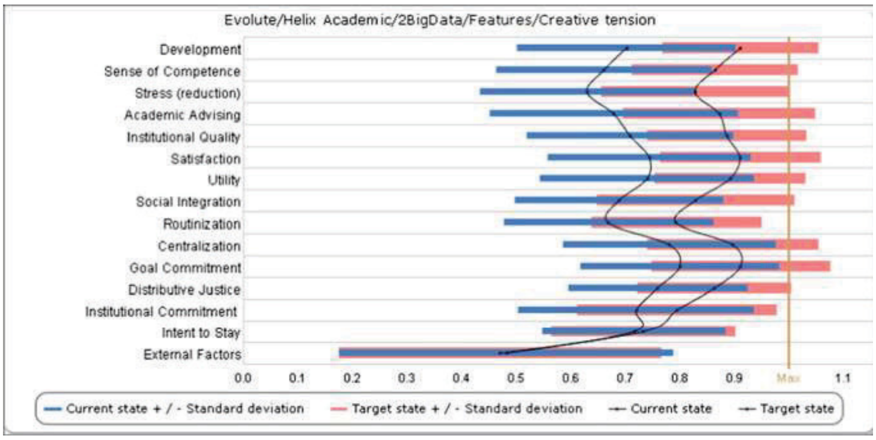

Fig. 9 Feature level results and their standard deviation

6 Conclusions

The interpretation of the results poses some challenges. We can see that there are certain similarities between students with a certain grade. However, this requires more in-depth analysis, especially the reasons why certain grades are more homogeneous than others.

The high dimensional space together with the different distance metrics play an important role. The role of different distance metrics should be studied. It also requires sensitivity analysis concerning the profiles.

In future, we need to gather more data on student commitment and motivation and their test results to see if there is a relationship, as expected.

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Safety Culture and Collective Commitment in Organizational Context

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Abstract. In nuclear power plants and process industry safety is the number one priority over profitability and productivity. In such high-risk environments where individuals work independently their decisions can lead to dangerous situations to coworkers, organizations or even to society. In many cases, a loose commitment to occupational role causes individual to perceive safety culture as something too much detailed which makes them to lose focus on what is important regarding the safety culture. In our view, this is a problem for collective safety culture to raise to a higher level. To understand organizations collective safety culture and safety consciousness it is important to analyze employees individually to see what are their internal feelings, understanding and aims. This paper presents a joint analysis of organization's safety culture and commitment towards their organization by utilizing also Company Democracy Model (CDM).

Keywords: Safety culture · Commitment · Organization · Ontology · Evaluation · Self-assessment · Company democracy · Model

1 Introduction

In nuclear power plants and process industry safety is the number one priority over profitability, productivity and performance. In such high-risk environments where individuals work independently their decisions can lead to dangerous situations to coworkers, organization or even to society. In these kinds of organizations employees' safety consciousness, collective safety culture and their commitment to the organization and occupational role becomes extremely important.

A strong safety culture and the employees' organizational commitment are tightly linked together and complement each other. A safety culture is an extensive, organization-wide approach to safety management and is the end result of joint individual and group efforts toward values, attitudes, goals and proficiency of an organization's health and safety program [1].

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The term Safety Culture is composed from the words ‘Safety’ and ‘Culture’. The key word in this term is the Culture which is applied in Safety. Without a culture safety efforts, projects, initiatives and activities would be static, predictable, finite and non-deterministic.

When a person is committed to the company and its values, he also commits to its safety values and overall safety culture is developing. On the other hand, if the company has a strong safety culture, it also reflects to the commitment of the employees. Organizational commitment, therefore, provides a direct or indirect effects of various features affecting safety, such as people’s levels of motivation [2].

Organizations with a safety culture show a deep concern for employee wellbeing which will lead to higher organizational commitment. According to Cooper [2] organizations with strong, clear cultures are associated with higher levels of employee commitment. A strong safety culture typically leads to organization having few at-risk behaviors, consequently they also experience low accident rates, low employee turn-over, low absenteeism, and high productivity [3].

In organizations with strong safety culture, everyone feels responsible for safety issues and tries to pursue them every day. Similarly, as employees with strong affective organizational commitment show “willingness to go beyond their immediate job requirements” for the sake of the organization, employees in organization with strong safety culture go beyond “the call of duty” to identify unsafe conditions and behaviors, and intervene to correct them [3]. Cooper [2] defines commitment to safety as ‘an individual’s identification with and involvement in safety activities’, characterized by a strong acceptance of and belief in the organization’s safety goals and a willingness to exert effort to improve safety in the workplace. This definition follows Porter et al. [4] definition of organizational commitment. According to their definition organizational commitment refers to “the relative strength of an individual’s identification with and involvement in a particular organization”, and also Rusbult and Farrell’s [5] definition of organizational commitment as the willingness to deploy extra effort, the desire to remain, and the acceptance of the goals and values of the organization.

Consequently, these two aspects of working life i.e. safety culture and commitment are very well connected to each other in the development of the company’s profitability and competitiveness as highly-committed employees are doing their best to help the company to be successful, and when a person is safety conscious and committed to the development and improvement of safety less costly accidents and at-risk behaviors are likely to happen, which in turn will boost the company’s profitability and performance.

A good safety culture can also contribute to competitiveness in many other ways. Cooper [2] gives example that positive safety culture is used to rate contractors in tendering processes and therefore can make the difference between winning or losing a contract. Also, strong safety culture can affect people’s way of thinking and lead to the development of safety features for some products which are then used as marketing devices to relay marketing messages to prospective customers; and it also positively impacts on employees’ commitment and loyalty to the organization, resulting in greater job satisfaction, productivity and reduced absenteeism [2].

It must be emphasized that the development of a comprehensive “safety culture” at all levels of an organization takes time, and it requires visible and consistent leadership from senior management [6]. It is frequently a multi-year continuous process to integrate safety as a value of the organization and to an integral part of daily operations [3]. However, Parker, Lawrie and Hudson [7] point out that safety culture can vary within the organization based on the size and complexity of modern organizations.

Because low commitment and low safety culture can create very difficult problems for organization it is very important for management and leadership to understand these complex concepts. To understand organizations collective degree of safety culture and the degree of commitment of the employees it is important to analyze employees individually to see what are their internal feelings, understanding and aims.

In this paper a multi-stage assessment process of these two important organizational characteristics that can contribute to organization's competitiveness; safety culture and organizational commitment is presented. This joint analysis is using newly developed Company Democracy Model (CDM) by Markopoulos and Vanharanta [8] and self-assessment based Evolute-methodology [9]. The Company Democracy Model considers the people to represent the most significant and valuable resources and assets that any organization has and supports high levels of individual commitment and motivation within the organization in the form of cooperation and inclusiveness regarding the decisions, plans and actions of the organization.

2 Hybrid Ontology Methodology

There is wide variety among organizations and people in their understanding of what "safety culture" and "organizational commitment" is and how to act to influence them in a positive way. It is also true that many individuals working in the field of safety do not know what a safety culture really is [2] even though they are talking about it. This is also without a doubt true for many managers who do not completely understand and realize what organizational commitment means and is comprised of and how to affect its development.

To understand, represent and evaluate these concepts we use ontologies. An ontology is an explicit specification of the conceptualization of a domain [10]. Ontologies define the common words and concepts (meanings) that describe and represent an area of knowledge [11]. Therefore, ontologies can explicitly define the meaning of concepts related both to safety culture and organizational commitment. By clarifying the conceptual structures of the concepts to all stakeholders, decisions are based on the proper and relevant information. This hybrid ontology-based approach aids understanding and managing the whole clearer than previous methods. Also, the changes become transparent and easy to visualize [12].

We have created two separate ontologies to evaluate these two concepts. In the Safety Culture model, there are 17 features and 51 statements, measuring different features of safety culture [13]. The statements specify an aspect of one or more features. According to Cooper's model, safety culture is an entity formed through externally observable and internally psychological factors, as well as the interaction between work, organization and people. According to the model, safety culture may be analyzed by examining three sub-groups: the management system of safety, safety atmosphere/climate and attitudes as well as behavior [14].

The Organizational Commitment/Engagement model, contains 59 features which are assessed with 237 statements. These features are categorized under relevant constructs, such as work motivation, job satisfaction, person-organization fit, perceptions of organizational support, and turnover intentions [15]. All the identified categories are grouped under the three main dimensions of organizational commitment—affective, continuance, and normative (cf. [16]).

By using statements employees evaluate themselves in current time and they also evaluate the level they wish or target for future. For example, they evaluate themselves regarding how engaged or motivated they are in the different aspects of their work and how committed they are to their organization [15]. The evaluation is made using the Internet-based Evolute assessment system [17, 18], in which the respondent compares the statement to linguistic labels on a continuous scale, meaning that there is a non-numerical scale for answering each statement. From the values of statements, with fuzzy logic deduction, each competence is given a single value. The difference of target and current states can be considered as the creative tension or proactive vision of the statement [19]. The bigger the gap between the current and future state, the higher the proactive vision for that feature, and the greater the potential to improve. According to Senge [20], the creative tension is the energy that can move an individual from the place of current reality towards the reality of his own vision.

We use the proactive vision as the proof of motivation and aspiration. For example, if there is big proactive vision for some feature of safety culture, then people are motivated to improve that competence or if there is a big creative tension in some feature of commitment then the employees wish to develop this aspect of human resource environment further. Therefore, it is also wise, from organization's point of view, to arrange education or possibilities to improve those characters as it is organizations aim to guide and support employees' personal growth, development, and personal vision, in order to improve their core competencies according to the competitive pressures of the business world [21].

3 Management and Leadership Patterns and Process

3.1 Process for Occupational Commitment and Safety Culture Evaluation

Personnel consultation involves listening as well as considering the views of employees before decisions are made. One type of consulting method is the usage of self-evaluation. Self-evaluation takes place through an examination of one's own thoughts and feelings i.e., introspection. An individual doing self-evaluation can be seen as an autopoietic (self-defining) system: he or she defines himself/herself at work in the surrounding organization. A person can also evaluate an object in his or her situation, i.e. external business process by making a bottom-up extroversion of a chosen business process [22].

According to Nurminen [23] self-evaluation is an efficient method to develop oneself, manage personal growth, clarify roles, and commit to project related goals. The process of self-evaluation is a way of providing a type of formal structure to the development of organizational characteristic such as safety culture and organizational commitment. In the case of self-evaluation, the degree of its accuracy depends on whether the individuals want to evaluate themselves, and whether they do it with sufficient care to be beneficial for the purpose [24].

This research utilizes ontology-based self-evaluation [24] using Internet-based Evolute-environment. According to Barraclough and Carnino [6], self-evaluation of safety culture is a way to promote safety performance through the direct involvement of personnel in the critical examination and improvement of their own work. Involving personnel in the evaluation process can lead to better understanding of safety culture (in relation both to their own jobs and the organization), a broadening of knowledge of the objectives to be achieved, and the ways for achieving them.

Similarly, by asking employees to evaluate themselves regarding factors related to their commitment and engagement organization gives clear sign that they value employees' own feeling and opinions. However, this requires management to act based on the results of the evaluation. After the evaluation is conducted, employees are interested in results and how their collective opinions are utilized in decision making and put into practice. According to Ackoff [25], the values of those affected by the decision should be taken into account in a decision-making process. By consulting employees in decision-making processes, for example, by using evaluation results, makes them to feel that they are being heard, which may instill a sense of ownership over the outcomes [26]. If nothing is made accordingly, employees' engagement is likely to drop, which also makes such future project less likely to succeed because of employees increased feelings of not caring to participate such surveys.

The research methodology combines different methods to attain real situation-aware computing, to define the degree of commitment as well as the safety culture. The process focuses on covering both past and current data as well as current information in obtaining an idea of how people evaluate organizational environment regarding safety culture and sources of commitment and engagement towards their own company at present and in the future (see Fig. 1). The basic principle is to try to uncover how people view their company in their minds [22]. This evaluation is done by two ontology-based self-evaluation applications described in previous chapter.

In general, it is important first to understand the needs as well as the current state of the organization before targeting new organizational targets and expectations. This kind of proactive vision, created with the people inside the organization, gives the people the capability to collaborate and develop state of organization in harmony with top leaders and executives. The methodology, as well as the computer applications, supports the idea of evaluating the ontology in both its current and future state. This way, it is possible to capture the creative tension described by the test subjects of the human object ontologies as well as the future proactive vision from business object ontologies [24]. Therefore, by analyzing people's behavioral patterns in their work, meetings, decisions, and other activities, very important information can be gained about their past, to justify their present and forecast their future (see Fig. 1).

After the personnel evaluations are conducted the Evolute system has uncovered the overall collective picture of the company's safety culture and its employees' commitment and engagement towards the company. It leads off from the individual level towards the collective organizational level. The collective evaluations are

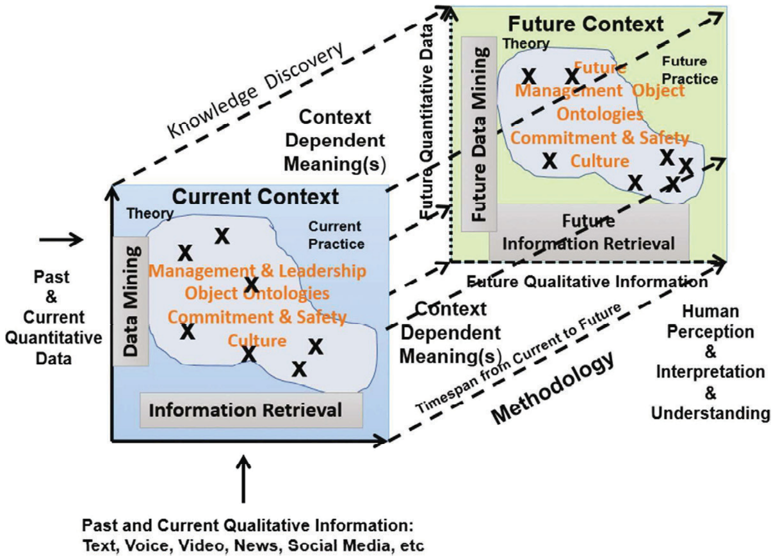

Fig. 1. Creation of context dependent meanings

analyzed and the priorities and creative tensions are calculated. This type of analysis follows principles of democratic company behavior making the analysis open which is important in the positive development of safety culture and commitment. According to Slater and Bennis [27] democracy is the only system that can successfully manage the changing demands of contemporary civilization in business, as well as in government.

In order for the organization to define a common language and establish a common understanding managers and leaders must know the constructs and concepts as well as the indicators thoroughly, so that they can manage and lead these fuzzy concepts in their organization and observe how changes occur through key figures. Therefore, democratic learning of these concepts is important because it allows all individuals, managers as well as other employees, to think through these concepts themselves and learn while giving important information for the organization.

The developed approach enables a comparison between desired future and current states. Also, asymmetries among respondents can be revealed, which is crucial information from a safety culture as well as commitment point of view. The assessment identifies the distance between the "as-is" and the "to-be" in the evaluated concepts. The assessment can also define the actions, priorities, effort cost and specific human recourses needed.

This is precisely the information, data and knowledge that is required for the management and leadership of these difficult concepts. We place this to the situation-aware computing area. The results of the test runs help us to create then a present situation-aware synthesis of meanings (See Fig. 2).

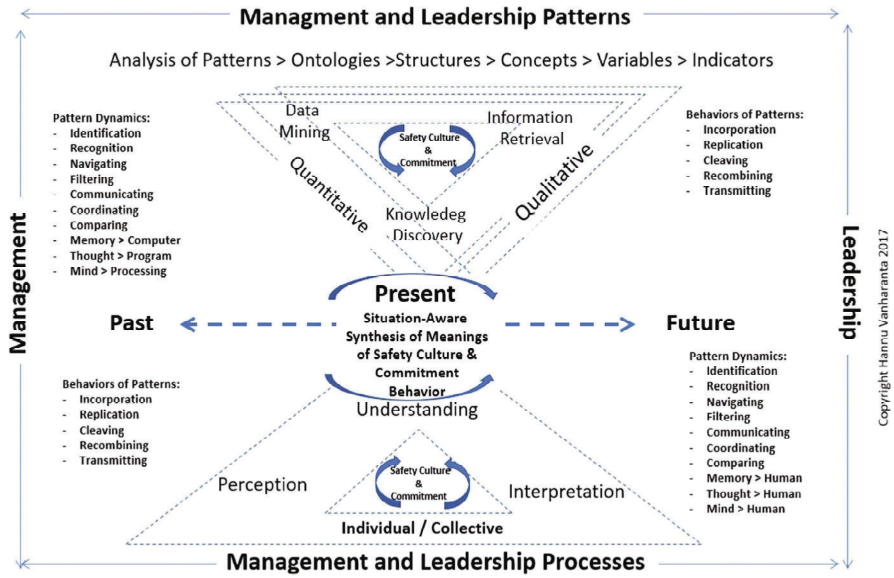

Fig. 2. Situation-aware computing through ontologies

The assessment results need to be implemented and executed towards reaching the development of the organizational human resource environment and strategy and operations framework.

3.2 Collective Understanding Through Company Democracy Model

The Company Democracy model is an applied philosophy model based on the creation of organizational culture that identifies, extracts, and utilizes knowledge in a collective way for the benefit of all [28]. The co-evolutionary spiral method in the model contributes towards the identification and achievement of the capacity, capability, competence, and maturity needed to turn information and knowledge into innovations. The spiral process, in this context, is based on the idea of the degree of democracy in organizations. The model is structured in such a way that the method reflects the Co-Evolute methodology [21] and its application in organizational democratic performance. Both organizational development methodologies (Co-Evolute and the Company Democracy Spiral Method) are aimed at the creation of an organizational knowledge-based culture [29, 30]. Both methods utilize organizational knowledge by developing a knowledge-based organizational culture that can constantly contribute to the organization by transforming organizational tacit knowledge into explicit knowledge [10].

The Company Democracy Spiral Method levels form a pyramid structure. The pyramid shape has been chosen to point out the incremental progression of the levels

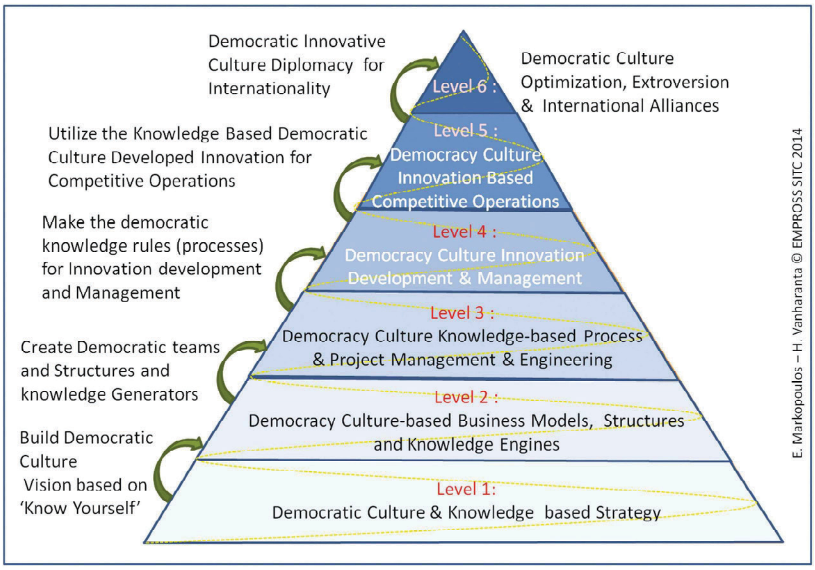

Fig. 3. The company democracy model with pyramid stages

and to illustrate that not all who attempt this route can reach the top without real commitment, determination, and organizational capability and maturity (Fig. 3).

The Company Democracy levels provide the actions to be processed to proceed towards the identification of the degree of company democracy through a new pyramid-type representation based on the individual and collective evolution dimensions (Fig. 4).

The individual side of the pyramid can remember and see the past inaccessible part of the company democracy process, which may be accessible today and in the future. From a collective point of view, the democratic company culture basis must be firm, the created paradigm must contain all the known information, and the democratic company culture must be understood, interpreted, and perceived by each company member. Therefore, for an organization, it is important first to understand the current degree of democracy and how this degree should be improved over time, through democratically oriented changes.

As an example, by applying the model to Safety Culture, the levels can determine the evolution of the safety culture in the organization and indicative strategic goals archived in each level (Fig. 5).

The first level of the Democratic Safety Culture establishes the culture via democratic processes where all people can propose, comment, suggest, think, and contribute in a dynamic and continuous safety culture framework. The second level generates the safety knowledge that derives from the democratic culture. The thirds level applies the safety knowledge in the organization via new processes, practices, projects and initiatives. The fourth level utilizes the results of the application of the safety knowledge via innovation generated from the effective application of the knowledge. The fifth

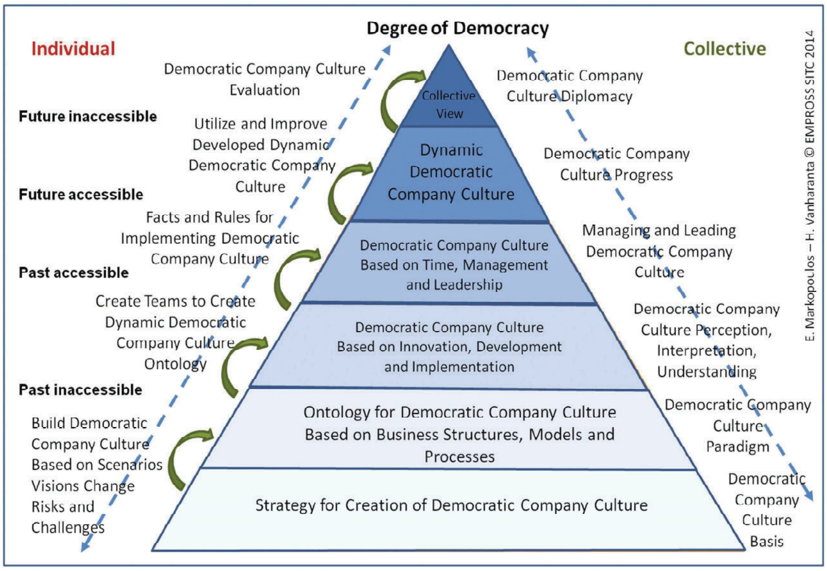

Fig. 4. Co-evolutionary spiral process for dynamic democratic company culture development

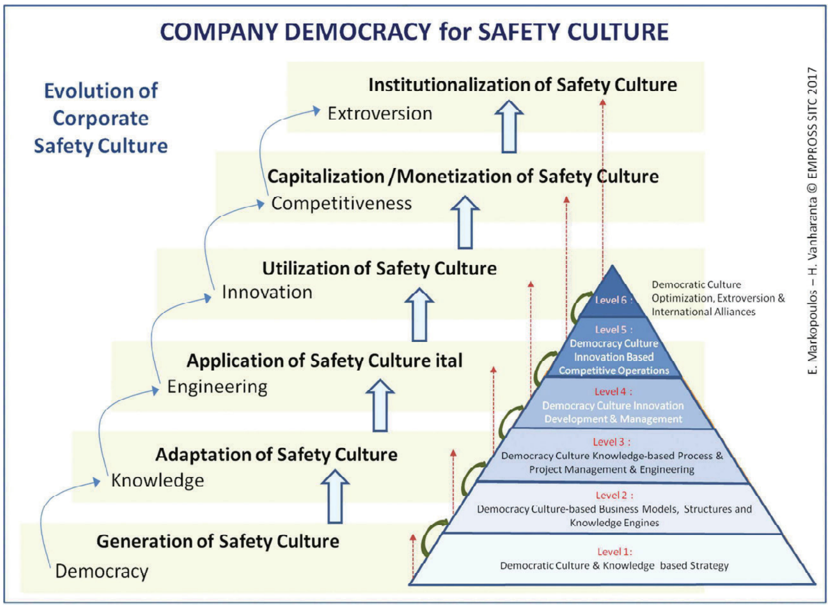

Fig. 5. Evolutionary of the safety culture through the company democracy model

level capitalizes in financial terms and in profit generation, the knowledge and the effectiveness of the safety culture. The sixth level institutionalizes the safety knowledge and exports its added value to the society, the economy and the market. The six levels are repeated over and over (via the spiral theory) as the safety knowledge targets can be expanded or rolled out in an organization.

3.3 Application Technology Behind the Evaluation Method

People are not good at making precise yet significant statements about a complex system's behavior [31]. This means that accurate observations cannot be made about safety culture and commitment. These concepts take place in complex social systems that involve many humans and other system parts.

Fuzziness in linguistics can be captured by creating linguistic variables that "contain" fuzzy sets [32, 33]. Fuzzy sets represent complex systems, such as safety culture and commitment, better than crisp sets for two reasons: (1) the predicates in propositions that represent a system don't have crisp denotations; (2) explicit and implicit quantifiers are fuzzy [34]. A fuzzy set can be defined mathematically by assigning to each possible individual in the universe of discourse a value that represents its grade of membership in the fuzzy set. This grade corresponds to the degree to which that individual is similar to or compatible with the concept represented by the fuzzy set [35]. In this work, the perception of different aspects of safety culture and commitment becomes a degree of membership in fuzzy sets. Just like in real life, everything is a matter of degree. Linguistic variables bridge the gap between the numerical space and the meaning in the human mind. This means that meaning-based research and tools can be developed in numerical space.

Fuzzy logic [31] allows reasoning using fuzzy sets and fuzzy rules. A translation system represents the meaning of semantic entities, and an inferential system arrives at an answer to a question that relates to the information resident in a knowledge base [34]. The knowledge base refers to the concepts (ontology) of safety culture and commitment in this case. A fuzzy logic application resembles an expert's task to evaluate and reason based on linguistic information.

4 Conclusions

As seen from the research these ontologies and applications support each other and the subject discussed requires extensive learning from organizations both from the content of a safety culture and the content of the organizational commitment and engagement.

There is a strong evidence that competence-based self-evaluation applications, i.e. human- compatible systems, clearly recognize individuals' own current reality and their needs for professional and personal development. We can show the collective feeling among the respondents, how they felt right at that moment, and where they feel there is most room for improvement. Based on the individuals' current and future visions, human resource development and other action plans of the company can then be done in a much more targeted way and also the future competence paths can be simulated. The applications show clearly the priorities that the organization should put their mind into and work together to develop and improve.

The aim of the evaluations is to advance people's knowledge about the subjects and at the same time improve safety culture through commitment and vice versa in interactive manner via connections between the ontologies. By combining the top-down management view with bottom-up understanding, it is possible to control, steer and command both the financial and the human resources to the targeted objectives and goals.

The evaluation runs must be made from time to time and by examining the result appropriate resources should be allocated to improve these and the whole organization.

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