Diversity and Innovation Management in Large Research Groups

Linda Steuer[1*], Mamta Sharma[2], Wolfgang Bleck[3], and Carmen Leicht-Scholten[4]
Research Group Gender and Diversity in Engineering (GDI),[1,4]
Steel Institute (IEHK),[2,3]
RWTH Aachen University, Germany
linda.steuer@gdi.rwth-aachen.de[1], Mamta.Sharma@iehk.rwth-aachen.de[2]
bleck@iehk.rwth-aachen.de[3], carmen.leicht@gdi.rwth-aachen.de[4]
**Corresponding Author*

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Abstract

Contemporary research appreciates a diverse workforce as a potential source of innovation. Researchers explore the fine details of why diversity management is central for generating innovations in heterogeneous research groups and how it could be effectively implemented into organizations. Complex research associations that discuss topics with a high impact on society increasingly address the necessity of establishing a diverse workforce to confront the challenges of tomorrow. Characterized by complex management structures as well as hierarchies, research associations have not been a subject of investigation until now. For this reason, the presented research project aims to develop a diversity and innovation management strategy with the ultimate goal of inducing change in the corporate culture. The proposed approach consisted of six phases; the first two phases investigated the status quo of diversity in the existing organizational structures of member institutes and the variety of particular working cultures within the research association. The third and the fourth phases utilized qualitative and quantitative studies. The third phase focused on the connection of management level to diversity and innovation, and the need for diversity and innovation management, and tailor-made methods of implementing them. The first three phases have been accomplished successfully; preliminary results are already available. The fourth phase will mainly focus on exploring the mind-set of the employees. The fifth phase will consolidate the findings in the first four phases into an implementable strategy. The final phase will address the implementation of this strategy into the organization. Phases 4 to 6 have not yet been undertaken.

Keywords: Diversity management, innovation management, research association, change management, engineering

1. Introduction

The potential of a diverse workforce and its positive effect on innovation processes is broadly scientifically discussed. Various studies have shown evidence on the positive impact of different forms of diversity (Østergaard, Timmermans & Kristinsson, 2011; Hewlett, Marshall & Sherbin, 2013; Hoogendoorn, Oosterbeek & van Praag, 2013; McKinsey, 2015). For this reason, companies of the private sector increasingly strive to incorporate and implement a diversity management strategy as part of their corporate governance (Aretz & Hansen, 2002; Aretz & Hansen, 2003a; Köppel, 2012). Scientific organizations also increasingly make the potential of diversity a topic of discussion. Further, the German Research Foundation (DFG) promotes diversity in the scientific system as an indicator for excellent research (DFG, 2015). Since the focus of scientific organizations is mostly on scientific issues that

have a high impact on all social levels, there seems to be a need for diverse perspectives, especially when it comes to scientific development processes. For this reason, big research organizations increasingly address the need for establishing a diverse workforce to be more innovative (Philips, 2014). One example is the establishment of the Clusters of Excellence (CoE) in Germany. Jointly managed by the German Council of Science and Humanities together with the German Research Foundation (DFG), the Clusters of Excellence are interdisciplinary research organizations that involve topics with a high social and economic impact. In addition to their importance for the society, they are key drivers of the Excellence Initiative and German elite universities. The Excellence Initiative is a central element of the German scientific system. (DFG, 2016)

Despite the potential of diversity in the context of innovation, studies that suggest implementation of management strategies tailored to the needs, external such as internal influencing factors of research associations are virtually non-existent. This results from the fact that concepts for the implementation of strategies for diversity and innovation management are focused on specific organizational structures and are based on the requirements of the private sector (Walther, 2004; Dömötör, 2011; Strobel & Kratzer, 2017). Furthermore, organizational efforts to manage diversity focus almost exclusively on equal opportunity, and neglect to take measures that would actively stimulate the realization of the true value of diversity and lead to innovation (Ely & Thomas, 2001; van Knippenberg, Homan & Ginkel, 2012). With regard to the challenges posed by globalization as well as the resulting need for diverse competencies and profiles, global-acting institutions with mono-cultural attitudes appear to be rigid, past-oriented, and not adaptable (Hansen, 2002; Horx, 2011). With respect to accelerated economic dynamics with growing change and innovation pressure, there is a necessity to use the resources of human capital effectively and efficiently.

The proposed project "Diversity and Innovation Management in Large Research Groups" is designed to put a greater emphasis on actively pursuing the benefits of gender, cultural/ethnical and disciplinary diversity as an informational resource resulting in greater team innovation. These diversity categories are from the results of the educational tasks of the Clusters of Excellence and from the streamlining of scientific working groups. This project is a part of the Cluster of Excellence "Integrative Production Technology for High-Wage Countries" at the Rhine Westphalia University of Technology Aachen (RWTH). It aims to develop a strategy that will lead to a corporate cultural change towards the reflection of diversity as a driver for innovation. The underlying thesis is that due to the scientific system, cluster-specific frameworks and structures require an approach that will strongly consider all influencing factors to achieve long-term success.

To establish a continuous improvement process, specific measures tailored to the organization and its structures are needed. Furthermore, evaluation tools must be developed to ensure a sustainable change from a long-term perspective. This is to pursue the goal of improving and increasing gender, cultural/ethnical, and disciplinary diversities.

This paper chose a conceptual approach for its research design. After the presentation of the current state of research, the diversity and innovation management approach as well as the different steps of strategy development will be discussed. Next, initial tendencies, which refer to the first research results, will be shown and an outlook will be presented.

2. Literature Review

A large part of innovative work in the present business world is not carried out by individuals, but by teams (Edmondson & Nembhard, 2009). Any group in business

or in research is assessed based on its success. Depending on the type of work, success is measured differently. For numerous enterprises, innovations represent a central element of their corporate strategy (von Ahsen, Heesen & Kuchenbuch, 2009; Götzenauer, 2010). In addition to economic indicators such as profit, productivity and competitiveness, innovation is the one characteristic that defines successful businesses (Staroske, 2000; Schmeisser et al., 2008; Hauschildt et al, 2016).

To understand the challenges of implementing diversity and innovation management into an organization, it is essential to keep the different dimensions of the term 'diversity' in mind. Diversity itself is a complex, eclectic parameter that can be defined in several different ways. At least two main types of diversity attributes are commonly distinguished: more visible ones such as race, ethnicity, age, gender and physical disabilities; and less visible ones such as education, skills and abilities, values and attitudes, tenure in organization, functional background, personality differences and sexual orientation (Jackson, May & Whitney, 1995).

A study by Gardenswartz and Rowe (1998) provided another perspective and came up with the "four layers of diversity". In their framework, they divided diversity categories into: (1) dimensions of personality; (2) internal dimensions (e.g. age, race, gender); (3) external dimensions (income, religion); and (4) organizational dimensions (department, work location). Dimensions of personality include an individual's values and beliefs; the internal dimension includes characteristics which are not changeable or require a high amount of effort to change; the external dimension involves aspects that are controllable; and the organizational dimensions are those aspects that are easily changeable. (Collins, 2009)

Following, research on the potential, as well as challenging aspects of diversity is briefly presented in the section. The context between diversity and structural factors that have an impact on the diversity and innovation management strategy will also be discussed.

2.1 Potential of a Diverse Work Force

The reports of Caye et al. (2011), the European Community (Focus Consultancy, 2010), and Rizy, Feil and Sniderman (2011), argued that there is a need for diversity in business and that benefits can be earned from it. Modern customers vary strongly in their behaviors, values, priorities, age, gender and other dimensions of diversity; therefore, a good mix of employees is necessary to cater to them. Additionally, scarcity of talent makes it indispensable to recruit from diverse groups. Heterogeneous teams are of special value when the tasks are cognitively complex and demand multiple viewpoints because such teams have a broader range of knowledge, expertise and perspectives (Hoffman, 1958). Diverse teams also exhibit greater creativity (Triandis, Hall & Ewen, 1965). With a focus on innovation, the presence of women in the top management can improve the company's performance due to information and social diversity which can increase motivation in women in the middle management (Dezsö & Ross, 2014). Studies in science and higher education have indicated an increase in productivity and creativity in culturally diverse teams, whose members differ in education and academic discipline (Santandreu Calonge & Safiulli, 2015). Age diversity can be a valuable asset and resource, influencing both individual and team performance (Pitt-Catsouphes, Mirvis & Berzin, 2013). Baldridge and Burnham (1975) indicated the positive effects of functional differentiation in organizations which lead to the collaboration of professionals from different fields resulting to improvements in the administrative systems. Functional diversity in teams in terms of specialists working together can lead to much improved products compared to isolated work (Ribberstrom, 2013).

Team diversity in organizations ultimately influences turnover and performance via its effect on cognitive, commu-

nicative, and symbolic processes (Milliken & Martins, 1996).

Diversity has been reported to be beneficial in encouraging innovation in business and in education which have been mentioned frequently in literature. An example is the study by Bantel and Jackson (1989), who examined the relationship between social composition of top management teams and innovation adoptions in a sample of 199 banks. How-ever, not all forms of diversity have the same effects. Based on econometric analysis in the study by Østergaard, Timmermans and Kristinsson (2011), gender diversity and educationally diverse backgrounds can lead to innovation, but age diversity does not. Moreover, ethnicity as a single diversity category does not significantly affect the innovation potential of companies. To implement a diversity and innovation management strategy it is necessary to reflect on the potential challenges and on how to address these challenges.

2.2 Challenging Aspects of Diversity

Despite the abovementioned potential of diversity, heterogeneity also involves challenges that must be taken into account; employee diversity correlates with the need for active exchange and coordination to avoid misunderstandings and conflicts in order for the team to become successful (Díaz-García, González-Moreno & Sáez-Martínez, 2013). It requires overcoming initial friction and conflicts resulting from different points of view (Ribberstrom, 2013). This is consistent with the work of Pelled, Eisenhardt and Xin (1999), suggesting that diversity in functional background can cause task conflicts. The need for the management of available diverse workforce is also pointed out by Bassett-Jones (2005), stating that diversity, although being a source of creativity and innovation leading to competitive advantages, could also cause misunderstanding, suspicion and conflict in the workplace, resulting in absenteeism, poor output quality, low morale and loss of competitiveness; hence, Andersen and Moynihan (2016) described diversity as a 'double-edged sword'. Pelled, Eisenhardt and Xin (1999) found that different forms of diversity shape different types of conflicts, and that conflict ultimately shapes team performance. Depending on task routineness and group longevity (mediators), diversity in race and tenure could lead to emotional conflict; whereas, age diversity does not.

Because diversity management is often accompanied by a change (Davis, Frolova & Callahan, 2016), it is important to consider the psychological aspects of change management (Graetz et al., 2012). For this reason, the active communication of the project goal by the management, as well as the involvement of employees in achieving the same goal, play an important role in integrating a diversity and innovation management strategy into research networks and enterprises (Kotter, 2011; Leicht-Scholten, 2012).

2.3 Structural Influencing Factors

The role of leaders in managing diverse groups cannot be undermined. Irrespective of whether a group is ethnically homogeneous or heterogeneous, innovation of a team is at its highest when supervisors are perceived as being highly collaborative in conflict management (Reade and Lee 2016). Multicultural team leaders with high global identity encourage better team communication and inclusion in diverse working groups, and thus reap the benefits of diversity (Lisak et al., 2016). Sánchez, Sánchez and Escribá (2010) found that managerial team heterogeneity has a positive impact on strategic changes. They argued that the identification of existing misfits between the enterprise and its environment is easier in these teams. With increasing diversity in the workforce, the command-and-control leadership will become outdated, and modern leaders will have to be influential rather than hierarchical in order to be effective enablers (Caye et al., 2011). Presence of hierarchical levels in an organization can hinder the flow of innovative ideas because of the increase in the number of communication

links, resulting in lower innovation (Hull & Hage, 1982). Centralization of decision-making is also known to prevent innovation (Thompson, 1965). On the other hand, less rigorous working rules (Burns & Stalker, 1961; Thompson, 1965), flexibility and openness (Pierce & Delbecq, 1977) encourage the generation of novel ideas.

Effects of diversity on innovation also depend on the group size (Weiss & Hoegl, 2016). Studies show that team effectiveness as well as team processes are significantly related to the size of the team (Díaz-García, González-Moreno & Sáez-Martínez, 2013).

Communication, both external and internal, is another parameter that influences innovation. Internal communication helps disperse novel ideas within an organization and combine them with other ideas (Aiken & Hage, 1971) which help them be sustained (Ross 1974). External communication can promote exchange of innovative ideas between organizations (Tushman, 1977). Drach-Zahavy and Somech (2001) concluded that mutual willingness among heterogeneous team members to interact (via information exchange, learning, motivating and negotiating) is one of the keys to generate innovation based on team diversity.

3. Method: Developing a Diversity and Innovation Management Strategy for a Research Association

In developing a diversity and innovation management strategy for a research aggregate such as the Cluster of Excellence (CoE), a framework that considers the aforementioned potentials, challenges and structural influencing factors is required. As the literature review shows, diversity dimensions have an impact on organizational structures such as teamwork and leadership. Conversely, this means that successful implementation of a strategy requires consideration of existing values, norms and beliefs that characterize an organization.

In the following, the conceptual framework for developing a diversity and innovation management strategy for a research association will be described. Based on different diversity management approaches, key indicators that allow the development of a diversity and innovation management strategy with a holistic system and theoretically-oriented focus will be identified.

3.1 Conceptual Framework for Investigating a Complex Research Association

Klaffke (2009) noted that in the light of their individual strategic objectives, organizations have to consider how competitive advantages can be created by diversifying the employees. This means that management strategies must be developed in a manner that is specific to the organization, taking circumstances into account to ensure a successful implementation.

Klaffke's approach, the "3-S-Diversity Model", is composed of the following elements: skills, structure and strategy, which stand in an equivalent relation to the culture of diversity. The element Skills summarizes an appreciative attitude with a corresponding mind-set and measures to achieve this. This also encompasses the assignment of competences with regard to leadership and cooperation into diversity structures. The intention is that employees understand the range of possible individuality among the differentiated aspects of personality and competence under the influence of cultural, social, private, and organizational environments (Aretz & Hansen, 2003b). The pillar Structure stands for the targeted adjustment of instruments and processes such as recruitment policies. This element requires a strong integration in the management level. The commitment to the diversity strategy is manifested by defining target values and measurable goals. The third component Strategy stands for implemented concepts that lead to an organization considering both the organization's need for diversity, and an individual's need to be included in a diverse organization (Klaffke, 2009).

Aretz and Hansen (2002) stated that a system-theoretically oriented approach

takes organization-specific structures like hierarchy levels, recruitment processes and leadership concepts into account. They pointed out that diversity management goes beyond merely increasing diversity quotas and tolerance; it should aim at achieving long-term changes in appreciating diversity and its subsequent potentials. They also viewed diversity management in the perspective of entrepreneurial structures by assuming that the impact of a complex environment requires internal complexity. This internal complexity is mirrored in a functional differentiation of subsystems that are tailored to the external environment while other subsystems are focused on the internal environment. Furthermore, these systems can be distinguished in those which provide intangible resources and those which supply tangible ones. This resulted in the four types of subsystems (shown in Figure 1) which are commonly used in the private industry and are described in detail below.

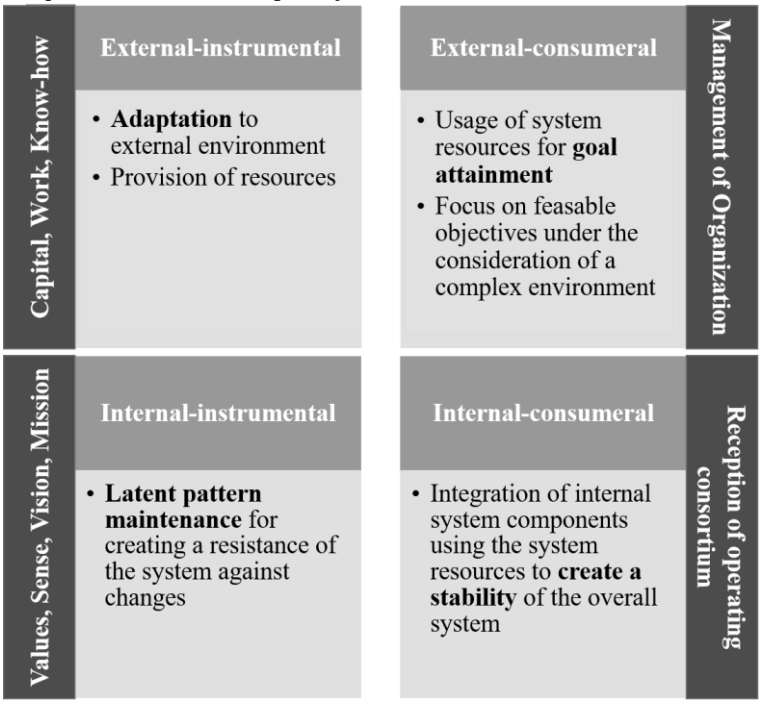

Figure 1: Entrepreneurial Frame:
Subsystems and their Functional Tasks by Aretz and Hansen (2003)

"External-instrumental" subsystem describes the provision of resources to establish diversity. Employees need both time and knowledge to actively deal with changes and requirements. It is suggested that both resources could be provided through employee trainings that enhances knowledge and internal competencies. Furthermore, establishment of incentive systems and target agreements are other ways that could provide resources that support the implementation of diversity management and an appropriate corporate culture.

The "External-consumeral" subsystem deals with the active usage of system resources to fulfill intended goals. The core of this dimension is the organizational action and thus, the organizational responsibility. The top-down representation of corporate values and culture is highly important especially for the implementation of diversity management. Measures should be linked to corporate strategies and targets since diversity management depends on the

institutions' organizational framework. In this context, human-resource contentions, market access contentions, creativity contentions, cost contentions and problem solving contentions have to be considered.

The "Internal-instrumental" subsystem states that diversity management should be a part of the corporate's vision and values to become fully integrated. As part of the corporate's identity, a clear definition of diversity and diversity management is necessary to enable its members to work together under those specific corporate structures. Especially at the beginning of the implementation process, it is necessary to train employees and to stimulate a critical reflection of the management strategy; therefore, it is essential to make potentials, as well as challenges in the context of diversity, a subject of discussion.

The "Internal-consumeral" subsystem describes that diversity management will be successful when measures are internalized by the system. This means that diversity must be integrated holistically into the entire organization in a context-sensitive way by considering processes, corporate strategies and organizational structures. To avoid the formation of subgroups, the management level, is again, of prime importance.

Lastly, the "Internal-consumeral" subsystem states that the management level has to objectively justify the strategy and connect it with the stakeholders' and shareholders' perspectives.

Cox (2001) considered the process in a more human-centered perspective. In his model, he defined different elements that need to be considered when implementing a diversity management in an enterprise. From his point of view, a successful change requires the involvement of the following elements: (1) Leadership; (2) Research and Measurement; (3) Education; (4) Alignment of Management; and (5) Follow-up. These elements are further discussed in the succeeding paragraphs.

Under "Leadership", Cox (2001) stated that change must be introduced by the management in a top-down approach. Managers must exemplify and define corporate values, aims and directions. In the staff level, a recent theoretical analysis suggests that the key to benefiting from diversity, such as gender, lies in the team members' diversity mind-sets. In this context, mind-set refers to employees' mental representation of diversity which is reflected on how they engage and inter-act with a team composed of diverse members (van Knippenberg, van Ginkel & Homan, 2013). The corporate culture shapes the mind-sets of its employees. Specific behaviours exhibited by the management lead to imitation of the same behaviours byemployees of all hierarchy levels (Marshall & McLean, 1985). Especially with regard to a change of an existing corporate culture, prevailing mind-sets need to be considered to prevent reactance and rejection; therefore, new diversity and innovation management should be linked to corporate strategies and guiding principles. The active communication of the necessity to establish a management strategy that takes diversity into consideration is an important milestone for its successful implementation (Schwarz-Wölzl & Maad, 2014).

The "Research & Measurement" element aims at data collection that allows the quantitative structure of an enterprise to be captured. For example, the demographic data of employees and confidence of customers and employees are analyzed and used as a basis for a diversity and innovation management strategy that is tailored to the organization. This allows the prevailing management strategies and personnel policies to be reflected on the management strategy (Ditzel, 2015)

All factors identified from specific indicators during the research phase that need immediate action has to be acted upon by employees throughout all hierarchical levels is necessary in order to achieve a successful organizational change (Kotter, 2011).

The "Alignment of Management" considers structures and processes of hu-

man resource management. To achieve a sustainable use of the potential of diversity during creation of innovation, processes have to be adjusted to this strategy. This implies the adaption of recruitment processes, personnel branding and marketing (Ditzel, 2015).

The "Follow-Up" element aims to achieve a continuous improvement process and to control all measures. According to Cox (2001), the change process is "[…] continually accessed and refined over time in a process of continuous loop learning". Establishing tools that measure the success of diversity and innovation management are important to identify barriers and adjust measures accordingly during the early phase of implementation. Instruments such as the Diversity Scorecard, the development of enterprise-specific key figures and an Open Balanced Scorecard are appropriate to measure success (Hermann-Pillath, 2009).

Taking the described aspects into account, a structured and transparent development and implementation of a management strategy is of particular importance.

3.2 Research Design for Developing a Diversity and Innovation Management Strategy for a Research Association

Based on Cox (2001), Aretz and Hansen (2002, 2003a, b), and Klaffke (2009), the constructive handling of diversity in organizations must be understood and anchored as a leadership task. The transparent integration of a corresponding project into the organizational structure and the explicit support of the organizational management are important to achieve openness towards the project (Vedder, 2009). Because of their specific environmental requirements, this is even more challenging to implement in a research institutions (Leicht-Scholten, 2011). For this reason, this project is structurally supported by the Management Board of the Cluster of Excellence's "Integrative Production Technology for High-Wage Countries" which advocates for the implementation of a diversity management strategy for promoting innovation. Due to the structural as well as conceptual role of the project and the consideration of the Cluster of Excellence as a unified organization, the project was assessed in the so-called Cross-Sectional Processes (CSP), which mainly focus on collaboration processes within the Cluster of Excellence (CoE "Integrative Production Technology for High-Wage Countries, 2017). With regard to the collaboration, employees, structures and results were considered. Considering the research question, the conceptual framework of the research project focuses on the following diversity categories: (1) gender, (2) specialization and educational background/ discipline, and (3) interculturality. These factors were positively discussed in the innovation context (Østergaard, Timmermans and Kristinsson, 2011; Díaz-García, González-Moreno & Sáez-Martínez, 2013; Lisak et al., 2016).

The different steps of an approach that lead to an organization specific diversity and innovation management strategy for a big research association are described in the succeeding paragraphs. The concept is based on the approaches of Cox (2001), Aretz and Hansen (2002, 2003a, b), and Klaffke (2009). The "Research and Measurement" of Cox as the special requirement for a big research association is not entirely comparable to those of an enterprise and thus, needs a detailed investigation. Figure 2 illustrates the different phases of the pursued research approach in the context of Klaffke's (2009) pillars.

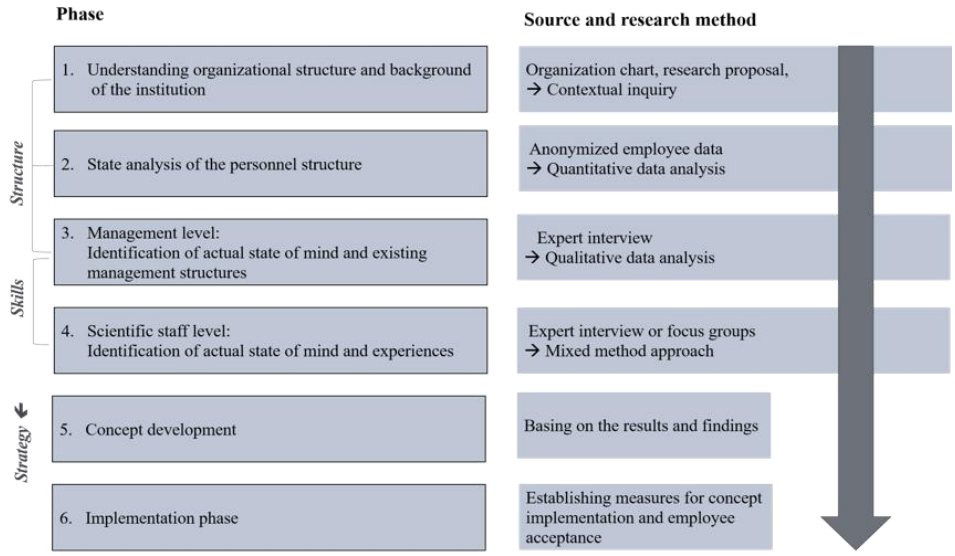

Figure 2: Six Phases of Corporate Culture Change

Phase 1: Organizational Structure and Background of the Institution.

To develop a customized diversity management strategy, it is crucial to understand not only the whole research association with its given structures and processes, but also the background and environment of the institution.

Considering Aretz and Hansens (2002, 2003a, b) model of a system-theoretically oriented approach, in company's context, subsystems that are applicable to a research institution can be derived and are shown in Figure 3. The first phase was focused on the external factors which can hardly or cannot be influenced by the Cluster Management at all. Internal structures were considered in Phase 2 and Phase 3.

"Cluster-external" patterns and frames are based on the existence of submanagement levels in institutions. Defined as competitive research and educational institutions, the Clusters of Excellence are conglomerates of different specialists and researchers coming from various faculties and research institutions (DFG, 2014). They have been established in the frame of the so-called Excellence Initiative of the German federal and state governments, the German Research Foundation (DFG) and German Council of Science and Humanities (DFG, 2016). These research networks are often highly complex, especially with regard to authorities assigned to issue directives. Furthermore, the university chairs and research organizations are characterized by their individual leadership styles and management structures and a great autonomy in structure and management which results from the independency of science. This aspect represents a fundamental structural difference from the implementation of diversity and innovation management strategies in research groups as individualized personnel management and open and learnable corporate structures represent core aspects of applied diversity management (Aretz & Hansen, 2003b). The independency of these institutions results in inconsistent recruitment processes, approaches in human resource management and handling of diversity and innovation processes. The heterogeneity of existing approaches requires a detailed investigation to enable a link to existing structures.

In addition, the Clusters are established as organizations with a high international visibility, and function as scientific networks among the participating institutions such as universities, professorial

chairs and research institutes (DFG, 2014). Due to the organizational anchorage of professorial chairs to specific faculties, the entrepreneurial background of research institutes, such as the Frauenhofer-Gesellschaft (2017), and the strong linkage to universities, Clusters are characterized by complex organizational structures. These structures differ from entrepreneurial structures especially with regard to authority in the underlying habits and working routines, accountability and corporate culture. As a consequence, the conditions for the establishment of a diversity and innovation management strategy differ considerably from those of private enterprises. The complexity of the Cluster of Excellence "Integrative Production Technology for High-Wage Countries" at RWTH Aachen University is comparable to multi-layered organizational structures of economic enterprises.

"Organization-external" patterns and frameworks include the influence of university management and faculties of organizational institutions. Embedded into the educational sector, Clusters of Excellence are influenced by the requirements of their environment. In Germany, lectureship and research are combined and have to be conducted by each institute. This results in a variety of task-fields for the workers. Because of this, researchers have to fulfill educational tasks, train junior managers, and fulfill duties for their research assignment.

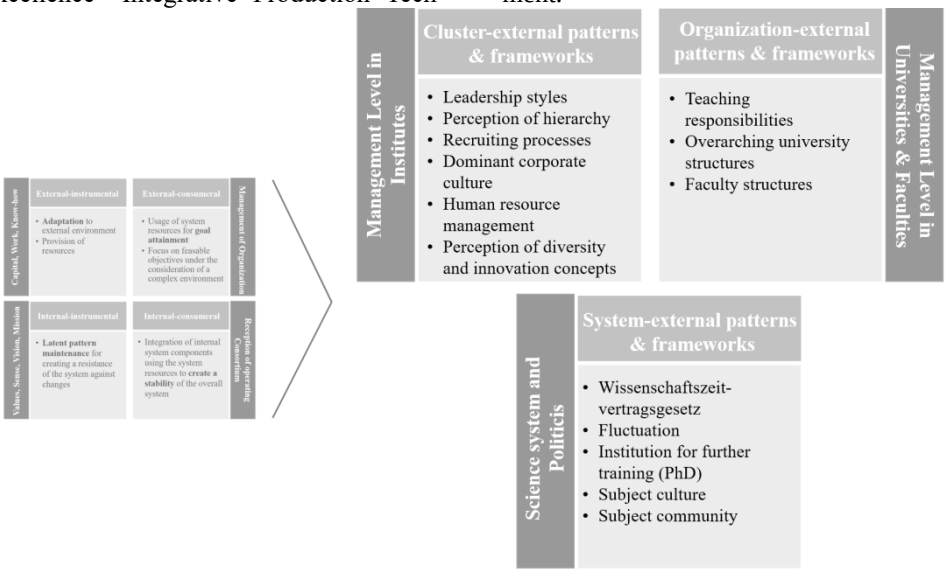

Figure 3: Subsystems of research organizations

With regard to "System-external" aspects, it must be considered that employees are embedded in their respective specialist/scientific culture. This means that, in comparison with companies that have a corporate culture and a superior common goal, these research groups consist of members who have heterogeneous specialist cultures, have been socialized in different organizations, and are representative of the individual interests of their respective units. The majority of scientific staff are striving to achieve their doctorate degree. For this reason, working at a research institute can be considered as further training that aims at archiving the next step of a career path. This perspective is supported by the statutory framework called "Wissenschaftszeitvertragsgesetz". The law dictates that working in a scientific institution must be considered as an individual scientific qualification phase; therefore, the law modifies the possibility of fixed terms for employment. Research assistants can be

employed at institutions for a maximum of six years (§ 2 Abs. 1 Wissenschaftszeitvertragsgesetz (WissZeitVG)). This influencing factor leads to a natural fluctuation and allocation of resources. The resulting effects must be considered in the development of the strategy, as staff structure underlies a continuous change.

The three categories discussed above represent external influencing factors which need to be considered in the development of a diversity and innovation management strategy for a research association. The analysis shows that predominantly external influencing factors shape the landscape of cultures, visions and attitudes. Considering Cox's (2001) step of "Research & Measurement", a research plan that allows the detection of all hidden structures and mindsets is necessary.

Phase 2: Status quo of personnel structure

After the analysis of structures, it is important to gain an impression of the existing diversity in the research alliance. This is important to develop a needs-oriented strategy that promotes diversity as a driver for innovation. Aretz and Hansen (2003b) pointed out that a suitable approach for handling diversity in a company depends on the specific "diversity mix" which each company must determine.. Despite differences in conditions, this is also applicable to research facilities. To be able to identify the profile of a research association, it is necessary to analyze the structure of the company's personnel.

For this reason, a quantitative data analysis of anonymized employee data was the first step to get an impression of the personnel body of the organization. The focus of this first analysis was on the diversity categories of gender, status group, discipline and culture. An elicitation of the diversity category "age" was not possible in this project due to inconclusive data indications.

The descriptive data analysis of the diversity category 'gender' shows that the majority of the 381 employed Cluster members coming from 23 institutions are male (86.4%); while 73.8% of researchers working in the network are doctorate candidates (research assistants), 8.1% post-doctorates, 0.5% are junior professors, and 8.5% are professors (see Figure 4). Considering the aspect of interdisciplinary, the analysis shows that 82.4% are from engineering sciences, 11.8% from the faculty of natural sciences and mathematics, 3.4% from economics and social sciences and only 1.3% from linguistic and cultural sciences. The remaining 1.1% have not given any indication with regard to their disciplinary affiliation. For the diversity category 'culture', 9.7% of the members employed in the Cluster of Excellence have a non-German background. Since this is a quantitative analysis, it must be added that the migrational background and thus, the extent of interculturality cannot be determined.

To sum up, the first results show the need to increase gender and cultural diversity. A higher heterogeneity with regard to the professional orientation would be desirable; however, the high proportion of engineers is based on the thematic orientation of the research group and is difficult to change.

Phase 3: Mind-set of management on diversity and innovation

Starting from this initial situation, the next step is to analyze the existing management concepts. The intention is to gather and understand the existing management approaches and mind-sets on the subject of diversity and innovation in order to connect the new strategy with the current state and thus, be able to develop a strategy tailored to the institution. This refers to the internal perspective of Aretz and Hansen (2003b) model (Figure 1).

To reveal persisting mind-sets, experiences and attitudes, a research design that allows a detailed discussion of the research object is necessary; therefore, a qualitative analysis was carried out based on Mayring (2015). The interviews were based on a partly structured interview guide including open questions, which vary in concrete

form and sequence. This allowed to consider the individuality of the interviewee.

In order to get an insight into the different institutions it is necessary to deal with each institution and the prevailing mind-sets of the management level. The professors, junior professors, supervisors and group leaders of the institutions integrated in the Cluster of Excellence were the determined sample population. These status groups are characterized by a direct human resource responsibility, a decisive role in the recruitment process and experiences with the processes of the Cluster.

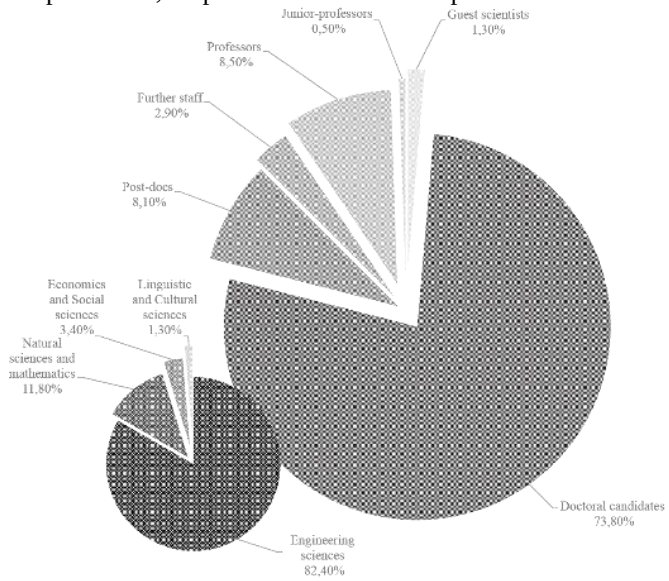

Figure 4: Personnel Structure of the Cluster of Excellence

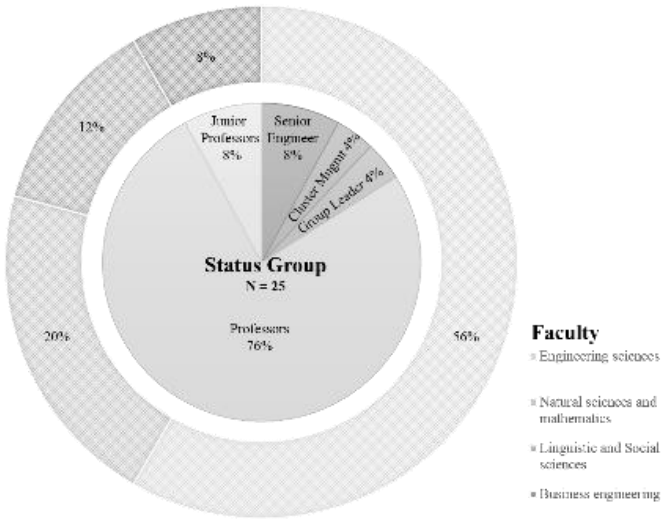

Figure 5: Status Group and Faculty Data of Interview Partners

After the analysis of employee data, the sample group was identified which consisted of 35 individuals including 29 professors, two junior professors and four persons from group leading, senior engineering and Cluster management level. The sample consisted of 17.1% female researchers. A total of 25 individuals con-

sisting of 19 professors, two junior professors, and four group leaders, senior engineers and managers were chosen to participate in the interview (refer to Figure 5). The response rate was 71.4%; where 24% of which are women.

To get an insight into the internal structures and subsystems of the research object, a qualitative approach using semi-structure interviews was conducted. This approach promotes broad acceptance in the research group through personal encounter and allows a reflection process on the individual policy of the institutions. The results have shown that the qualitative survey supported the self-reflection on diversity and innovation as well as the management approaches of the directors of the institutes. Through communication of the project, the topics of diversity and innovation became subjects of discussion which caused a renewed active analysis.

The interviewees can be characterized as leaders of ther respective research groups. They either lead an entire research unit or a team; thus, they all have corporate responsibility as well as a strong integration into the institute's internal recruitment processes. The participants were asked about their understanding of diversity and innovation, the existence of management structures, and their individual experiences with diversity. Furthermore, questions about hierarchical structures and their importance were included in the questionnaire. As already mentioned steep hierarchies can hinder the innovation process (Hull & Hage, 1982). This category allowed the different organizational structures to be analyzed and helped to understand the reason for their existence. These aspects are important in a qualitative interview because both, the causes of the current diversity profile as well as the structures for the management of human resources, were part of the investigation. The interviews were based on a semi-structured questionnaire in order to ensure a comparability of the statements.

The analysis of the 25 types identified in sub-codes led to the identification of 6 super-ordinated types (Steuer & Leicht-Scholten, 2017). In each case, these types stand for a group of interviewees, who represent equal or comparable attitudes. The six types are described briefly below.

The “superficially informed” are individuals with basic knowledge of diversity strategies. Most does not have or have a vague idea of the strategies on how to manage diversity. They assume that diversity does not have to be managed and therefore, handling of diversity is driven by the unanimous opinion that it happens consequentially. This becomes evident through statements such as: “I do not like the term [diversity management] because I do not distinguish. I believe that universities are much more subject to social influences, which we, as institutions, can only conditionally change” (Interviewee No. 6). On the basis of the preferred management style and attitude towards hierarchy, the assumption suggests that the interviewees have not yet been able to make any concrete experiences with diversity, and thus do not link them with a positive potential. As a result, the majority of the “superficially informed” do not see a connection between diversity and innovation or is unsure about it.

The “active follower” has a basic idea of diversity and diversity management. They see a connection between diversity and innovation and foster activities that in their opinion support processes of innovation creation. Although they do not have a deeper knowledge of diversity and innovation, this group pursues approaches of active diversity management, as they think that diversity has to be managed in order to have a positive impact. “I would say that you have to worry about it; and that is often implicit. And they go hand in hand.” (Interviewee No. 5).

The “passive follower” is fundamentally or basically informed about diversity and diversity management. The majority

applies forms of diversity management as they see a need to manage it. In contrast, they do not see innovation management as part of their scientific management task and therefore, use either a passive approach, or no approach at all.

The "intentional refusers" are fundamentally informed about diversity concepts; however, they have a specific idea of diversity management. They reflect the context between diversity and innovation but take a passive approach of diversity management or decide actively not to integrate any approach.

The "sceptics" are well-informed about diversity, but they show reluctance with regard to the implementation of diversity management approaches for different reasons. Consequently, in the description of concrete diversity management approaches, they showed an understanding that can be considered as basic knowledge. Nevertheless, they see the need to manage diversity; especially the environmental factors that may lead to skepticism of implementing diversity and innovation management strategies. In this context, an interviewee mentioned: "You just asked for the management, how should I deal with it? This is indeed a trade-off, it is a contradiction a bit, those are two conflicting goals. You are trying to reach a research result - in the shortest possible time, with as good a result as possible, as measured by publications, publications, etc.. But, that you may no longer only act in your own community […], will not be rated, but is rather a shortcoming." (Interviewee No. 17). This statement elucidates the perspective of the "sceptics", as they strongly see management approaches like diversity and innovation management in the context of their environment. Based on structural barriers in this environment, they see the need to manage diversity to be more innovative; but they are hindered by restrictions and structural disadvantages.

The "reflected users" have a profound knowledge of diversity and diversity management. The majority of them are actively pursuing a diversity management strategy. With regard to interdisciplinarity, one of the interviewees mentioned, "[t]he most important capability […] is this - as I say - interdisciplinary openness. Or I'll formulate it another way. The tolerance and acceptance of other specialized cultures as at least equal to themselves." (Interviewee No. 12). Another participant stated that: "[…] because I believe that it is obviously also the presence and the introduction of arguments and aspects from the holistic view of society that leads us all much further." (Interviewee No. 3).

The identified types allowed the authors of this paper to form conclusions on the prevailing mind-sets and institutional cultures in this research organization. In this context, managers function as role models and must embody the institution's norms and values, and corporate culture (Sackmann, 2014). To compare the identified types with the employees, it is necessary to actively involve employees into the research concept (for further discussion see Steuer & Leicht-Scholten, 2017)

Phase 4: Mind-set of employees on diver-sity and innovation

Team characteristics are not to be equated with the characteristics of team members. The individual group dynamic is influenced by its individual team members which in turn also influences the individuals' way of thinking and behavior (Díaz-García, González-Moreno & Sáez-Martínez, 2013); therefore, it is important to understand the dynamics in the Cluster of Excellence. To do so, the project investigated the understanding of the organization's members on diversity. and innovation.

Based on the quantitative analysis, research assistants (doctorate candidates) are the biggest group of employees in the Cluster of Excellence (73.8%). For this reason, it is crucial to integrate this group into the process to avoid reactance against the diversity and innovation management strategy. In order to obtain a broad perspective of the prevailing attitude towards the

topic and a detailed reflection of experiences, a mixed measure approach was conducted in this phase.

A qualitative employee survey was done to allow a deeper insight into the mind-set of research assistants. In addition to the identification of previously dominant attitudes, the aim of this phase is to supplement the data obtained from the interview of the management with that of the perspective of the employees. The results will be used to identify which approaches might be successful and which aspects do not lead to the desired results. Furthermore, the qualitative approach will allow comparisons of the mentioned existing approaches and strategies from management perspective with the expectations and perceptions of employees. This will allow to identify the gap and will assist in the development of a concept for a strategy that combines both perspectives that will have a long-term impact.

For the qualitative survey, focus groups will be identified which will consist of subsets of the entire institution that has already been studied quantitatively. The application of focus groups has advantages and disadvantages (Litosseliti, 2003). There is a possibility that employees might influence each other (false consensus), and especially in this case, they might know each other, which could, as a consequence, lead to a non-safe environment. On the other hand, focus group discussion will allow a critical dispute on the topic (Raab, Poost & Eichhorn, 2008). Furthermore, Gibbs (1997) mentioned that although focus groups are not empowered to make decisions, participants appreciate that they are allowed to be actively involved. Nevertheless, it is important to take into account the extent to which interactions and mood effects can have an impact on the survey, especially against the topic diversity and innovation.

This phase is currently being planned. Results will be published as soon as possible.

Phase 5 and 6: Strategy development and sustainable implementation

Based on the analysis of the given structure and skills, a tailored strategy can be developed (see Figure 3). As already mentioned, this methodology is important because of the given structure of the Cluster of Excellence and the associated dominant engineering habit (Bourdieu, 1982). In the framework of the strategy, the different findings in phases one to four are summarized and interwoven into a concept which aims at increasing diversity and fostering innovation through a diverse workforce.

Considering the implementation phase, the approach should be exemplified by the Cluster Management, but also by the leaders of institutions; however, it is particularly important not to "sell" diversity from a top-down perspective, but to listen to criticism and rejection, and to be sensitive to the specific approach (Aretz & Hansen, 2003b). In this context, employees' can be actively interwoven in a participatory approach that reflects the needs and barriers of a diverse workforce. With regard to the results of the qualitative interviews of professors (phase 3), the goal is to develop measures that actively convince and integrate members of the "superficially informed", "intentional refusers", and "sceptics" (Steuer & Leicht-Scholten, 2017). Against the background of numerous institutions that are included in the Cluster of Excellence, the exemplary function of the executives is of particular importance.

With regard to the enforcement of diversity, it is essential to integrate learning environments that encourage the practical handling of diversity. This strategy features an 'Innovation Lab' (Steuer et al., 2017) that allows institutionalized meetings of groups with diverse and frequently changing members under a specific research question and thereby, symbolizes a spirit of practiced diversity in the innovation context. In addition, the integration of strategic metrics, such as the Balanced Score Card, will allow a sustainable evaluation of measures which could result in a continuous qualitative improvement (Müller et al., 2016).

3.3 Challenges and Limitations

The system-theoretically oriented approach allows a fundamental perspective on structures and strategies of the research association. It represents the basis for a sustainable reorganization process under the consideration of subsystems and influencing factors (Aretz & Hansen, 2003b). The presented approach is based on the approaches of Aretz and Hansen (2003a, b), Klaffke (2009) and Cox (2001) that considered the implementation of diversity management in an entrepreneurial frame. The limitation of transmitting these systems to an organization embedded in a scientific environment, makes adjustments necessary; especially factors such as the fluctuation of scientific staff which has to be considered in phase 4, the limitation of company affiliation which is reasoned by the "Wissenschaftszeitvertragsgesetz (WissZeitVG)", and the high independency of research groups and institutions. All these require a specific approach.

The challenge is to develop strategies that will enable an organizational change through all levels of the research organization, taking into account the mentioned variables of insecurities. The aim is to implement a broad understanding of diversity and to avoid reactance against linked measures. Nevertheless, diversity results in higher complexity and requires good management and transparent communication processes to be successful. Based on the findings in phase 1, this is of particular importance as homogeneous and mono-cultural personnel structures have a higher probability of reactance. Furthermore, the high complexity of big research associations is accompanied by high efforts in understanding the enterprise and its members which aggravates the development of a suitable approach.

4. Conclusion and Outlook

The presented project followed a conceptual approach that deals with the implementation of a diversity management strategy with a strong focus on innovation creation in a research association with a very high complexity. As a consequence, there is a lack of comparable concepts dealing with this topic which leads to a lack of comparisons to other projects and experience reports. It would be highly interesting to discuss the experiences and results in the international community.

Although research groups claim to be an inherent organization (qua organizational chart), diffuse hierarchical structures exist; therefore, the development of diversity management in a research organization faces different challenges than the implementation of a corresponding startegy in companies with a stringent top down management. For this reason, it is important to establish a common corporate culture and, based on that, a common understanding of diversity management.

The implementation of the first three phases of the process has shown the necessity to actively deal with the workforce of research associations and to analyze the underlying structures and mind-sets.

In the first phase, the analysis of the organizational structure revealed key areas that can positively or negatively influence the integration of a diversity management system. As diversity management is always accompanied by a change in management approach, the identification of subsystems allowed the conscious integration of possible barriers or promoters. Phase 2 allowed the detection of individual needs that require action, which could serve as the basis for developing a strategy that could answer the specific requirements. Furthermore, the amount of an organization's diversity indicates how much of the team processes, which are influenced by diversity, are part of an employee's daily life. This will help under-stand if mind-sets and experiences are based on concrete situations in the working environment or are influenced by theoretical assumptions. To further investigate this, an employee survey is necessary which will be conducted in phase 4. Phase 3 connected the barriers or promoters identified in phase 1 with specific persons. The

qualitative approach made it possible to experience mind-sets as well as attitudes in the context of diversity and innovation management. As a consequence, the results of the third phase allowed integration of the key personas according to their type into the implementation process. On the other hand, the concept need to be tied to the prevailing mind-sets and strategies to actively follow-up on the different previous management approaches, and thus to actively integrate the management level and its perspective. This aims to minimize denials of new approaches and allow a broadly accepted change towards a joint strategy.

Subsequent to the implementation, further delicate adjustments of the strategy will be carried out. This opportunity will allow detailed aspects of the association between diversity management and innovation be identified.

With regard to the presented Cluster of Excellence, the next step will be to develop and implement customized measures. Further research could investigate which measures work and why they work, in order to understand the logic, structures and control lever of such a big research organization. To achieve this, it is necessary to anchor controlling elements and measurement methods in the research approach. A corresponding need to adjust methods and instruments of control or a re-development might be required. In doing so, the research could contribute in the discussion of the development of tools which will allow measurement of the competitive advantage of diversity in an innovation context.

The analysis points out that the existing structures and mind-sets of research networks have a significant influence on the use of diversity as an innovation factor. This results in the need to break down these structures and thinking patterns in order to integrate them into a management strategy. The potential of the presented approach lays in its transferability on other complex research organizations. It represents a basic approach for achieving a long-term integration of diversity for aiming socially responsible research and innovation creation.

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About Authors

Linda Steuer is research associate at the research group "Gender and Diversity in Engineering" (GDI) and the Technology and Innovation Management Group (TIM) at RWTH Aachen University. As graduated business psychologist Linda Steuers reasearch fields cover: Innovation Management, Futurology, Diversity Management, Teaching and labour research, applied gender and diversity research in STEM subjects, Competence Management and Design Thinking. In the course of numerous projects in the field of interdisciplinary and diverse teaching, such as a transatlantic course with the Stanford University, Linda Steuer has gained scientific experiences.

Mamta Sharma is a research associate at Steel Institute at RWTH University. Whe was involved into the Cluster "Integrative Production Technology for High-Wage Countries" in the frame of the project "Gender and Diversity" which was also assigned to the cross sectional processes. She is metallurgic engineer by training.

Wolfgang Bleck is holding a professorship at the faculty of Georesources and Materials Engineering at RWTH Aachen University. His research interests cover the development and characterization of cold formable and high-strenghth steels, new processes for steel products and light-weight structures. He holds different memberships such as in the German Steel Institute VDEh as a member of extended board, elected member of the scientific advisory board in the frame of the "Ar-beitsgemeinschaft industrieller For-schungsvereinigungen (AiF) and in the frame of the AVIF and FOSTA.

Carmen Leicht-Scholten is holding a bridging professorship at the faculty of Civil Engineering. Political scientist by training she has been published in the field of gender and diversity in higher education and science and technology studies for many years. Carmen Leicht-Scholten was responsible for the development of the Gender- and Diversity-Strategy of RWTH University that succeeded in the German Excellence Initiative. She has been the first German gender expert to discuss gender and diversity in the process of the excellence initiative. With the development of the concept of gender and diversity for Aachen University she has been a pioneer and best practice for many other German universities. Carmen Leicht-Scholten has been expert in many national and international projects in STS and is evaluator for the European Commission. She is German

representative of the cost action Gender-STE and representing Aachen University in CDIO, an innovative educational framework for producing the next generation of engineers. Currently she is working in different national and international projects refering to social responsibility in an engineering. She is coeditor of "Gender-Zeitschrift für Geschlecht, Kultur und Gesellschaft" and author of various publications on gender in science and engineering.