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**HENNING BUNDTZEN**



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## The PhD School

Name: Doctoral School of Management and Organizational Science

Discipline: Organizational behaviour

Head: Prof. Dr IMRE FERTÖ  
Professor, DSc  
MATE, Faculty of Economic Science

Supervisor: Dr habil SZILÁRD BERKE  
Habilitation, PhD  
MATE University, Faculty of Economic Science

Co-Supervisor: Dr habil PATÓ GÁBORNÉ SZÜCS BEÁTA  
Habilitation, PhD  
University Pannon, Faculty of Supply Chain Management

.....  
Approval of the Head of Doctoral School

.....  
Approval of the Supervisor(s)

MATE - HUNGARIAN UNIVERSITY  
OF AGRICULTURE AND LIFE SCIENCE  
KAPOSVÁR CAMPUS  
Faculty of Economic Science

**ANALYSING CORPORATE CULTURE BY THE  
APPLICATION OF PERSONAL CONSTRUCT  
PSYCHOLOGY**

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Written by  
**HENNING BUNDTZEN**

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## **AUTHOR'S DECLARATION**

Whilst registered as a candidate for the above degree, I have not been registered for any other research award. The results and conclusions embodied in this dissertation are the work of the named candidate and have not been submitted for any other academic award.



Henning Bundtzen

## ABSTRACT

The aim of this dissertation is to contribute to organisational science by employing an exploratory and inductive research approach in the aspiration of finding new paths in corporate culture research. With Kelly's personal construct psychology, a theory originating in psychology was utilised to explore the associations leaders and employees have with the organisations they work for. This methodology was chosen because the theory is proven to create unbiased results that are not influenced by the researcher or use of questionnaire. A holistic view of corporate culture was created by conducting 61 repertory grid interviews with 21 leaders and 40 employees, which generated a quantitative and qualitative dataset of 782 personal assessment criteria. A three-dimensional visualisation of the comprehensive dataset was analysed by engaging semantic cluster analysis aiming to find patterns describing unthought cultural patterns worthy of analysis. This research approach led the author to examine five distinct topics within the context of organisational behaviour. Firstly, corporate sustainability was analysed in a contemporary work environment using the described methodology to assess the corporate sustainability status quo of the investigated organisation. This analysis was followed by an adaption of Herzberg's two-factor theory of motivation to today's economic environment and altered workforce values. As the dataset included results of a direct leader-member exchange, two sections are dedicated to leadership-related subjects; the arresting discrepancy between the managers' own ratings and the entire leadership culture of the organisation induced the question of the influencing factors of a distorted leader's self-perceptions. A review of current scientific literature revealed that error prevention and organisational silence impact the self-perception and efficacy of leaders. Moreover, both the strategy towards addressing mistakes and how leaders communicate their own errors proved relevant. The section on

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vulnerability in leadership investigates the common effects on psychological safety and empowerment shared with error management as prerequisites for organisational learning. Combined with organisational commitment and employee resilience, this will support proactive employee behaviour. Finally, one section is dedicated to organisational agility, as the pandemic-influenced year 2020 made agile work practices relevant to a degree seldom seen in economic history. The grid data deployed by Generalised Procrustes analysis allowed the visualisation of the agile status of the organisation. As COVID-19 showed commandingly how volatile, uncertain, complex and ambiguous (commonly grouped under the acronym VUCA) economic development and governmental decisions can be, in the final section of this dissertation, an agile framework was developed that brings the characteristics of VUCA in direct context with how agile working methods and enablers respond to such external forces. In summary, the unusual but scientifically substantiated method applied in this dissertation has revealed some interesting new scientific evidence on corporate culture.

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### 1. INTRODUCTION

*“A person’s processes are psychologically channelized by the ways in which he anticipates events”. George A. Kelly, 1955*

With the above statement George A. Kelly initiated his theory of personal construct psychology (PCP). The theory describes a psychological approach to the subjective view of how people make sense of the world around them (Senior & Swailes, 2004). If Kelly is correct this theory is capable of supplying a completely new approach to investigate organisational behaviour, specifically corporate culture (CC), as the culture of an organisation reflects a group of people forming their subjective views by engaging with the same organisational experiences. This invokes the following questions: What will occur if we apply this psychological investigation methodology, originally developed for individuals, to multiple people within an organisation by conducting repertory grid interviews (RGIs)? Is a combination of the subjective “worlds” of employees and leaders to create a concrete and interpretable figure of the CC mathematically possible? Finally, will this investigative methodology reveal patterns that spur new insights into organisational research, or will it be impossible to create a common picture of the respondents?

To answer these questions the underlying study deploys RGIs to derive CC-related constructs from employees and leaders. The results are bipolar constructs, upon which all elements that represent the organisation are rated. Generalised Procrustes analysis (GPA), which enables a three-dimensional visualisation of the interview results, is applied as the statistical methodology. In addition to the graphical visualisations, statistical results are produced using elements to construct cluster relations. Based on the quantitative and qualitative results generated by the above procedure, scientific literature reviews were conducted to draw generally applicable findings. Figure 1 summarises the chosen procedure for this research project on organisational culture.





## INTRODUCTION

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The approach enabled the publishing of several conceptual papers in the context of organisational research. A strong focus on the topics of leadership, employee motivation and proactivity as well as organisational performance was laid for this study in the selection of research elements. Due to interesting findings with regard to error handling, this focus was expanded to include organisational silence and error management. Furthermore, the clustered results as well as the economic situation directed the research towards organisational agility as a response to strong economic and governmental changes. In summary the research follows a triangulation model by generating qualitative and quantitative results simultaneously.

Due to the inductive and explorative nature of the research approach, the next chapter does not include conclusions based on the literature. Subject-based literature reviews are outlined in the literature review in sections 3.2 to 3.6 to contextualise them for the reader with the results and discussion part of sections 5.2 to 5.5.

## 2. BACKGROUND AND OBJECTIVES

*“I can see how the scope for using PCP in business organisations is enormous. As a professional community we have only scratched the surface in this vast domain. Business organisations are merely aggregates of individuals making sense of streams of events in particular contexts and in relation to particular others. Personal Construct Psychology is the science of human sense making. So how might PCP be used to intervene constructively within a particular organisation?” (Brophy, 2007)*

This citation clearly summarises the objective and approach of this dissertation whilst also highlighting the potential of a PCP investigation targeted to CC. The primary goal of this research is to show investigative that applying PCP in a repertory grid is a possible way to research CC. In consequence the research question and main objective is formulated as follows:

*Is personal construct psychology an applicable methodology to investigate parts of a corporate culture?*

The aim is to translate a psychological theory of organisational behaviour into a research and diagnostic tool via RGIs for CC. RGIs were chosen as an interview technique as it is suggested by Kelly (1991) as a preferred and unbiased way to enquire the personal perceptions of individuals. Furthermore, computer technology today enables a recapitulation of numerous RGIs. Thus, the first sub goal to answer the research question is:

1. *Are RGIs a suitable way to enquire and visualise the complex framework of corporate culture in quantitative three-dimensional plots?*

This is done by conflating the results not of individuals but of entire groups within an organisation (Cassell et al., 2000). From a scientific and practical point of view this is relevant due to the economic, governmental and ecological changes of recent years. These changes should consequently impact both scientific research

## BACKGROUND AND OBJECTIVES

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and practical solutions. These forces are commonly characterised by terms and topics such as volatility, uncertainty, complexity and ambiguity (VUCA); the millennial workforce; sustainability; new work; connectivity; mobility and new leadership approaches. The second sub goal consequently states:

2. *Does the interpretation of the results allow one to draw conclusions on the above-stated contemporary CC-related forces and economic scenarios?*

The applied methodology is especially suitable to investigate this research question due to its unbiased enquiry approach. Subjects are not pointed to thoughts related to these new factors by questions. That way it can be investigated unaffected if they are part of the intrinsic assessment criteria of the enquired subjects.

Based on these forces and trends a literature review was conducted which resulted in the identification of five distinct topics (see chapter 3: Literature review). These five subjects were derived to gain possible insights from the data set by analysing the semantic corridors between constructs, clusters and research elements. The objective of this dissertation is thus to test current scientific standards in the following five research areas:

1. Corporate Sustainability
2. Two-factor theory of motivation
3. Self-reflection in leadership
4. Employee proactivity
5. Organisational agility

The objective is to determine if these diverse topics can be tested by applying the repertory grid technique to draw a holistic view of the CC. This is formulated into the following research questions as a third sub goal:

3. *RGIs based on PCP reflect contemporary research topics in organisational behaviour allowing to draw scientific conclusions?*

## BACKGROUND AND OBJECTIVES

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If it is possible to draw conclusions from the compiled data set this research demonstrates a different scientific approach to investigate CC. The aim is to show by transferring and measuring the CC in a three-dimensional space allows placing a special investigative focus on the five above-mentioned topics. This entails making the specific CC of a company visible and qualitatively interpretable, then focussing a subject-specific spotlight on the dataset.

Common approaches to analysing CC include qualitative research methods consisting of “how and why” questions without producing quantitative results (Gray et al., 2012). Making an entire CC three-dimensionally visible, interpretable and mathematically analysable would comprise a significant contribution of this research study with regard to science and practice in itself. The results, however, are unknown as the qualitative assessment criteria are not set by the researcher but rather are defined in the process of the interview by the participant. This bears the risk of eliciting non-interpretable group results if no distinct cultural pattern is created by the generated data. On the other hand, this uncertainty has the potential to create new corporate cultural perspectives that have not yet been researched. Thus, research sub goal four is as follows:

4. *Does the generated dataset promote further worthwhile research directions for extended investigation?*

The author is aware that it is not possible to draw generalised business conclusions from the limited dataset alone, even if it comprises qualitative and quantitative data. The aim is rather to apply an inductive approach to identify new research paths. Making such a complex system of values, norms and subjective views visual and interpretable is, from the author’s point of view, a worthwhile approach both scientifically and practically. To produce generalised new results the scientific literature of each topic was reviewed to substantiate the first results; the research was thus used to identify new research contexts, which were validated by contemporary scientific literature to allow common conclusions.

## BACKGROUND AND OBJECTIVES

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Another aim of this study is to advance PCP in organisational research. If successful PCP-based RGIs hold the potential to allow unbiased and efficient access to analysing CC. A questionnaire or interview framework that must be adapted for each organisation and purpose could be exchanged for a single set of elements representing CC. Another aim of this research is thus to define a set of elements applicable to multiple scenarios. The selection of these elements should ensure that culturally relevant topics, for example team orientation, level of customer centricity, vision or leadership, are elicited. A more precise scope or aim with regard to the specific subject within the context of CC cannot be stated before the conducting of the interviews due to the exploratory approach of this research.

### 3. METHODOLOGY

*Description of the case study*

As a basis for this research 61 repertory grid structured interviews were carried out from November 2018 to April 2019 within an organization. The research object is a wholesale company in the consumer industry with approximately 500 employees of which 21 staff members are in leadership roles. The company is led by two general managers who besides the founder are also shareholders of the organization. The company has experienced 45 years of growth and accomplished 200 Mio. € turnover in 2018. The forecast and current business development is positive whilst a turnover increase is forecasted for 2019 and 2020. The pandemic crisis in 2020 has affected the organisation considerably, leading to an unexpected growth of sales, difficulties to obtain sufficient goods from overseas and fast changing customer requirements which were triggered by different lockdown scenarios in various countries. Overall the organization is financially healthy, paying above standard pay scale. Employees have the possibility to invest into a shareholding company so that they directly participate from the success of the corporation. Fluctuation among employees is at a comparably low level. Recruitment of additional staff is still unproblematic and applicants state that they have been told about the great working atmosphere. Hence a high employer attractiveness is presumed. Table 2 indicates the structure of the participants who carried out the repertory grid structured interviews for this case study are:

**Table 1: Participant structure**

<b>Gender</b>		<b>No. of former employers</b>		<b>Position</b>	
male	37	0 - 1 employer	17	Leader	21
female	24	2+ employers	44	Employee	40
<b>Age</b>		<b>Education</b>		<b>Job tenure</b>	
21-30 years	10	no training	0	less 1 year	8
31-40 years	20	vocational	37	>1 - 5 years	10
41-50 years	24	Bachelor	9	>5 - 10 years	11
51-60 years	6	Master	16	>10 - 20 years	22
> 60 years	1	PhD / doctor	0	>20 years	10

## METHODOLOGY

<b>Department</b>					
CEO	2	Transport logistics	3	Procurement	4
Sales national	9	Internal services	3	IT	3
Export sales	8	Warehouse	15	Accounts	1
Product management	6	Marketing	3	Personnel	2
Internal logistics	2				

*Source: Compiled by the author*

The participant structure is in accordance with the distributional factors of the entire organisation. The employees were chosen in proportion to the size of the department, taking age difference into consideration. The figures for job tenure, age and education are close to the structure of the company. To investigate the entire CC of this organisation the above-mentioned aspects as well as the focus topics identified by the literature review were taken into consideration upon the definition of the set of elements for this CC study. As a consequence, for this research, the 27 elements listed in the table below were chosen to conduct the RGIs. They represent a wide range of objects, individuals, systems, concepts and even time horizons to support the creative elicitation of constructs related to the CC of the investigated entity.

**Table 2: Elements utilised to investigate corporate culture**

<b>All elements</b>		
<b>The organisation &amp; market</b>	<b>Leadership &amp; motivation</b>	<b>Quality &amp; internal processes</b>
The company as it used to be	Myself today	HR
The company today	My direct manager	Logistics/warehouse
The company in 2.5 years	The company without leadership	Sales department
The ideal company	Ideal leadership	Product management/purchase
A negative company	Leadership culture	IT
The company's brand	Myself as a manager	Marketing
The market in the future	CEO 1	Employee culture
An unpleasant competitor	CEO 2	Quality principle
A meaningful company	A highly motivated person	An efficient process

*Source: Compiled by the author*

In particular these elements were selected adjacent to the CC model created by Denison et al. (2004), as it creates a holistic cultural view of an entity. While



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formulating the elements it is important to not directly choose Denisons dimensions as elements, as these are constructs (if elicited by the subjects). Instead, the above stated elements set lists elements that are likely to evoke constructs related to Denisons model. The deployment of both the elements “leadership culture” and “my direct manager” is controversial as the latter is a part of the first element. This was criticised by Easterby-Smith et al. (1996) but has retrospectively been proven to generate valuable insights into the self-perceptions of managers and the influencing factors for such self-evaluation. Another critical aspect is the inclusion of specific persons represented by the two CEOs of the organisation. They could possibly function as a test of the degree of socially desirable answers if evaluations are unusual compared to the remaining assessments.

### *Introduction to the repertory grid technique*

Collecting data within the framework of PCP offers several possibilities. For this study software-supported RGIs were chosen. Originating from a clinical context in psychology, RGIs have developed into an application technique in various research areas, including organisational behaviour and CC (Heckmann & Burk, 2017). Distinct from solely quantitative questionnaires or qualitative interviews, RGIs simultaneously produce qualitative statements which are quantitatively evaluated by the interviewee (Leach, 1980). In this manner a certain feature of an employee’s world is translated into a cognitive map through a grid (Easterby-Smith et al., 1996; Rosenberger & Freitag, 2009). The participant’s wording to distinguish these elements is recorded in a data matrix (Scheer & Catina 1993). As a precondition a list of objects (called elements) are determined based on the domain of interest. These elements are presented to the interviewee to conduct an elicitation process (Leach, 1980). The RGI technique records the bipolar constructs in a data matrix which allows statistical and mathematical calculations to be conducted on the characteristic of values and norms (Heckmann & Burk, 2017 (Rosenberger & Freitag, 2009)).

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In general, two types of repertory grids can be distinguished; firstly, in a common grid, not only the elements but also the constructs are predefined. As a result, this defaults the qualitative aspect of PCP, possibly to constrain the research scope. In a common grid distances between objects and attributes can be statistically defined by cluster analysis (Fransella et al., 2004). In a unique grid the opposite approach is chosen, neither elements nor constructs are predefined or kept constant throughout the interview process. Whilst in a common grid the interviewer strongly influences the context and qualitative aspects to be rated, in a unique grid the subject and qualitative attributes are determined by the interviewee. For this research study a mixture between common and unique grids is applied:

1. Elements are predefined, to ensure that attributes association with CC are derived.
2. Constructs are created and rated by the participant to prevent limitation or exertion of influence by the researcher.

This approach was selected as the study attempts to understand the experiences of an employee of the organisation and excerpt their thoughts and images of the world around them. However, to limit this imagination to the organisational context, excluding attributes about one's private life, the research elements must be predefined. Still, as the elements are rated on the basis of the constructs, the mathematical relationship between the interviewee's attributes form the cultural picture of an organisation. In this manner RGIs based on PCP are a powerful methodology to generate qualitative data of an employee's attitudes, emotions and experiences of the organisation they work for (Easterby-Smith et al., 1996; Stephens & Gammack, 1994). As with PCP the repertory grid technique has been applied to numerous business contexts including work surroundings, employment and learning assessments, which highlights the technique's flexibility (Bourne & Jankowicz, 2018; Stephens & Gammack, 1994)). To classify important issues from the final list of elicited constructs, a widely used analytical approach is

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content analysis via cluster creation (Hauser et al., 2011). Content analysis attempts to group features into a distinct category with a common meaning. The groups themselves can be predefined (which was not the case in this repertory grid study) or obtained inductively from the list of elicited constructs (Heckmann & Burk, 2017).

### *Determination of sample size*

The determination of the sample size for repertory grid studies can be an issue because the triangulation research approach includes both qualitative and quantitative elements. As a consequence the two main aims of the interviews and content analysis must be considered. The researcher firstly wishes to cover the majority of the research domain's inherent topics (Heckmann & Burk, 2017). These are the clusters created by the combination of mathematical and content analysis. Second a minimum number of constructs is contained in each cluster to enable the statistical analysis of the repertory grid dataset (Heckmann & Burk, 2017). One possible option is to conduct additional interviews until a saturation of subcategories of organisational culture is reached, or in other words until no further clusters are created by the additional constructs elicited through the added interviews (Napier et al., 2009). However, this requires that a cluster analysis be conducted between each interview. Other studies are based on a rule of thumb which proposes 15–25 RGIs to cover any domain of interest (Tan & Hunter, 2002). These assumptions are made because the quantity of elicited constructs per subtopic, the probability and even the overall number of clusters are undetermined before the interviews are conducted. Nevertheless, a possible approach can be to make expectations about the required number of categories based on a literature review (Heckmann & Burk, 2017).

An approach for an ex-ante determination of the required sample size suggested by Heckmann and Burk (2017) is based on the probability assumption of receiving at least a set percentage of the total subject, in which each contains at least a minimum number of constructs. This approach combines the two main research

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aims of this study and facilitates a predefined sample size. To create a holistic picture of the CC of the research object, criteria have been determined as outlined in Table 4.

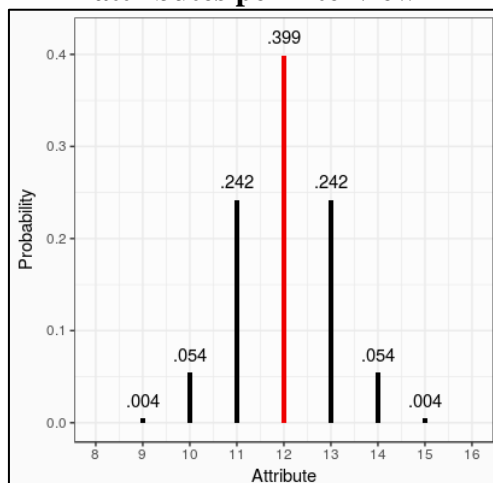
**Table 3: Input settings for sample size determination**

Type of input setting	Target/projection
Expected constructs per interview	8–16
Type of probability for no. of attributes (Figure 6)	Normal distribution
Expected mean	12
Standard deviation	1
Expected average of constructs	12
Type of probability for no. of categories (Figure 7)	Exponential
Targeted probability	95%
Clusters/categories	20
Min. number of constructs per category	10

*Source: Compiled by the author*

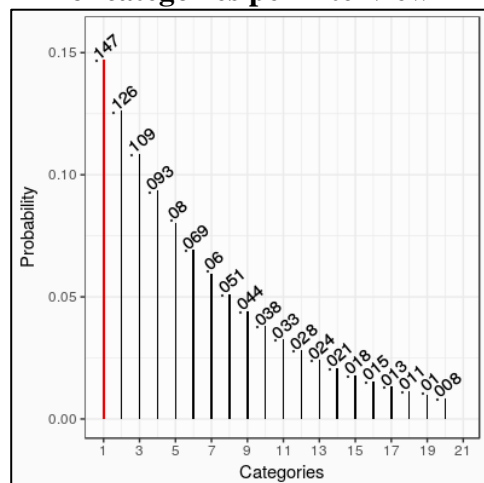
The number of expected constructs per interview is based on the targeted interview length of approximately 120 minutes. All interviews were scheduled for this timeframe, and few were shorter than the scheduled two hours. Based on the above setting the following probabilities were calculated as preconditions for the calculation of the final sample size (see Figures 4 and 5).

**Figure 2: Probability for number of attributes per interview**



*Source: Created by the author*

**Figure 3: Probability for number of categories per interview**

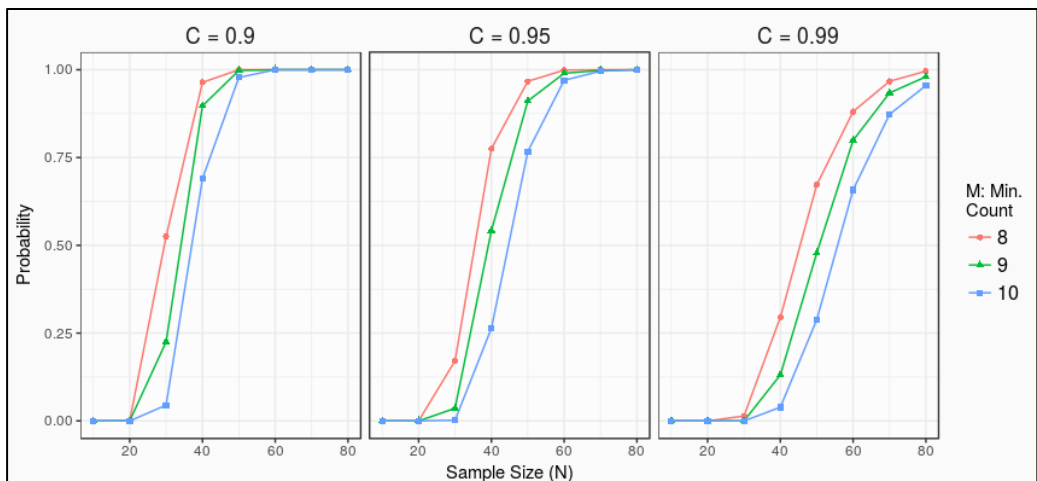


*Source: Created by the author*

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For the determination of the sample size, a probability of 95% covering all inherent topics was targeted. A test was run for probabilities of 90, 95 and 99% in combination with a minimum number of 8, 9 or 10 attributes or constructs per category. Figure 8 demonstrates that on the basis of these criteria, a minimum sample size of  $N = 60$  is required to achieve at least 20 clusters, with a minimum count of 10 constructs per cluster, to be evaluated as self-contained topics within the CC context of the investigate object. As 21 people were in leadership positions, the final sample size of  $N = 61$  was determined, including the 21 managers, as well as 40 employees across all departments of the organisation. As the CEOs decided that a participation is not compulsory for employees, the employees solicited voluntary, and lots were drawn in dependence of the department size. In this manner, data with a direct LMX context was generated.

**Figure 4: Determination of sample size**



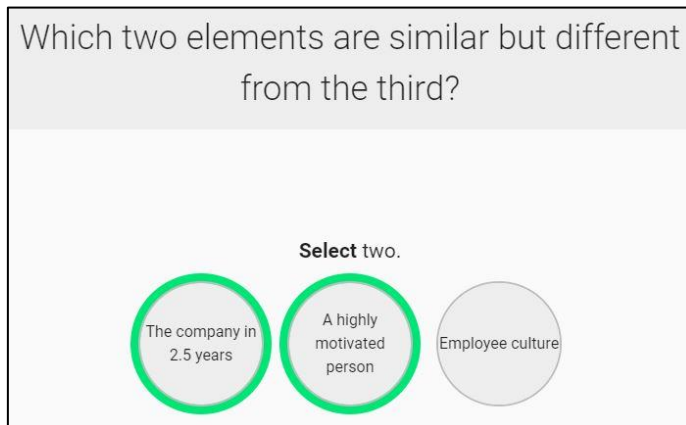
*Source: Compiled by the author*

In ex-post consideration this approach was quite conservative as the final number of clusters derived was 36, of which each holds at least 13 individual assessment criteria. The average number of constructs created by each interview was 12.8, meaning that the estimation of 12 clusters was quite exact.

*Execution of the interviews*

The following describes the four distinct reiterating phases of the interviews. In the first phase a triad of three elements from the set of 27 are presented to the interviewee, who is asked to select which two elements are similar to each other but different from the third (see Figure 9).

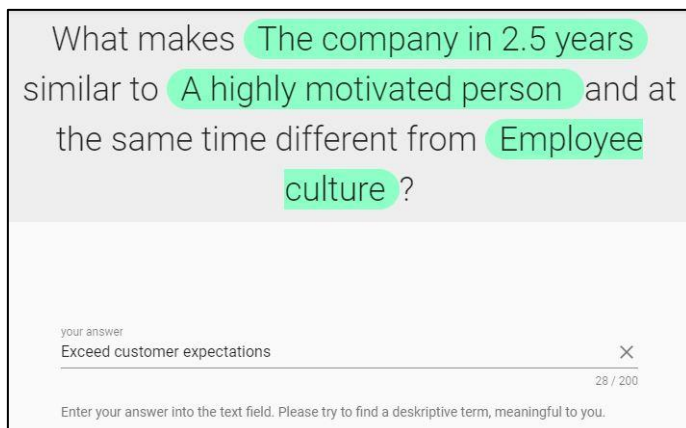
**Figure 5: Interview Phase 1 – Triad comparison**



*Source: Compiled by the author*

Once the subject has selected two intuitively, Phase 2 is designated to elicit the first personal construct related to the selected two elements, which reflect the organisational culture of the entity under investigation. The interviewee is asked what makes the two elements similar and at the same time different from the third.

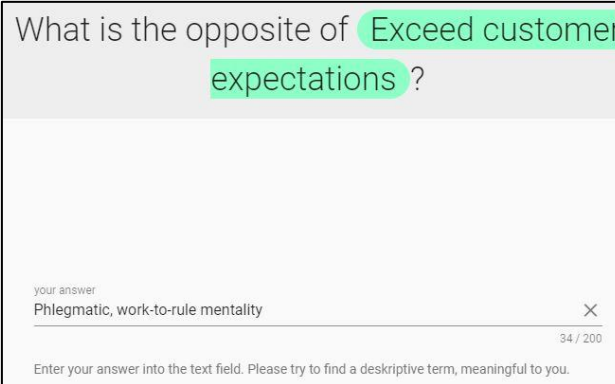
**Figure 6: Interview Phase 2 – First construct elicitation**



*Source: Compiled by the author*

After elicitation of the first, qualitative construct formulated by the interviewee, the system asks for the opposite assessment criterion of this construct. This bipolarity of constructs enables the visualisation of quantitative results in repertory grids in a later step, as highlighted in Sub-section 3.1.3 about PCP in organisational research.

**Figure 7: Interview Phase 3 – Opposite construct creation**



What is the opposite of Exceed customer expectations ?

your answer  
Phlegmatic, work-to-rule mentality X

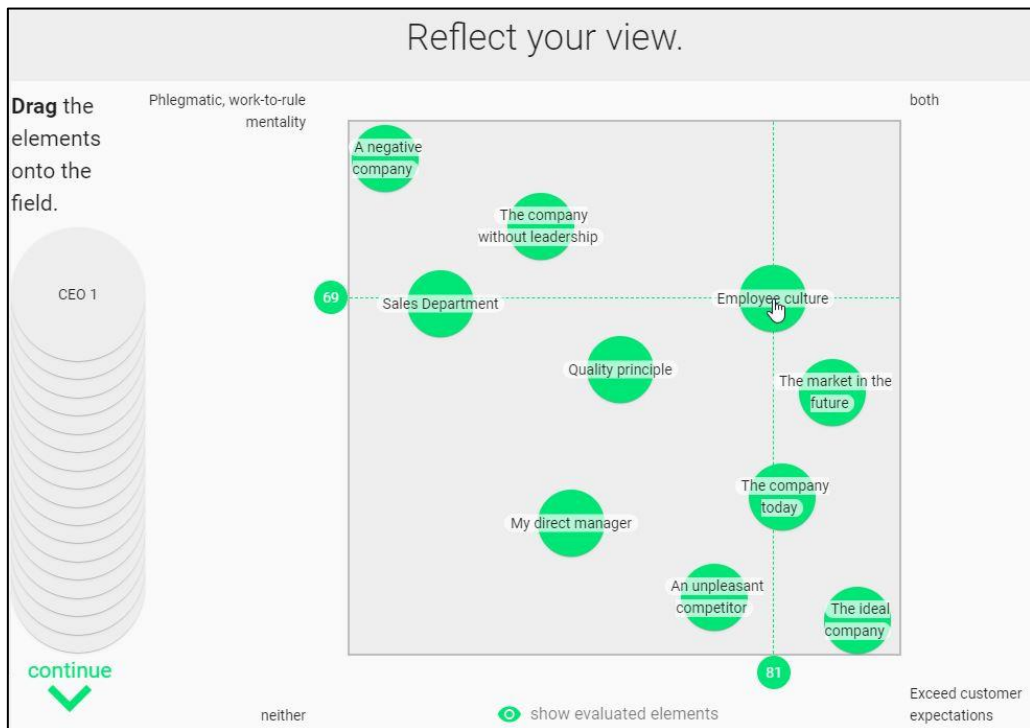
34 / 200

Enter your answer into the text field. Please try to find a descriptive term, meaningful to you.

*Source: Compiled by the author*

In a final step the participant is presented with a tetra-polar field in which all 27 elements must be rated; the possibility exists to leave elements unrated in case of a lack of possibility for intuitive evaluation. In this manner not only the qualitative assessment criteria are elicited in the form of personal constructs to develop a holistic picture of the underlying CC. In addition, quantitative data in relation to personal assessment criteria is produced on a scale from 0–100. The interviewee has the possibility to assign only one characteristic by choosing between the specifications “exceed customer needs = 0” and “phlegmatic, work-to-rule mentality = 100” for the elements. In addition, any combination with the other two extremes, “neither” or “both”, can be selected for each element. Figure 12 exemplifies the software view of the interviewee with rating examples of the utilised corporate elements. These components are put into the tetra-polar field by drag and drop, highlighting the exact rating scale at the edges of the rating frame. During the interviews, rated elements were hidden to ensure an intuitive rating without rethinking the evaluation after placing additional elements.

**Figure 8: Interview Phase 4 – Element rating**



*Source: Compiled by the author*

After rating the participant returns to Phase 1 with a different triad of elements. A new set of bipolar constructs is elicited on which the rating depends. Consequently, there is no appendix with a questionnaire as such. The role of the researcher is to support creative thinking in case the person has difficulties with a triad or finding the opposite construct due to the difficulty evoked by triadic comparisons (Easterby-Smith et al., 1996). However, the researcher should not influence the constructs through questions aimed at provoking a certain construct. Instead inductive or deductive thinking is supported by asking for specific events or common concepts with laddering questions such as “What do you mean by...?” (Easterby-Smith et al., 1996). This depends on the subject’s general comprehending (inductively or deductively). In summary the iterations throughout the 61 qualitative interviews produced 782 personal constructs. These multiplied by 27 element ratings resulted in 21,114 unique graded construct element ratings, building a comprehensive CC database of the entity.

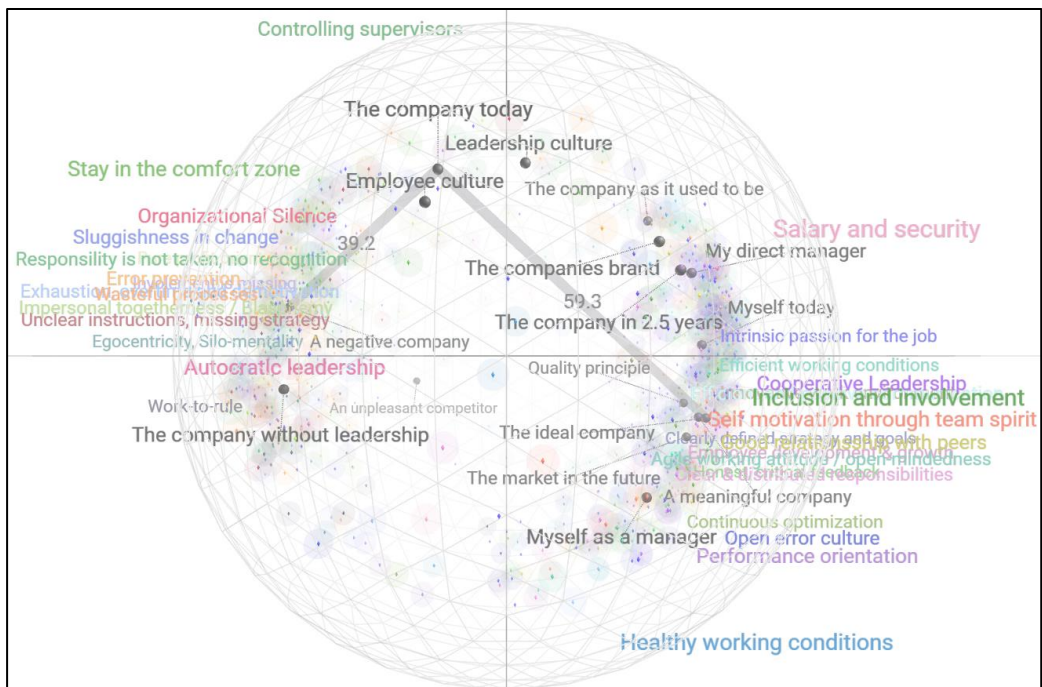


## 4. RESULTS AND DISCUSSION

*Compiled repertory grid data set of this study*

Generalised Procrustes analysis is utilised in this chapter for result visualisation. Structured RGIs are an inherently qualitative research methodology as subjects enter their own wordings based on their interpretations of the organisation. The utilised computer software creates in the reflection phase in-depth data based on the entries of the participant (Mak et al., 2013). This dataset can be statistically transformed from the sum of individual grids using GPA to create an aggregated grid, which allows visualisation of the CC, as shown by the following figure 13, which shows the entire dataset including the most relevant elements, as well as all clusters and construct locations, indicated as dots.

**Figure 9: Visualised dataset with Generalised Procrustes analysis**



*Source: Compiled by the author*

In a first step the interviewees different usage of scales are adjusted to a collective central mapping sheet (Grice & Assad, 2009), this process is identified as

translation. Afterwards variations grounded in the distinct utilisation of attributes by the interviewees are eradicated by reflection and rotation until a maximum agreement is achieved by applying Procrustes rotation technique (Grice & Assad, 2009; Gower, 1975). This process is followed by scaling to unit variance through shrinking and stretching the configuration size aiming at an equalisation of different ranges of the scale displayed in figure 12. This is done without altering the relative distances between the elements (Tomic et al., 2015). Provided that the mean, rotation and scale reflect individual variations of subordinate significance for the explanation of element discrepancies, GPA is an appropriate statistical tool for investigating repertory grid data. Relative distances between elements are kept, which is essential to the visualisation and statistically based interpretation of the research results of this study (Tomic et al., 2015). After the application of GPA each element and construct have a unique set of coordinates enabling the researcher to create clusters and interpret the relative distances of elements and construct clusters. The spatial distances reflect the group's cultural associations within the organisation.

### *Cluster creation through content analysis:*

Visualising and analysing 782 constructs in one graph or even statistically would result in an unclear outcome. As several attributes have similar or identical meanings, an aggregation into clusters with descriptive headings is an appropriate approach to explore this dataset on CC. In a first step the system created an initial set of clusters based on the spatial location of all constructs. This set was reviewed and extended by the researcher semantically to ensure that related constructs were combined in one cluster. Feixas et al. (2002) explored the degree of consensual accordancy between researchers, in case an identical dataset of attributes and elements was qualitatively dissected independently. The agreement resulted in an 87.3% consensus (Feixas et al., 2002). As a consequence the conducting of content analysis aiming at the creation of clusters was added to the methodological approach of this study.

## RESULTS AND DISCUSSION

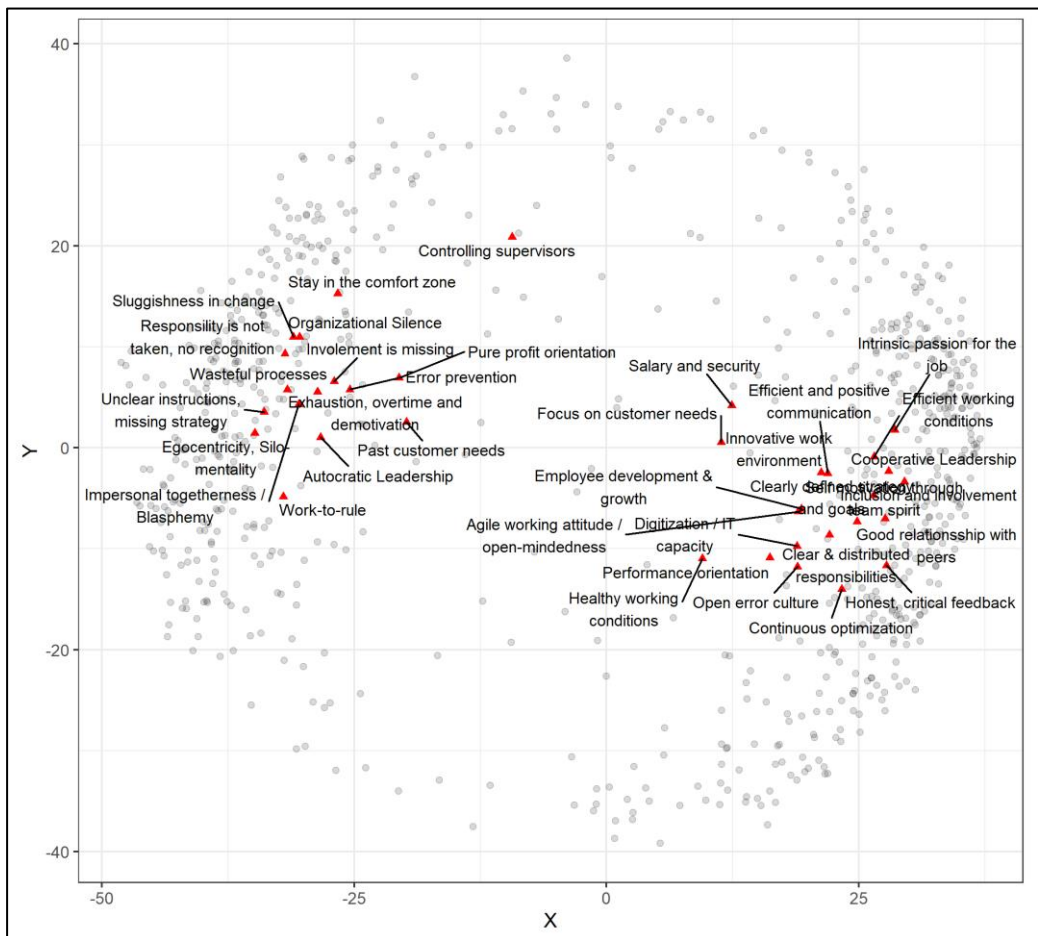
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The following figure 14, created in R, visualises the centric position of each aggregated cluster, this time shown in a two-dimensional plot. The spatial distances between the clusters centric positions and elements represent the organisations evaluation which allows an analysis of the CC. Minor distances in this setup represent a high degree of association of an element with a cluster. The subsequent sections build on these circumstances to explore the dataset under different focuses with regard to content. The centric cluster positions located in the area of  $x \approx 25$  and  $y \approx 0$  are the clusters with positive associations as they are located closely to the element “An ideal company” ( $x = 32.1$ ;  $y = 0.8$ ). The element “A negative company” in contrast is located rather opposite in this diagram ( $x = -37.01$ ;  $y = -3.86$ ) indicating that the centric cluster points located in the spatial area of  $x \approx -30$  and  $y \approx 0$  are perceived as negative cultural patterns by the interviewed subjects. The two-dimensional visualisation in figure 14 was chosen to provide an overview of the entire set of clusters created in this study. Each section of the results and discussion chapter, namely

- 1) Corporate sustainability
- 2) Two-factor theory of motivation
- 3) Self-perception in leadership
- 4) Employee proactivity
- 5) Organisational agility

analyses a part of the entire framework, making a three-dimensional visualisation as indicated in figure 13 possible again, without impeding readability of the results.

**Figure 10: Centric positions of aggregated clusters**



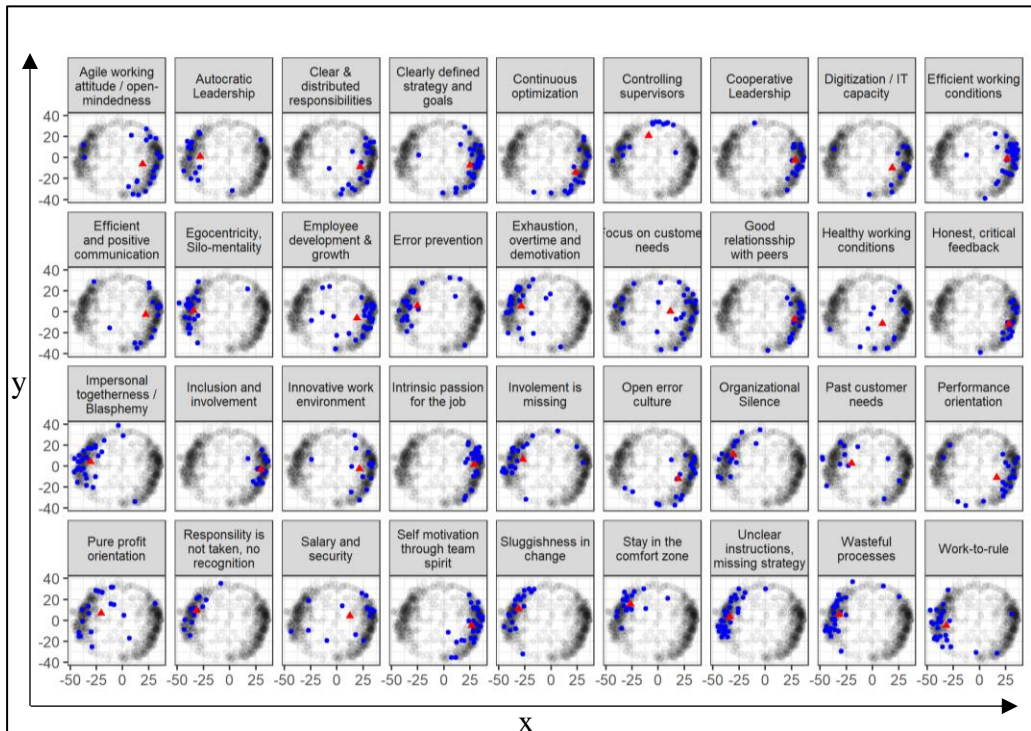
Source: Compiled by Dr Mark Heckmann based on the study's dataset

The following overview indicated by Figure 11: Construct locations of each cluster shows the location and spreading of elements around the centric position of each cluster. A spatial concentration of all constructs of one cluster denotes a high degree of consensus between the interviewed people for this issue, e.g. *Unclear instructions, missing strategy* being condensed entirely close to the element “a negative company”. In contrast *Pure profit orientation* is evaluated more diverse as the constructs representing this cluster are spread throughout the graphical sphere. Another example for a cluster that is semantically coherent but the evaluation by the subjects differ is the cluster *Focus on customer needs*. These differentiated assessments indicated clearly the advantage of RGIs. While

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semantically the personal constructs all relate to the focus on customer needs, for some subject this is a positive cultural pattern while others evaluate this as negative. They might evaluate it more positive if the corporate culture would put the wellbeing of its employees before the customer requirements.

**Figure 11: Construct locations of each cluster**



*Source: Compiled by Dr Mark Heckmann based on the data set of this study*

In consequence the ratings of the elements described in phase 4 (see figure 12) ensure that the researcher interprets the assessment criteria elicited during the interviews in accordance to the subjects perceptions. A factor that a standard qualitative interview does not provide. Table 4: Construct correlations of all clusters lists the statistical values for all clusters and their degree of correlation with the main elements of this study. In general the table lists the number of personal constructs  $N$  of each cluster, including the percentage of total constructs. A higher percentage indicates a higher level of importance of the distinct cultural factor. For example the cluster *wasteful processes* consists of 31 related constructs (4,0%) meaning that a many subjects (about 50% of the inquired personnel)

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associated this organisational scenario with the investigated company. *Controlling supervisors* (14 constructs; 1,8%) on the other hand is still reflected in the corporate culture but only about 23% of subjects created constructs describing this organisational pattern. The minimum value to create an own cluster was set to 10 related constructs. Divided by a maximum of 61 interviews this reflects a quota of 15% of the entire 61 interviewed employees and leaders. In each subsection of the results and discussions distinct element cluster combinations are contextualized to investigate the specific topic. To avoid duplication of interpretation the following table is not analysed in this section.

**Table 4: Construct correlations of all clusters**

Topic-related clusters		Constructs		Degree of correlation				
		N	in %	The company today	A negative company	The ideal company	Leadership culture	Employee culture
Interpersonal	Self-motivation through team spirit	27	3.5%	0.510	0.329	0.888	0.588	0.524
	Good relationship with peers	19	2.4%	0.482	0.317	0.920	0.557	0.495
	Egocentricity, silo mentality	26	3.3%	0.590	0.921	0.303	0.498	0.596
	Impersonal togetherness/blasphemy	30	3.8%	0.657	0.901	0.342	0.564	0.666
	Efficient and positive communication	16	2.0%	0.543	0.386	0.858	0.612	0.548
Recognition and feedback	Responsibility is not taken	15	1.9%	0.683	0.916	0.316	0.581	0.685
	Performance orientation	16	2.0%	0.525	0.417	0.823	0.573	0.546
	Honest, critical feedback	15	1.9%	0.424	0.310	0.920	0.489	0.430
	Error prevention	23	2.9%	0.701	0.857	0.387	0.614	0.708
	Organisational silence	15	1.9%	0.704	0.900	0.325	0.601	0.703
	Open error culture	21	2.7%	0.498	0.390	0.852	0.551	0.516
Job attitude	Employee development & growth	29	3.7%	0.531	0.405	0.850	0.589	0.539
	Intrinsic passion for the job	27	3.5%	0.510	0.330	0.866	0.594	0.504
	Work-to-rule	28	3.6%	0.579	0.841	0.359	0.499	0.595
	Past customer needs	12	3.6%	0.724	0.773	0.446	0.651	0.752
	Focus on customer needs	29	3.6%	0.647	0.487	0.746	0.697	0.660
	Stay in the comfort zone	18	2.3%	0.783	0.817	0.340	0.672	0.785
Leadership	Autocratic leadership	15	1.9%	0.603	0.870	0.364	0.525	0.602
	Cooperative leadership	19	2.4%	0.508	0.324	0.895	0.590	0.515
	Clearly defined strategy and goals	34	4.3%	0.470	0.349	0.891	0.535	0.472

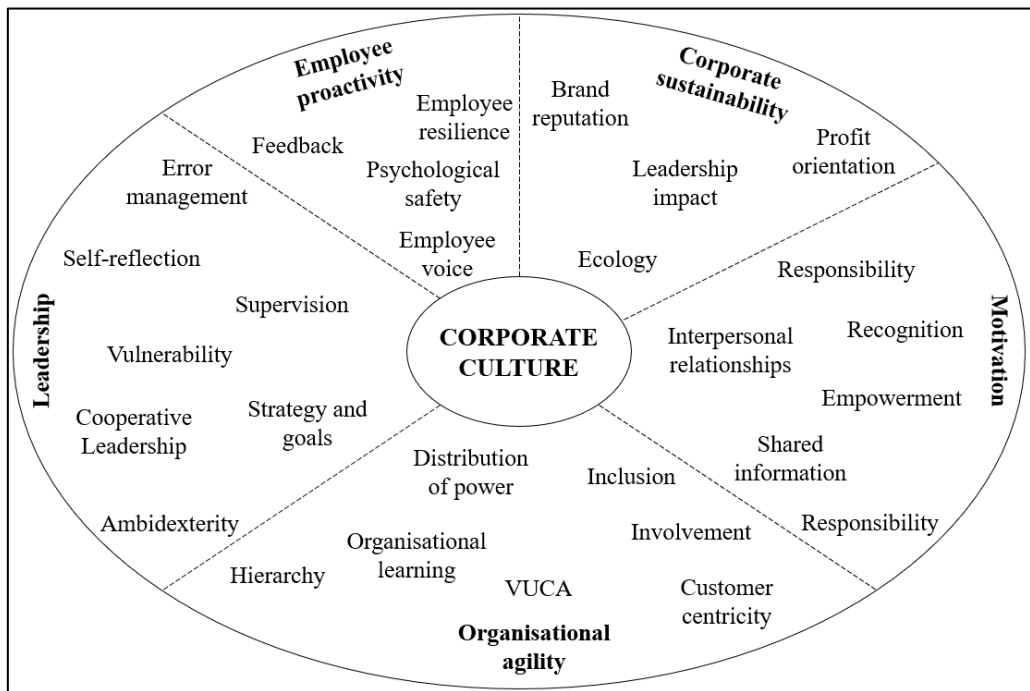
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	Controlling supervisors	14	1.8%	0.862	0.677	0.467	0.811	0.814
	Unclear instructions, missing strategy	30	3.8%	0.630	0.920	0.310	0.533	0.640
	Clear & distributed responsibilities	20	2.6%	0.495	0.371	0.883	0.556	0.506
	Involvement is missing	21	2.7%	0.664	0.886	0.368	0.580	0.658
	Inclusion and involvement	15	1.9%	0.503	0.290	0.849	0.589	0.522
Working conditions	Exhaustion, overtime and demotivation	26	3.3%	0.675	0.890	0.357	0.584	0.681
	Wasteful processes	31	4.0%	0.661	0.913	0.327	0.564	0.668
	Digitisation/IT capacity	11	4.0%	0.495	0.400	0.847	0.547	0.503
	Agile working attitude/open-mindedness	23	2.9%	0.532	0.407	0.848	0.589	0.540
	Efficient working conditions	32	4.1%	0.511	0.345	0.879	0.588	0.509
	Sluggishness in change	19	2.4%	0.709	0.890	0.318	0.603	0.712
	Continuous optimisation	21	2.7%	0.447	0.343	0.889	0.504	0.461
	Healthy working conditions	15	1.9%	0.562	0.475	0.754	0.593	0.588
	Innovative work environment	13	1.7%	0.544	0.393	0.853	0.611	0.547
	Salary and security	19	2.4%	0.669	0.480	0.735	0.729	0.677
	Pure profit orientation	19	2.4%	0.702	0.822	0.429	0.631	0.695
	Unassigned	12	2.4%	0.565	0.506	0.742	0.591	0.578
<b>Total</b>	<b>782</b>	<b>100%</b>						

*Source: Compiled by the author*

It became evident that the topics within CC reinforce and influence each other. Figure 29 shows which organisational culture-related topics were highlighted in each section, as well as the multiple keywords of each CC-related subject. These are interlinked elements which emphasis the complexity when analysing the culture of an organisation. The figure certainly does not list the full extent of CC elements but is rather limited to the ones drawn from the quantitative and qualitative results of this study and the scientific literature reviewed.

**Figure 12: Analysis of corporate culture linkages**



*Source: Compiled by the author*

CC is a complex framework of a diverse number of people’s assumptions and interpretations. Making these visible via an unbiased methodology enabled the discovery of new paths in research of organisation behaviour. The utilised software, *rep:grid*, has proven to be a strong support in this investigation, both in the data generation and analysis. The dataset can be extracted including all 782 constructs and their unique grid coordinates. In this manner the data can be analysed later with additional tools such as R.

The explorative approach to analyse organisational culture, combined with reviews of contemporary literature, revealed to be a research approach worth following. In particular this holds true for triangulation methods that generate quantitative and qualitative data simultaneously. In this case the limitation of one investigated organisation had the opposite advantage that explicitly LMX-related data was created and analysed.



## RESULTS AND DISCUSSION

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As a starting point CS was analysed to highlight the importance of leadership and a strong strategical commitment towards CS. Section 5.2 on CS presented, through exploratory and literature review-based research, a deeper insight into CS within the CC, whilst suggesting, however, that in practice the topic is not as relevant as expected. Here the intuitive and unbiased approach of PCP proved advantageous as it obviates socially desirable results by leaders and followers. Herzberg's motivation-hygiene theory was tested and visualised in a contemporary work environment, and its outcome suggested a resurrection alongside an adaption of the theory to today's economic circumstances. An essential part of the motivation theory was and is leadership, which brought the subsequent topic of self-perception in leadership into focus. This topic, as well as the effect of a manager's distorted self-perceptions, has not been researched comprehensively in scientific literature, which already made this research worthwhile. The findings of this study introduced error handling and employee voices as strong influential drivers for leaders' own evaluations. After the publication of these findings, it became evident that one element was missing in drawing corporate-wide conclusions, namely the handling and communication of managers' own mistakes and uncertainties. The dataset was thus explored again, focussing on vulnerability in leadership and its effect on employee proactivity. The literature supports the conclusion that organisational learning and employee commitment mediate the proactive employee behaviour, requiring resilience and psychological safety to communicate errors as prerequisites. Finally, the dataset allowed the visualisation of the agile status quo of an organisation leading to a new investigative model that links VUCA forces with the different parts of organisational agility. In summary, the explorative approach provides valuable insights into future research directions, especially for quantitative analysis methods to substantiate the initial findings.

### *Corporate sustainability*

Repertory grid analysis is a suitable method to visualise the CS status quo of an organisation. By not directly asking CS-related questions, unbiased results regarding leaders' and employees' sustainability-related assessment criteria have been generated. As sustainability has increased in importance on a societal level, questionnaires targeted to assessing CS are more likely to evoke socially desirable results than confronting people with elements alone. Furthermore, the investigation related to CS concluded that in the investigated organisation, its relevance is not high in the minds of the employees, whilst reinforcing the scientific tenet that leadership is an important lever for advancing CS in an organisation.

### *Motivation in a work context*

The grid data was used in another context to re-evaluate Herzberg's motivator-hygiene theory. The conducted semantic cluster analysis revealed that even without targeted questions, clusters were derived that advocated a readoption of Herzberg's theory. However, the results of this study suggest a revision of the factors originally listed by Herzberg to update the theory to today's working environment. Workforce generation, altered to include different traits and values, requires representation in the same way. Agile working practices are required due to the different economical structure 60 years after Herzberg wrote his theory. Not only can organisational agility in this context increase the flexibility and reaction speed of an organisation, but the findings of this study suggest that it even functions as a motivational factor for employees. As a consequence the leadership requirements with regard to motivating employees have changed, which suggests that it has developed into a motivational, rather than hygiene, factor. In addition teamwork and feedback have become motivational factors which is likely to be linked to the changed workforce generation.

### *Self-perception in leadership and cultural influences*

The inductive approach of this study encouraged research on the factors influencing managers' perceptions of both themselves and others. A recent scientific literature review originally claimed that corporate strategy towards addressing error is a central element still underrepresented in scientific and practical notions. In this manner a new link was made between error prevention and performance orientation, which in combination led to a cultural scenario described as OS. This absence of feedback and open error culture induces false self-perceptions or overestimation in leadership. When a CC further does not engage in inherent recognition or involvement, a reluctance towards taking responsibility will consequently result, as there is no return on exposure to possible error commitment.

### *Leadership vulnerability*

A new meta-framework was created that describes how vulnerability in leadership influences proactive behaviour by followers. As prerequisites error management and psychological safety were identified by analysing 41 scientific models and frameworks from the research field of vulnerability in leadership. In addition organisational commitment and employee resilience are requirements for employee proactivity. In this manner a vulnerable approach to leadership supported by organisational learning and engagement creates a proactive culture in which ideas are brought forward, responsibility is taken and self-efficacy is reinforced through feedback and a forward-thinking mentality.

### *Organisational agility*

In a comprehensive literature review the subject of organisational agility was studied to highlight which elements are important in the process of making an organisation more agile. The results were compared to the clustered results of the RGIs. In this manner PCP was identified as a potential new scientific approach to

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assess and visualise, in a three-dimensional grid, the agile status quo of an organisation. This can contribute to business practice as well as to science.

Whilst investigating corporate agility, it became evident that there was no model or framework on organisational agility that linked the elements of VUCA to those of agility. Thus, a new assessment model was created by combining 23 of the most relevant frameworks and models. As its layout is similar to the cultural model created by Denison et al. (2004), it can contribute to future research and practical application in the same way. In summary, the model most emphasises which agile enablers, sensors, practices and responses an organisation must incorporate as an answer to VUCA.

## 5. CONCLUSION AND SUGGESTIONS

The results of this dissertation are limited with regard to the quantitative data collected. As noteworthy new patterns in organisational behaviour were identified, however, this leads to the following further research suggestions and implications for scientific research:

- Substantiation through a new methodology that CS is fostered through leadership impact.
- The research developed an updated structure for Herzberg's two-factor theory of motivation. Testing the concluded results of motivator and hygiene classification quantitatively in a contemporary work environment is required to validate, discard or adapt the findings. The research highlights that resurrecting the theory is a worthwhile research path.
- Quantitative testing of the hypothesis model developed for the influencing factors for a misleading self-perception in leadership was suggested in the section 5.4; a respective scale must be developed.
- Error handling from a cultural, as well as a leadership, perspective is highlighted by this research as an underrepresented field with potential new insights with regard to the impact and importance of error management and communication in organisational research. Quantitative data could substantiate the interesting interrelations identified in this personal construct study.
- Finally, a new assessment model linking organisational agility elements with VUCA forces was developed based on the research conducted in the section on organisational agility. Developing a scale to generate quantitative data would be the next step towards establishing or modulating the model for scientific research and practical deployment.

With regard to practical implications, the following findings can be drawn from this study:

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- PCP transacted through RGIs has proven to be a powerful tool to investigate CC. This way it can provide managers and employees valuable insights into CC-related issues as well as positive aspects that can be reinforced.
- An RGI study based on PCP is a suitable access framework to analyse and transform CC giving leaders an unbiased picture of the CC of their organization. The visualisation can be easily interpreted which makes them practically applicable.
- In practice a focus by employees and leaders with regard to handling and communicating errors made by others and their own is required. Mistakes are a valuable element in organisational learning, the development of self-efficacy and psychological safety.
- Proactive employee behaviour requires the above-mentioned prerequisites to ensure empowerment is thoroughly experienced in practice.
- Organisations can assess the agile status quo of the organisation by conducting RGIs. The results of section 5.6 on organisational agility suggest though that the created assessment model can directly produce results in linking the criteria to the forces described by VUCA.

A final key suggestion of this research relates to current notion of managerial science and practice, advocating that corporate culture can be formed by stating clear corporate values. This proclaims that a set of values determined by leadership will guide managers and employees as it gives them something to aspire to and live by. The concluding advice is that a communication of corporate “shiny” values will change the culture in a favourable and desirable way. This flawed reasoning misses one key element in forming corporate culture that is highlighted by this personal construct study on corporate culture. The reasoning is based on a linear deed and perception interrelation. Meaning for example, “transparency” as a proclaimed corporate value leads to transparent information sharing by leaders and employees which in return is perceived an act of

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transparency. The last step though depends on the anticipated and perceived behaviour of another person. Hence, the last fragment of the above-described action chain can result in a perception of bogus-transparency. If a manager formerly keeps information to himself, but after the values being communicated proactively shares information, the question arises how this act is interpreted. As the anticipated behaviour is that the managers true values are obtaining an advantage by additional knowledge the act of information sharing is likely to be perceived as “not sharing all or the important information”, which in return leads to a devaluation in corporate culture. In consequence the positive intention of stating aspirational corporate values can cause a negative corporate cultural result. As PCP is identified as a suitable approach to assess and visualize a CC, it can be a new access point to initiate a change in CC. This implies that research does not focus on favourable or unfavourable organisational values but rather the impact of management practices and organisational structures that ensure a coherent action, anticipation and perception interrelation.

Based on this conclusion this research suggests that research and in practice business advisory focuses more on expectations and interpretation like in the personal construct framework as the same event or action is perceived differently by the participating subject. This is reflected in the different personal constructs created as well as the diverting evaluations of these constructs. Thus, CC cannot be influenced by a proclaimed value but rather evolving from management practices and the resulting behaviour. This advocates research in distinct practices, rules and frameworks and their influence on perceived culture and business performance rather than the right values.

### *Limitations*

The most relevant dichotomy of this study refers to the dataset being limited to one organisation. On the one hand, two factors favour this limitation of scope: direct LMX data, which enabled new implications, such as the results with regard to self-perception in leadership, and the possibility of creating a holistic CC view of an organisation, since a conflation of repertory grid data from several organisations would not have generated expedient results. On the other hand, making enquiries with interviewees of several companies would have made comparable results, which would lower the representativeness of the organisation. In addition the depths and number of clusters or topics would decrease with a reduction of interviews per organisation. Still the results would not be generalisable in a quantitative manner. As a consequence an in-depth qualitative approach was chosen with a limitation to one organisation. In retrospect this has proven to be an effectual method as new paths in organisational research were identified. To make the qualitative results of this research which combined empirical and qualitative elements generally applicable, quantitative enquiries would need to be performed. These quantitative enquiries should be carried out in a diverse number of organisations from several countries. That way the collected data can support or discard the validity of this studies finding to generalize them practically and scientifically. In this manner the exploratory approach developed several research paths.

An extension within the organisation under investigation was carried out to collect the perspectives of more employees. The purely quantitative enquiries based on the quantitative results of the primary RGI approach did not add any new insights or different results. Thus, these quantitative results were not integrated into the formulation of this dissertation to prevent a dilution of the investigative PCP methodology. The studies limitation of one company in one country can rather be removed by applying the element set to further organisations in other countries than Germany. The employed software *rep:grid* allows this as it is a multi-



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language tool. Only the elements must be translated manually to ensure a consistent sense in the other language.

In particular, implications result from the findings in the context of error management and self-perception in leadership. The quantitative and qualitative data created empirically in this study guided the literature review, which made evident that further research is required in this field due to its importance in the framework of CC.

Another limitation of this research work is that the creation of clusters was limited to one researcher. Ideally the 782 constructs would have been analysed by one or more additional people to increase the semantic cluster validity. However, the usage of the *rep:grid* tool is limited to trained people, which is why the author created the clusters and had them reviewed. An independent cluster creation with an ex-post alignment would be the ideal approach to the clustering and review process of the constructs of this dataset. As Feixas et al. (2002) showed an independent clustering process by two researchers created high degree of consensus (87.3%) meaning the validity can still be assessed as being given.

Another limitation is the uncommon type of interpretation of the repertory grid results. As no significant levels of correlations are created, the analysis required working with spatial distances and the associations of the interviewees. Example levels of “high associations” can be found in literature, such as the work of Hauser et al. (2011), which served as an orientation. However, no definite level can be drawn for the exact interpretation of results, so the interpretation must follow an approximation methodology, which leads to the implications of this research.

## 6. NEW SCIENTIFIC RESULTS

This dissertation – and the associated publications – have resulted in the following 5 new scientific results:

1. *It was demonstrated that PCP via the execution of RGIs is an appropriate methodological approach to investigate parts of a CC.*

In consequence the first research question: *Is personal construct psychology an applicable methodology to investigate corporate culture?* can be confirmed. This dissertation represents an entire RGI data set of a corporate culture which was not identified in the scientific literature before. As Brophy (2007) has stated PCP is a powerful tool to research CC, which is reinforced by the results of this dissertation. Consequently, has

2. *this research broadened the current estate of PCP related studies by a holistic cultural study of one organisation.*

The specific quantitative and qualitative results compiled by this investigative method allowed a three-dimensional visualisation which provides scientists and practitioners an easy-to-understand approach for exploring organisational behaviour.

3. *Thus, RGIs a suitable way to enquire and visualise the complex framework of corporate culture in quantitative three-dimensional plots.*

This was highlighted within the results and discussion chapter, namely the specific sections 5.2 to 5.6 which give valuable insights into parts of a complex CC framework. The pandemic crisis in 2020 and 2021 showed arrestingly how volatile, ambiguous and uncertain the economic environment organisations are facing can be. Linked to research questions three (Does the interpretation of the results allow one to draw conclusions on the above-stated contemporary CC-related forces and economic scenarios?) this research showed as additional novel result that:

4. *Without pointing subjects to underlying economic forces, in repertory grid structured interviews personal constructs are created that relate to contemporary corporate values and perceptions.*

In addition, this study showed that:

5. *RGIs based on PCP reflect contemporary research topics in organisational behaviour allowing to draw scientific conclusions.*

The derived results in each section 5.2 to 5.6 highlighted that new scientific conclusions can result from PCP research in a CC context. As they are lengthy discussed in each subsection the subject specific novel results are not reiterated in this chapter.

The final objective of this dissertation was to evaluate if the generated dataset promotes further worthwhile research directions for extended investigation. This can be answered positively as for example new cultural pattern have been identified that advocate a stronger focus on the approach to handle errors as part of organisational behaviour. Conclusively the main contribution of this dissertation is to substantiate PCP as a suitable research method in organisational research. This research emphasizes that RGIs based on PCP are a possibility to originate novel research directions.

## PUBLICATIONS

### **Publications related to this dissertation:**

- Bundtzen, H. (2019). Assessing Corporate Sustainability with Repertory Grid Based Personal Construct Psychology. *Regional and Business Studies*, 11(2). <https://doi.org/10.33568/rbs.2406>
- Bundtzen, H. (2020). Adapting Herzberg's Motivation-Hygiene Theory to a VUCA World – A Repertory Grid Study. *European Journal of Economics and Business Studies*, [S.l.], v. 6, n. 3, p. 145-159, jan. 2021. ISSN 2411-9571. Available at: <http://journals.euser.org/index.php/ejes/article/view/4933>. Date accessed: 16 feb. 2021.
- Bundtzen, H., & Hinrichs, G. (2021). Innovation Capability of the Company: the Role of Leadership and Error Management. *Marketing and Management of Innovations*, 1, 112-123. <http://doi.org/10.21272/mmi.2021.1-09>
- Kussin, L.; Bundtzen, H. (2021). How Error Prevention and Organizational Silence Influences Managers' Self-Perception – A Repertory Grid Study. *Business Ethics and Leadership*, 5(1), 31-44. [https://doi.org/10.21272/bel.5\(1\).31-44.2021](https://doi.org/10.21272/bel.5(1).31-44.2021)
- Bundtzen, H., Hinrichs, G. (2021). The Link Between Organizational Agility And VUCA – An Agile Assessment Model. *SocioEconomic Challenges*, 5(1), 35-43. [https://doi.org/10.21272/sec.5\(1\).35-43.2021](https://doi.org/10.21272/sec.5(1).35-43.2021)
- Bundtzen, H.; Heckmann, M.; Hinrichs, G. (2021). A constructivist approach to visualise organisational agility. *Business Ethics and Leadership*, 5(2), 96–106. [https://doi.org/10.21272/bel.5\(2\).96-106.2021](https://doi.org/10.21272/bel.5(2).96-106.2021)
- Bundtzen, H.; Hinrichs, G. (2021). Rep:grid Software Supported Visualization of a Corporate Culture. *TEM Journal*, 10(3), 1092-1098. <https://doi.org/10.18421/TEM103-12>

**Publications not related to this dissertation:**

Hinrichs, G., Bundtzen, H. (2021). Impact of COVID-19 on personal insurance sales – Evidence from Germany. *Financial Markets, Institutions and Risks*, 5(1), 80-86. [https://doi.org/10.21272/fmir.5\(1\).80-86.2021](https://doi.org/10.21272/fmir.5(1).80-86.2021)

Hinrichs, G., Bundtzen, H. (2021). Communicating a Sales Job to Occupational Changers: A Qualitative Content Analysis of Online Job Advertisements. *TEM Journal*, 10(2), 853-857. <https://doi.org/10.18421/TEM102-45>