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A PROPOSED OCCUPATIONAL HEALTH AND SAFETY INFRASTRUCTURE AS ENABLER FOR SUSTAINABILITY-ORIENTED INNOVATION

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the Scientific Title of PhD in Engineering
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FOREWORD

"The first effort to research a new problem is most likely to be inelegant, imprecise and crude."
Abraham Maslow, 1966 in The Psychology of Science, p. 14

The present manuscript is the outcome of my doctoral studies at the Politehnica University Timisoara, Romania which took place from 2017 till the present.

I address my deepest thanks to my PhD supervisor Prof. Anca DRAGHICI for her guidance and support throughout the many years of effort, as for her patience and encouragements throughout this research "adventure" of mine. She has opened me to new and challenging streams of research and for this I shall forever be thankful to her.

I also wish to thank the members of the Supervising Committee: Associate Prof. Larisa IVASCU, PhD. Eng., Lecturer Dr. Caius LUMINOSU and Prof. habil. Claudiu-Tiberiu ALBULESCU, PhD. Ec. who reviewed my research activity and contributed to its direction. The constructive exchanges around the viewpoints in the Faculty of Management in Production and Transportation of the Politehnica University Timisoara have contributed to the construction of my own research.

I will conclude this foreword by thanking my family for their constant support, understanding and trust without which I would not have gotten to the finish line: to my parents, to my husband and to my child.

Timişoara, May 2021 MSc. Eng. Corina-Monica RUSNAC (DUFOUR)

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1 INTRODUCTION

1.1 Motivation and importance

This research project stemmed from my own work experience. I have always been passionate about the operational environment as I enjoy the effervescence of "production", the hustle and bustle of shifts changing, problems arising and being solved, in the rhythm of the technical expertise and insight that are unique to the organization and to the people that are its heart and soul. I have had the opportunity to work alongside people of unique expertise in their technical fields, but who had the insight to always remind me that the organization works with and because of the people in it. Decisions involving people are the most difficult to make; they are built with patience and careful consideration and bloom through the care and unity of those they fall upon. I shall forever be grateful to those persons who have had the open-mindedness to teach me this in principle and action.

I often go back to this pivotal learning of my early days on the managerial front, and I go to work every day telling myself that up to the end of a career we can still learn from our own team. Some years onwards, I decided to take a step back and try to find answers to some of my deeper questions, that everyday management life did not provide the time for; here I was set on the path of a PhD.

It gave me a powerful insight into the path of management that I shall strive to walk upon in the many following years.

Looking forward, I settled for a research theme blending personal managerial questions regarding Occupational Health and Safety (OHS) and new societal concerns as reflected by Sustainability-Oriented Innovation (SOI). OHS is not a new field, and by dealing with the protection of employees and the environment is one of the oldest percussors of sustainable development. Indeed, from both environmental and social points of view, Occupational Health and Safety was one of the first non-financial issues to disrupt the production-consumption patterns (WCED, 1987).

Decades of organizational, industrial, academic, or legislative efforts, have unfortunately not eradicated OHS events (incidents, accidents etc.). Industry and academia both agree that the results of traditional approaches have reached a plateau and that new innovative approaches are required. The organization is a complex system that is constantly adapting. In a short span, the world has changed as the Industrial revolution propelled mankind in the era of possibilities as travelling, agriculture, commodities became not just tangible realities but part of the minimum living standard. In the second half of the 20th century the post-war international economic system (as mentioned in the Bruntland Report from 1987) was born and with it emerged new nations. This brought forward issues regarding the access and distribution of important natural resources reserves and environmental concerns in a context of civil and political awareness. Sadly enough, despite a long-standing understanding that the environment and society are not alienable from economic action, these issues are as acute today as they were decades ago. The 21st century brought its own set of complexity through the internet era and globalization. Today, organizations are faced with natural resource

scarcity, demographic, and political change, rising discrepancies in legal constraints and the emergence of a new resource which is knowledge.

Societal and environmental change are now setting the tempo for organizations as they struggle to keep up and stay ahead, become more agile and customer-oriented, more innovative to expand their market or create new markets, to be attractive employers and highly performant for their shareholders while proving sustainability to stakeholders. In one generation, Schumpeter's disruptive creation theory which defined agility and innovation as the new eruptions in the equation for success, has been itself disrupted by the sustainability factor.

If in the past, sustainable development was most often assimilated to environmental concern; the shifting of the public eye to wider societal concerns has repositioned Occupational Health and Safety (OHS) and Sustainability-Oriented Innovation as vectors of strategic agility and sustainable competitive advantage.

Throughout the present thesis, the author focused on the problem of interconnection between Occupational Health and Safety and Sustainability-Oriented Innovation. The main motivations driving the author's research include current limitations in the advancement of Occupational Health and Safety, limited comprehension of Sustainability-Oriented Innovation both in academia and in practice and finally, the growing importance of the human/social axis of sustainability, which underlies both Occupational Health and Safety and drives Sustainability-Oriented Innovation. It is the author's belief that the future will be driven by strong social voices and, while the understanding of individual phenomenon has shown its limits, we are to turn to the understanding of interconnections to avoid disparate and partitioned efforts. Therefore, ***the general scope of the PhD program was to characterize the relationship between Occupational Health and Safety and Sustainability-Oriented Innovation.***

If OHS has a long-standing tradition in the field of management, SOI is a rather novel concept, yet both are approached by numerous streams of the management literature leading to diverse, disparate, or even ambiguous approaches. The novelty of the present research project is its research agenda combining the two fields of study and investigating the interrelationship between them.

1.2 Research approach and objectives

Considering the scope of the research, current understanding of each of the studied phenomena was scrutinized to construct the foundations for the theoretical and applied research studies.

The general objective of the present research is concerned with the characterization of the relationship between Occupational Health and Safety and Sustainability-Oriented Innovation. The intention is (a) to investigate whether a relationship exists between OHS and SOI and (b) to delineate this relationship through the identification of mediating factors. To this end, from a theoretical stand-point research streams and gaps were analysed through sequential research on themes convergent to the doctoral scope. The author proposed a theoretical ***Mutual Influence Model***. The applied research focused on the study of current-day organizational practices regarding

OHS and SOI through a mixed-methods approach. The theoretical Mutual Influence Model was then overlapped to the practical findings.

The operational objectives of the research program are:

OP1. The theoretical investigation of the existence of mediating factors between Occupational Health and Safety and Sustainability-Oriented Innovation. This is achieved through the identification, synthesis and critical analysis of the state-of-the-art research on Occupational Health and Safety and Sustainability-Oriented Innovation - Chapter 2 and on the specific question of the relationship between Occupational Health and Safety and Sustainability-Oriented Innovation from a theoretical perspective (existence, mediating factors) – Chapter 3.

OP2. The second objective consists in the practice-based identification of theoretical mediating factors in organizational practices and understanding of their interrelationships. This requires the identification of the best-fit research approach and construction of the research design - Chapter 4 and specific experimental research regarding organizational practices relative to Occupational Health and Safety and Sustainability-Oriented Innovation - Chapter 5.

OP3. Theoretical and experimental development of the Mutual Influence Model - Chapter 5. This objective is dedicated to identifying similarities and dissimilarities between the theoretical hypothesis and organizational practices.

A systematic development of the PhD Scope and Objectives in the chapters of the thesis is given in Figure 1.1 PhD Thesis Logic.

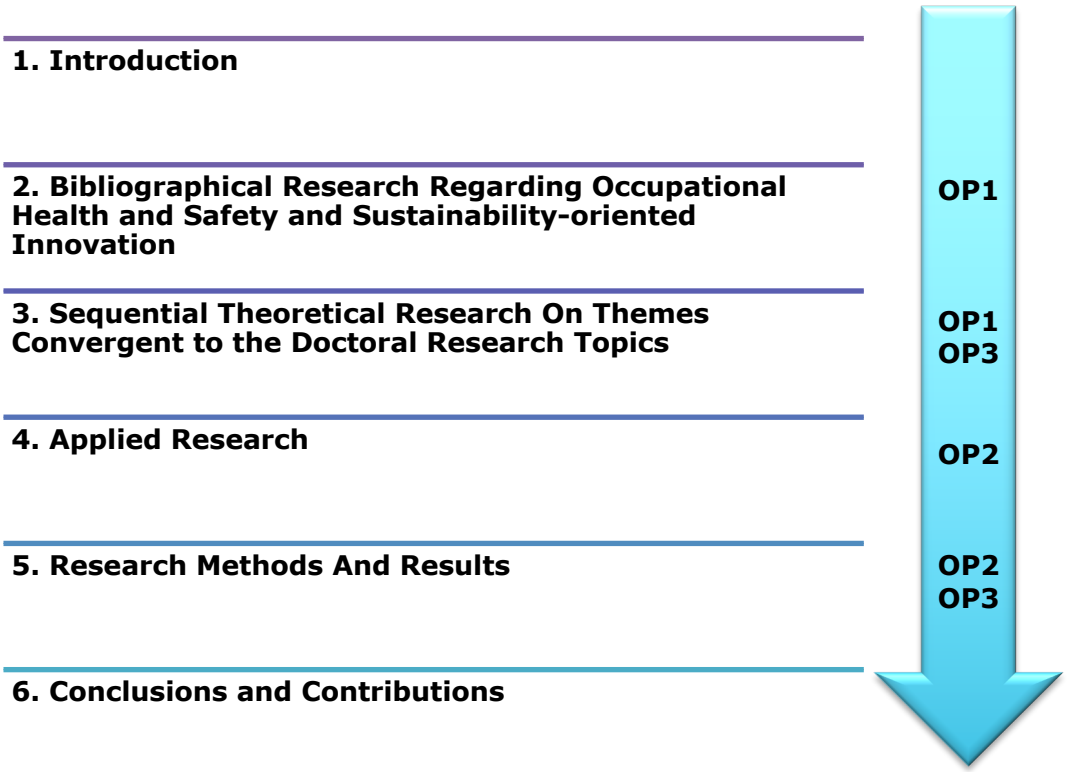


Figure 1.1 PhD Thesis Logic

1.3 Phd Thesis structure

The author's research quest is depicted in six chapters (notwithstanding Bibliographical and Appendix sections, Lists of Figures and Tables). Each chapter

contributes to the attainment of the operational objectives through extensive descriptions of the research process in terms of structure, results, and conclusions.

Chapter 1, INTRODUCTION, was thought as a depiction of the author's research objective: compare theoretical findings with self-reported existing practices and beliefs. To this end, five sustainability reports were considered as a mirror of organizational practices. Sustainability reports are periodical communications dedicated to organizational efforts in the field of sustainability, with focus on OHS and innovative approaches implemented by and in the organization.

Chapter 2, BIBLIOGRAPHICAL RESEARCH REGARDING OCCUPATIONAL HEALTH AND SAFETY AND SUSTAINABILITY-ORIENTED INNOVATION, discusses current understanding of the researched phenomenon. The author resumed state-of-the-art understanding regarding Occupational Health and Safety and Sustainability-Oriented Innovation, respectively. The chapter points out the vastness of the two subjects and the variety of the research angles that can be adopted. The focus of this chapter is on the absence of academic consensus regarding OHS and SOI, respectively, and therefore to paint the wideness of the subject: definitions, legal considerations, management systems implications and structural variety.

In Chapter 3, SEQUENTIAL THEORETICAL RESEARCH ON THEMES CONVERGENT TO THE DOCTORAL RESEARCH TOPICS, the author leaned over the problem of interconnection between OHS and SOI, which is superficially mentioned in literature. The author presented original theoretical research on themes convergent to the research theme to outline the interconnections between OHS and SOI. Given the lack of common ground regarding OHS and SOI, respectively, the problem of interconnection was complex to trace, as individual continuants of each phenomenon are not clearly defined. Consequently, the author departed from traditional research configurations of in-depth understanding of each phenomenon before the understanding of interconnections and adopted an innovative research approach of direct study of interconnections. Therefore, and mostly based on the author's co-authored research, theoretically mediating factors between OHS and SOI were identified.

Chapter 4, APPLIED RESEARCH, is focused on methodological considerations for the applied research. It dedicates sections to theoretical considerations regarding mixed methods research and goes on to discuss the research deign, as well as data collection and analysis procedures.

Chapter 5, RESEARCH METHODS AND RESULTS, is dedicated to the research results: mixed methods (qualitative and quantitative) results are presented and discussed in depth; the author also critically reviews the conclusions regarding "sharp-edge" practices in comparison to those theoretically hypothesized.

Finally, Chapter 6, CONCLUSIONS AND CONTRIBUTIONS, is a distilled synthesis of the bibliographical, theoretical and applied research, and discusses the author's personal contributions at each stage of the research. The author considers also future avenues and implications of the current research.

The thesis concludes with a chapter listing the bibliographical references (articles, books, and web pages) and a chapter dedicated to appendix which details the different research phases and results, the author's CV and list of publications.

The research results were disseminated in 16 articles published in international conferences' proceedings and journals, from which 5 in ISI journals, 4 in ISI proceedings and 3 in BDI index journal and 4 in BDI index proceedings.

2 BIBLIOGRAPHICAL RESEARCH REGARDING OCCUPATIONAL HEALTH AND SAFETY AND SUSTAINABILITY-ORIENTED INNOVATION

The purpose of the present chapter is to summarize state-of-the-art knowledge for the two studied concepts: Occupational-Health and Safety and Sustainability-Oriented Innovation.

From a structural perspective, the chapter is divided in two sections: *Section one* which deals with Occupational Health and Safety and *Section two* deals with Sustainability-Oriented Innovation. Each concept is dealt from the perspectives of the various research streams (historical, legislative, stakeholder, management etc.) encountered during the bibliographical study, therefore leading to a "non-traditional" exploration approach.

The development of the operational objective OP1 is done as follows:

- Bibliographical research of the state-of-the-art knowledge regarding OHS and SOI;
- Exploration of up-to-date theories and research streams regarding each concept;
- Identification of the existence of a knowledge plateau and the necessity of a new research perspective.

2.1 Occupational Health and Safety

The present chapter shall identify, analyse and synthesize relevant research with the purpose of creating a bibliographic review on Occupational Health and Safety. Figure 2.1 summarizes the methodology used to research the subject, and the key research axes.

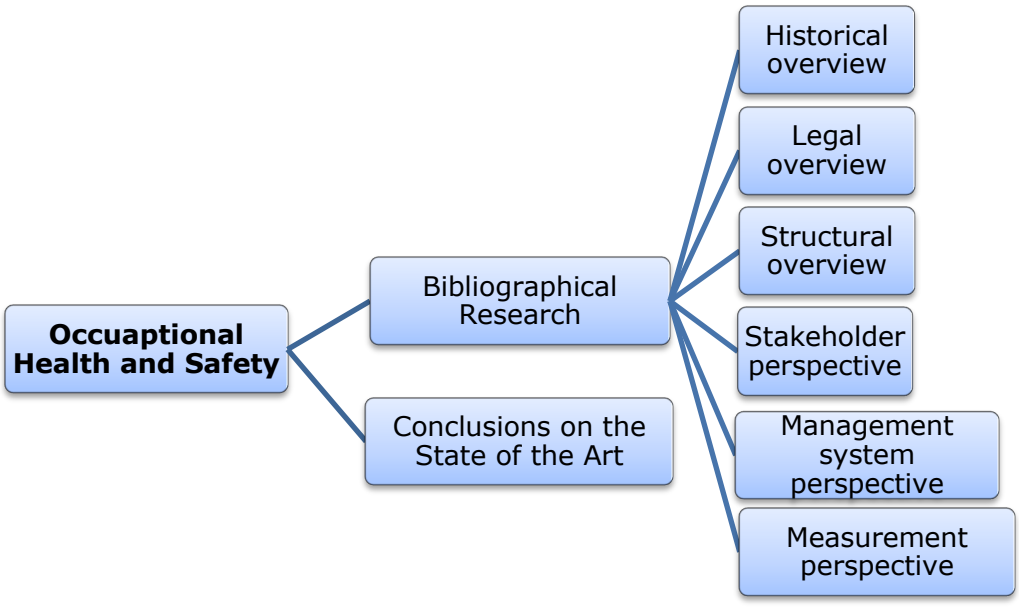


Figure 2.1: Research Methodology for Occupational Health and Safety

2.1.1 Historical overview

Occupational Health and Safety is a complex field as it finds itself at the crossroad of many disciplines such as law, medicine, ergonomics, operational management, knowledge management or psychology.

Darabont and Pece (1996) proposed a very interesting retrospective on OHS preoccupations, going back to ancient civilizations who documented their worksites by referring to the presence of doctors, to measures against lead poisoning or even the use of primitive protective equipment for stone working. OHS considerations englobing not only man, but the work tools and the work environment gave birth to the many disciplines that influence OHS today, such as law, medicine, psychology etc., and to which recent scientific developments have added disciplines like knowledge management or ergonomics. Moreover, the contributions of Arnaud de Villeneuve to professional illness, of Leonardo da Vinci to lead time, of Broelli to muscular effort impact on the human bone structure, of Ramassini on ambient pollution led to two distinct domains regarding the relationship between man and work: work accidents and professional disease (Darabont and Pece, 1996). Finally, the industrial revolution saw the emergence of the first OHS legal frameworks.

As history shows, the confluence of many fields of study, and the dependence on national contexts, research, and legislative initiatives, renders the definition of Occupational Health and Safety far from being consensual. What is more, due to the dependence on social, economic, and territorial history, OHS evolution is not linear throughout the world; resultingly it was chosen to present OHS based on the works of Hollnagel et al. (2015), who proposed that safety be considered through an evolutionary angle.

Safety-I (up to the 1908s) emerged in high-risk industries in the context of less intricate and interdependent production environments. As bimodal (right/wrong) functions were the only modes of the production environment, under Safety-I variability is the most important liability and OHS events (accidents, incidents, near-miss) occur due to failures which could have been identified before-hand. The human component is viewed as the root cause of most variability and hazard. The limits of this corrective, post-event approaches are numerous: firstly, there is a limited understanding of the causes for correct system functioning; secondly, it disregards the complexification of the production environment (communication tools, robotization); thirdly, it dismisses procedural and technological misconceptions (Russ, 2010). Finally, it condemns human adaptative capacity.

The shortcomings of the Safety-I perspective paved the path for the Safety-II era: the focus shifted on understanding how the system operates despite variability and change, and what are the elements that make that the goals of the production system are attained. Adaptative capacity introduced risk assessment as monitoring tool, and it was now possible to understand the limits of the adaptative capacity of both constitutive elements and those at the organization level. Therefore, OHS became concerned with adapting the rules to organizational components. In this regard, OHS management becomes a process of constant and continuous innovation.

Three methods were explored for enhancing productivity and, subsequently, OHS performance: training, design, and automation. Technological evolution imposed that training first focuses on the manipulation of technology, and later "the cognitive functions involved in, e.g., diagnosis, problem solving, decision

making, and planning" (Hollnagel, 2012, p. 4). Initially, design considered basic considerations regarding ergonomic, basic safety and ease of use, and then developed due to the increased complexity of the production system to data/information management and performance of necessary actions. Finally, automation, was used as a crutch for human action and was soon omnipresent.

The third era was triggered by the information revolution; Safety-III discusses the age of interdependence (Hollnagel, 2012). This period has seen the complexification of the production environment and the rise of the interdependence between man and machine, which rendered previous working patterns and conceptions obsolete. Indeed, as it is true to this day, safety and performance are not optimizable by eliminating human error, nor overcoming human limitations, but by using workers as a resource to counter inevitable performance variability.

Today more than ever, the constant geopolitical, climatic, legal, and social challenges make that even the most clockwork organizations become, at a certain point, intractable systems. Therefore, simple application of rules, high degree of automation, or detailed design render the organization inert and obsolete; the human factor, through innovation becomes key in rendering the organization agile, adaptative and competitive.

2.1.2 Legal overview

OHS legislation is concerned with defining working conditions (Yränheikki and Savolainen, 2000; Roy, 2003; van Gemert-Pijnen et al., 2006; Høivik et al., 2009; Moreau and Neis, 2009; Russ, 2010; Newnam and Watson, 2011; Manu et al., 2013; Nordlöf et al., 2015; Bevilacqua et al., 2016; Yovi and Nurrochmat, 2018; Fox et al., 2018; Holte and Follo, 2018) and mechanisms for dealing with non-compliance.

The modern OHS national legal frameworks are built on the fundamental principal of the general duties of the employer, who has a legal accountability for risks emerging during the worktime and at the workplace. Without entering, in the specifics of legal changes, which are also highly dependent on national and economic context, it is to be reminded that, in Romania, starting with 1910, there was a shift in the legal paradigm, as the courts established employer responsibility for workplace accident, contrary to previous practice which required the employee to prove that the accident that the accident was due to the employer (Gheorghies, 2012).

Today, the fact that OHS accountability lies with the head of the organization (ILO, 2001; Cliff, 2012; Rezvani, 2016; Pringle and Frost, 2003; Johnstone, 2012; Jamieson et al., 2010; Battaglia et al., 2015; Geminiani et al., 2013), is a fundamental principle widely accepted throughout the academic and legal worlds. While acknowledging this legal fact, Rezvani (2016), pointed out that the multitude of organizational strata renders granular OHS monitoring merely impossible for senior management. This relates to the under studied field of cascading responsibility within the organization and among stakeholders (Dufour et al., 2020).

Therefore, the employer who is most often assimilated to top-management, has certain legal obligations such as knowledge of and compliance with legal obligations, definition and implementation of a preventive OHS structure (Moreau and Neis, 2009), risk assessment follow-up (Russ, 2010), definition of subsequent responsibilities (Fox et al., 2018; Geminiani et al., 2013; Guo, 2012; Husin et al.,

2012; Morillas et al., 2013; and Arntz and Gray, 2016), communication with workers' representative or documenting OHS events (Morillas et al., 2013). Non-compliance is sanctioned according to legal provisions (Bevilacqua et al., 2016). Middle managers, on the other hand are, according to Moreau and Neis (2009), in charge of workplace and related OHS procedure design and present less attachment to OHS (Høivik et al., 2009), especially as they try to find the efficient solution for both production and OHS. Finally, front-line managers are pivotal for OHS implementation and compliance on the sharp end, which is why they are responsible for safety audits (Nordlöf et al., 2015) and may join in the design of corrective measures or accident investigation (Roy, 2003). Finally, front-line managers may become responsible for risk assessment and OHS indicator follow-up (Koivupalo et al., 2015).

It is to be noted, that OHS legislation does not exempt employees from their own duties and responsibilities, among which complying with rules and orders flowing from legal requirements, participating and using training learnings (Haas et al., 2014; Fox et al., 2018) so as not to endanger oneself and others (Russ, 2010) and collaborating with co-workers (Nordlöf et al., 2015). The employees have the right and the duty to report OHS incidents to their direct manager or to safety delegates, even stopping production in case of justified safety concerns (Morillas et al., 2013; Koivupalo et al., 2015; Twaalfhoven and Kortleven, 2016; Coulson, 2018).

Research literature agrees that respect of national and industrial legal requirements is a prerequisite on which organizations are to build their OHS infrastructure. The obligations to which organizations are bound are general enough to allow organizations the latitude to define and enact their own responsibility system (Jørgensen et al., 2006; Fox et al., 2018) and consider that management and workers are bound equally to respecting legal and internal safety provisions (Nordlöf et al., 2015; Russ, 2010).

In conclusion, establishing organizational responsibilities that cascade from the legal ones, appears to be a critical field of research (Bluff and Gunningham, 2003).

2.1.3 Structural overview

The OHS obligations that stem from, at least, legal obligations are translated by the organization into hazard management strategies. According to Makin and Winder (2018), hazard management strategies address hazards in three key organizational elements:

1. The workplace in which employees operate to achieve production of goods and/or service;
2. The employees towards whom the organization has a duty of care;
3. The management whose role is to organize the attainment of organizational outputs.

The Merriam-Webster dictionary defines hazard as both "a source of danger" and "the effect of unpredictable and unanalyzable forces in determining events" (Webster – hazard, 2019). Hazards materialize from a modification to any of the three organizational components as well as from interactions between them or with the external environment (Makin and Winder, 2018). Although some hazards can be easily identified, most are unapparent at first sight because of routine, time span between cause and effect (e.g., exposure to substances, noise etc.), characteristic of an operating mode (e.g., maintenance) or focus on behaviour

rather than system design (ILO, 2014). Makin and Winder (2018) extensively studied hazard strategies relative to the three components and their interactions. The interactions between the different dimensions have been summarized in Table 2.1.

As any key organizational element can influence another element or itself, it is to be noted that in coherence with the conclusions of the previous chapter on legal compliance, the ambiguity regarding roles and responsibilities, as the accomplishment of tasks without the necessary decision-making prerogatives is a hazard creating factor.

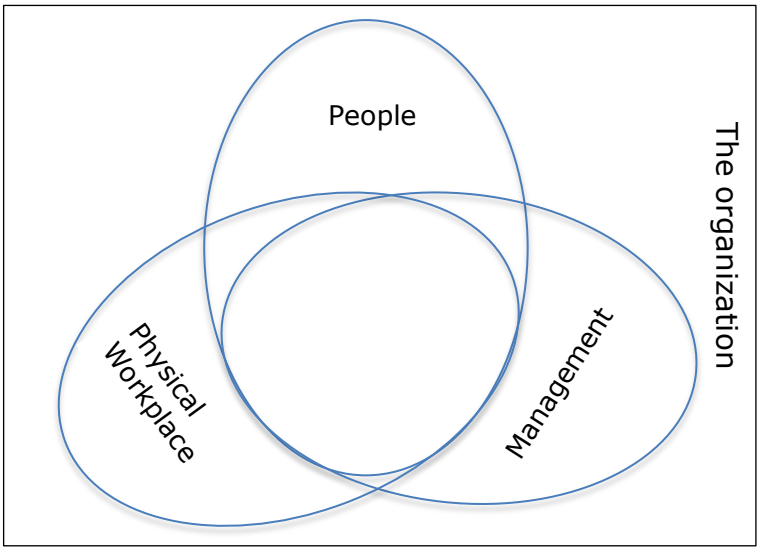


Figure 2.2: Fields of the workplace hazards - adapted from Makin and Winder (2018)

Apparent from the hazard emergence matrix, is that in its perpetual search for the optimal configuration, the organization also must manage two main enablers of OHS: knowledge and stakeholders. OHS professional knowledge is strongly influenced by turnover or restructuring, by pre-acquired OHS professional knowledge or the knowledge of the workplace. On the other hand, stakeholder management spans across many hazard areas. Firstly, internal stakeholders, and specifically workers and trade unions, influence organizational culture; this generates hazards by influencing the social acceptability of organizational demands (e.g., wearing personal protective equipment) or organizational change, which leads to inefficient or insufficient safety protocols. Managers, on the other hand are pivotal regarding workplace and work organization as through communication, consultation, and supervision, they can contribute to the definition of adequate and sufficient work specifications, which blend adaptability and knowledge transfer. To this end, managers' own OHS professional knowledge enables hazard mitigation across the three organizational elements.

In relation to the previous chapter, it is to be noted that hazard mitigation requires organizations to find a balance within and among each of the three dimensions of OHS. This continual quest for efficiency, is in Europe, according to the introductory lines of the European Directive 89/391, limited in that the legislator has set a breaking point for hazard elimination endeavours: "pursuant to Article 118a of the Treaty, such Directives must avoid imposing administrative, financial and legal constraints which would hold back the creation and development of small and medium-sized undertakings" (89/391/EEC, 1989) and

counterbalanced by considerations that "the improvement of workers' safety, hygiene and health at work is an objective which should not be subordinated to purely economic considerations" (89/391/EEC, 1989).

Table 2.1. Hazard emergence matrix in the "Safe Place-Safe Person-Safe Management" Conception (adapted from Makin and Winder, 2018, author's contribution)

Hazard areas' influence	Physical workplace	People	Management	External
PHYSICAL WORKPLACE	Changes or modifications to the physical workplace (e.g., installation of new equipment).	Ergonomic hazards (noise, vibration, lighting, design, handling etc.).	Poor decisions concerning equipment or facilities operation.	Economic climate, climate (heat, humidity, cold, UV radiation, etc.)
PEOPLE	Limits of human information – communication processes and human errors; weak design of human tasks.	Combination of biological, psychological, or socio-cultural factors impacting individuals, and/or social interaction.	The way in which work is organized	The influence of customs, norms and social culture.
MANAGEMENT	Structuring activities, work practice selection, failure to understand the process.	Procedure conception, short term employment, fluctuation of organizational size, managerial communication.	Managers' lack of leadership, commitment, competence, knowledge of OHS obligations, OHS attitude.	Communication issues with regulatory authorities, level of unionism, ability to request external support.

In literature, Hollnagel (2012) addressed this issue under the efficiency-thoroughness trade-off (ETTO) principle. This principle states that regarding OHS, as in many other domains, thoroughness will be side-stepped for efficiency. A supporting example is the 80/20 hazard mitigation principle, according to which 20% of the causes produce 80% of the effects. Consequently, the ETTO principle states that on a daily and almost unconscious basis, everyone in both private and professional life, and due to time/budget/complexity/other constraints makes choices between being thorough and being efficient. This induces that, safety can and will be by-passed up to an acceptable threshold so that other constraints are met. Clearly the acceptability threshold is debatable as safety is also influenced by individual and group perception, as it is abundantly clear form the hazard emergence matrix.

2.1.4 Stakeholder perspective

A stakeholder perspective on OHS is necessary as risk management requires "all stakeholders looking at the risks that arise in the workplace and then putting in the most appropriate safety and health measures in place to control them." (ILO, 2014, page 6). In this regard Dufour et al. (2020), have conducted an extensive study regarding stakeholders in the field of OHS. The study concludes that there is a prevalence of the assumption "that OHS management is the responsibility of the Safety Officer and/or of the upper management" (Dufour et al., 2020). It has been recognized that occupational management and OHS is a complex concept, strongly embedded in everyday activities at all organizational levels which renders OHS modelling (process charts, AHP, fuzzy techniques) dependent of the stakeholders involved. Consequently, circumscription of stakeholder perimeter and inherent responsibilities become an obstacle to OHS management.

A conventional perspective, focusing on position and links to the focal organization, is most often adopted in considering OHS stakeholders. This is also characterized by discrepancies in stakeholders' purpose, function, or title. In coherence with the findings of Makin and Winder (2008) regarding areas where hazards may develop within the workplace, Dufour et al. (2020) have proposed that stakeholders be divided in external stakeholders such as "governments, NGOs, work inspectors, work doctors, audit organizations and internal ones, which include top, middle and front-line managers, employees, trade unions" (Dufour et al., 2020). Focusing on internal stakeholders, the study proposes an organizational approach based on hierarchical layers.

In literature, the organization is considered as an independent OHS stakeholder which has the capacity and the resources to identify pertinent legal requirements imposed by national, international or industrial regulations, as well as the ability to develop and incorporate OHS rules within its management system (Jørgensen et al., 2006; van Gemert-Pijnen et al., 2006; Zeng et al., 2007; Sanne, 2008; Høivik et al., 2009; Russ, 2010 ; Newnam and Watson, 2011; Sang et al., 2011; Zwetsloot et al., 2011; Guo, 2012; Geminiani et al., 2013; Zwetsloot et al., 2013; Haas et al., 2014; Koivupalo et al., 2015; Nordlöf et al., 2015; Hale et al., 2015; Bevilacqua et al., 2016; Arntz-Gray, 2016; Bianchini et al., 2017). In relation to the developed rules, the organization will provide appropriate training (Moreau and Neis, 2009; Guo, 2012; Haas et al., 2014) and accurate OHS information.

The employees and the employer are groups of individuals working within the organization. In research, contrary to law, there is no unified label and definition for the notions of employer and employee. Employee refers to any person working in the organization (Nordlöf et al., 2015) or may refer only to the lower hierarchical levels with little or no decision-making capacity, such as front-line supervisors, workers, operators (Twaalfhoven and Kortleven, 2016; Arntz-Gray, 2016; Yovi and Nurrochmat, 2018). Employer is used for the business owner and management layers (Guo, 2012; Serratos-Perez et al., 2015).

Management includes all individuals with managerial functions. For the managerial strata to be able to coordinate and take coherent action, each managerial level must have a clear understanding of the common OHS goal and orient the decision-making process towards its attainment (Conchie et al., 2013; Tappura et al., 2014). Top management is assimilated to the employer. As highest managerial strata it drives risk mitigation through risk assessments and

appropriate organizational measures (Smallman and John, 2001). Top management is also a driver of safety culture by encouraging internal stakeholder dialogue and OHS knowledge initiatives. Middle managers are perceived as less involved in OHS (Høivik et al., 2009), although it is the managerial strata in charge of workplace design and OHS procedures (Moreau and Neis, 2009). The proximity between front-line managers (direct managers, section managers, unit managers etc.) and workers ensures bottom-up communication as front-line managers are the first informed of safety issues (Sang et al., 2011; Nordlöf et al., 2015; Twaalfhoven and Kortleven, 2016). If proximity enables implementation and compliance (Nordlöf et al., 2015), it can also deter the application of safety rules: replacement of official OHS rules/procedures by a sharp-edge solution (Sang et al., 2011) or side-stepping in favour of production (Laberge et al., 2014). To diminish the risk of side-stepping or developing parallel rules, front-line managers should be part of developing safety protocols (van Gemert-Pijnen et al., 2006; Twaalfhoven and Kortleven, 2016) and of designing of corrective measures and accident investigation (Roy, 2003).

OHS literature is unanimous regarding workers' status which transcends industrial, legal, or national contexts. They are either beneficiaries of OHS (van Gemert-Pijnen et al., 2006; Twaalfhoven and Kortleven, 2016) or individuals with responsibility towards themselves and others (van Gemert-Pijnen et al., 2006; Moreau and Neis, 2009; Morillas et al., 2013; Nordlöf et al., 2015; Twaalfhoven and Kortleven, 2016).

Trade unions are perceived as facilitators for OHS training and electing worker representatives (Parejo-Moscoso et al., 2013; Arntz-Gray, 2016; Coulson, 2018), especially in old industrial sectors such as mining. The changes in business models with a preponderance of SMEs (Jørgensen et al., 2006; Parejo-Moscoso et al., 2013; Bianchini et al., 2017; Holte and Follo, 2018), conjugated to a globalized production process and the emergence of individual responsibility (Coulson, 2018) has diminished trade-union's OHS responsibilities (Fox et al., 2018).

Regulatory bodies include government as state related regulatory or law-making bodies (van Gemert-Pijnen et al., 2006; Moreau and Neis, 2009; Yränheikki and Savolainen, 2000; Zwetsloot et al., 2011; Guo, 2012; Morillas et al. 2013; Manu et al., 2013; Behm et al., 2014; Annan et al., 2015; Nordlöf et al., 2015; Serratos-Perez et al., 2015; Bevilacqua et al., 2016 ; Boucaut and Cusack, 2016; Arntz-Gray, 2016; Bianchini et al., 2017; Fox et al., 2018; Holte and Follo, 2018; Yovi and Nurrochmat, 2018) or transnational legislators, such as the International Labor Organization (Guo, 2012; Annan et al., 2015; Arntz-Gray, 2016; Coulson, 2018; Yovi and Nurrochmat, 2018), the World Health Organization (Annan et al., 2015), the European Union (Zwetsloot et al., 2011; Morillas et al., 2013; Nordlöf et al., 2015; Bevilacqua et al., 2016; Bianchini et al., 2017). The complexity of national or transnational regulatory bodies generates obstacles for OHS compliance and alignment of responsibilities (Zwetsloot et al., 2011; Bianchini et al., 2017) and induces costly investments and little exemption of responsibility in case of OHS event (Hale et al., 2015; Bianchini et al., 2017).

All in all, the insufficient definition of roles and responsibilities among the different bodies, the lack of incentive in reporting towards the regulatory authority (Kerr, 2009) or the coordination between regional and municipal governments (Yränheikki and Savolainen, 2000) strongly contribute to the complexity of OHS stakeholder management.

On the other hand, with regards to regulatory bodies, knowledge management is problematic due to a lack of sufficiently trained professionals (Guo,

2012; Annan et al., 2015). Experts are OHS stakeholders which are necessary for innovative responses for hazard mitigation. They can be managers, workers or external service providers such as consultants (Husin et al., 2012; Parejo-Moscoso et al., 2013). Their expertise derives mainly from two sources: OHS training on the job (Guo, 2012; Haas et al., 2014; Nordlöf et al., 2015; Twaalfhoven and Kortleven, 2016; Lakhwani et al., 2018) or upstream education in OHS (Yränheikki and Savolainen, 2000; Parejo-Moscoso et al., 2013; Geminiani et al., 2013; Annan et al., 2015). This OHS professional knowledge constitutes a basis for decision-making regarding workplace design. Recent streams in OHS research point out that only lower-level risk diminishment measures can be implemented once a certain system is in place (Behm et al., 2014) and as such system designers bear responsibility in OHS hazard mitigation to the same extent as system users.

Regulatory bodies examine compliance to regulations imposed by public, private and public-private bodies (Sanne, 2008; Kerr, 2009; Høivik et al., 2009; Hale et al., 2015; Arntz-Gray, 2016; Coulson, 2018). Public regulators deal with compliance with OHS legal constraints, whereas private regulators can be insurance companies (Yränheikki and Savolainen, 2000; Nordlöf et al., 2015), external certifying organizations (Zeng et al., 2007), industry (Russ, 2010; Zwetsloot et al., 2011; Arntz-Gray, 2016) or associations (Holte and Follo, 2018). All regulating bodies can have a sanctioning capacity (Hale et al., 2015), such as fines (public regulators), absence of certification (public-private or private regulators), higher premiums (private regulators).

The safety representative is a representative of the employee (Roy, 2003; Høivik et al., 2009; Morillas et al. 2013; Parejo-Moscoso et al., 2013; Nordlöf et al., 2015; Coulson, 2018) or of the employer (Roy, 2003; Zeng et al., 2007; Nordlöf et al., 2015) on OHS matters whose role is to contribute to compliance with OHS requirements through "investigation of hazards or complaints, inspections, attendance in committees and specific training" (Lakhwani et al., 2018) as recognized recently by Dufour et al. (2020). The safety representative has an advisory role for both workforce and employer and thus represents a communication vector, whose decision span is limited as final decision lies with management. In this regard, "consensus among managers and safety representatives' points to satisfaction with the legal and regulatory framework, but dissatisfaction with its operational application" (Dufour et al., 2020).

2.1.5 The management system perspective

The International Labour Organization defines an OHS management system (OHSMS) as a "A set of interrelated or interacting elements to establish OSH policy and objectives, and to achieve those objectives" (ILO, 2001). OHSMS are structured approaches that translate hazard mitigation strategies to operational level (author's definition). Independent of structure or complexity, an OHSMS is based on risk management (SafeWork, 2005; Dufour and Draghici, 2020), i.e., hazard identification, assessment, and control. Makin and Winder (2018) advanced that corresponding to each OHS hazard area (workplace, people, management) there is a strategy (safe place, safe person, and safe system), the conjunction of which builds an OHSMS.

Safe place strategies are useful for predictable hazards as they are limited to the application of the hierarchy of controls. Safe person strategies respond to workplace variability, their purpose being hazard inhibition or enhancement of individual capacity to deal with hazardous situations; they are limited by the

subjective perceptions of risk assessment. Consequently, knowledge management is one of its tools, with applications ranging from training and continuous education to health campaigns. Finally, safe system strategies include creating a metric-based safety policy or carrying out incident investigation. If these strategies are limited by the choice of indicators and the meaning associated to them, safe system strategies are organization oriented, which renders them more global then safe place or safe person.

When adopting an OHS strategy or a combination of strategies, managerial and organizational reasons differ, which renders empirical studies and OHS documentation disparate (Frick, 2011). The organizational optimum that is obtained through a combination of the three safety strategies is most effective in creating a wholesome OHSMS while responding to Hollangels's ETTO principle. Therefore, an OHSMS combines preventive and corrective action, the present and the future, is tailored for daily, routine operations, while agile enough to adapt to unforeseen hazards, includes specialist and independent assessment, measurement and feedback systems and contingency plans, is supported through management commitment and subject to worker influence. Furthermore, a OHSMS requires the involvement, participation, and commitment of the whole organization because of the interdependence between those who generate and those who are exposed to risk (Arntz-Gray, 2016; Fox et al., 2018). OHS responsibility (Høivik et al., 2009; Nordlöf et al., 2015; Koivupalo et al., 2015), managerial competencies, policies, procedures, monitoring are all enablers of viable OHSMS (SafeWork, 2005).

In this regard voluntary frameworks are a structured OHSMS, which helps the organization to respond to legal requirements, technological and market constraints (Sanne, 2008; Dufour and Draghici, 2020). There are numerous voluntary frameworks for OHSMS: standards, guidelines, audits, emerging from public, private or non-profit organizations (Robson et al., 2007), some leading to certification. Nonetheless, OHSMS adoption and long-term implementation are subject to motivations such as organizational image, safe/increased productivity, enhanced health and safety at work, relationship to regulatory authority (Frick, 2011).

Within the management systems framework, one of the most widely acknowledged OHS standards is the OHSAS 18001:2007 standard, the implementation of which demonstrates strong organizational commitment to OHS (Bevilacqua et al., 2016). The OHSAS 18001:2007 was first published in 1999 and was derived from the BS 8800, and, in the absence of an ISO standard regarding OHS, has become the main certification standard in the field (Jørgensen et al., 2006). It is based on the Plan-Do-Check-Act methodology and defines requirements for developing and implementing an OHSMS that is coherent with organizational OHS aims, legal requirements and OHS risks (Degan et al., 2009). Figure 2.3 proposes a conceptual map of OHSAS items based on its 6 chapters.

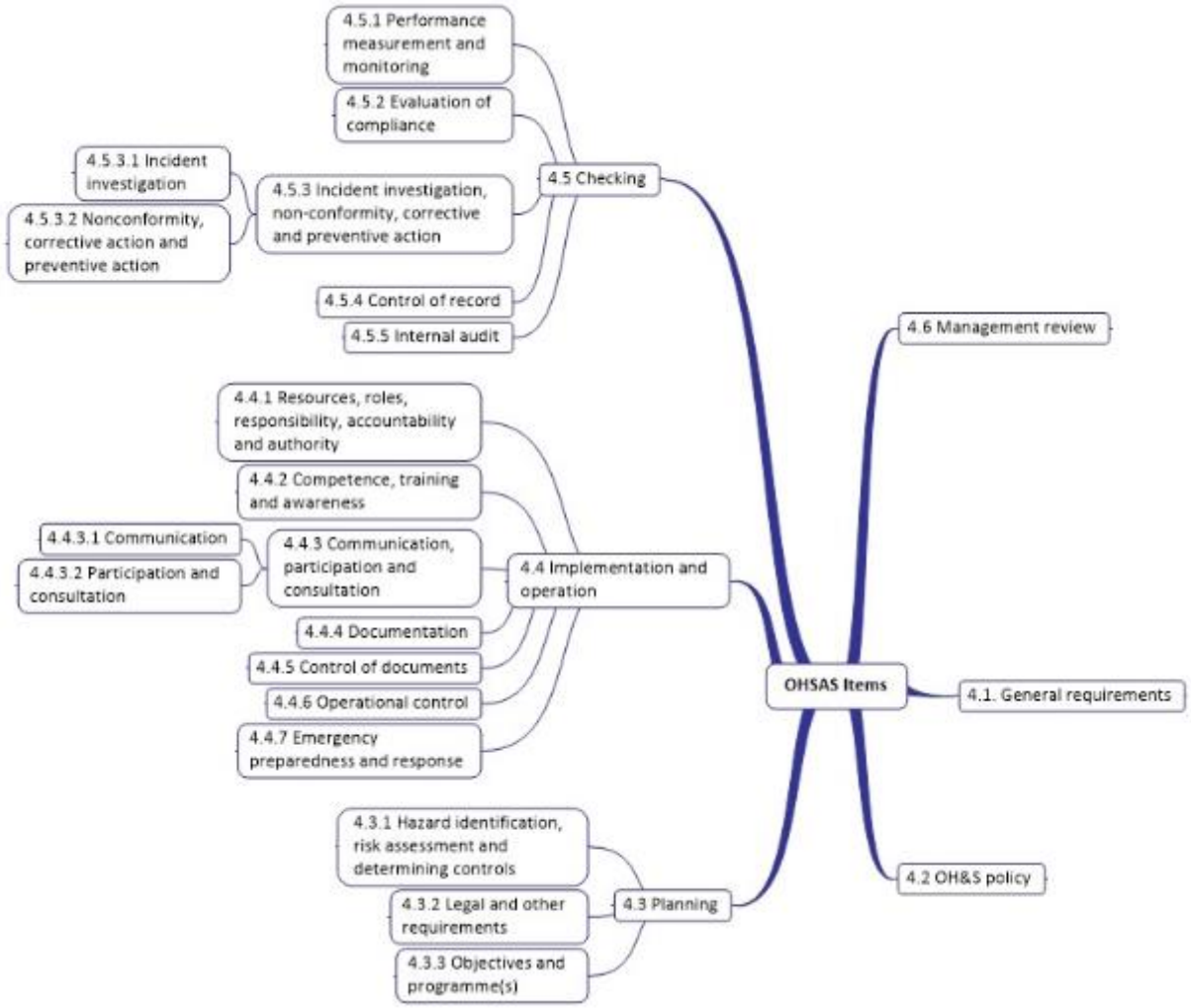


Figure 2.3: The conceptual map of the OHSAS 18001 :2007 items (BSI, 2007)

Research into the OHSAS 18001 ranges from the integration with other management systems (Jørgensen et al., 2006), implementation methodology, success and failure factors (Bevilacqua et al., 2016), the relationship between certification and accident rate (Heras-Saizarbitoria et al., 2019; Ghahramani and Salminen, 2019) or the effect of certification on safety climate and OHS practices (Ghahramani and Salminen, 2019), the impact of safety culture on OHSAS 18001 implementation (Ghahramani, 2017). As statistics point out to a stagnation in accident rates (Fargnoli et al., 2011; Gaureanu et al., 2019), recent empirical studies point out that the OHSAS 18001 certification on its own is not a guarantee for long-term OHS improvement. Specific factors such as knowledge management, safety culture (Ghahramani, 2017), stakeholder management (Omran et al., 2008; Dufour and Draghici, 2020; Dufour et al., 2020) are pointed out as enablers of long-term success of OHS. In their study, Dufour et al. (2020) concluded that one of the main drawbacks of the OHSAS 18001 is the need for more clarity regarding the OHS internal chain of responsibility, as responsibilities are mainly attributed to the organization, rather than a hierarchical or functional level.

2.1.6 The measurement perspective

According to Safework Australia (2005, p. 3), "OHS performance can be described as a measure of the level of effectiveness of those business activities aimed at the prevention of injury and disease to persons in the workplace". If the main purpose of OHS performance evaluation is to reduce the level of risk, it also tries to propose a snapshot of past OHS performance, to prove compliance with and commitment to legal obligations, as well as to reflect the effectiveness of management practices and provide feedback information.

OHS performance has been traditionally evaluated through outcome indicators, which are either retrospective or lagging indicators or prospective or leading indicators. The most used indicators are the lagging ones, which reflect outcomes and failures of safety management through numbers, frequencies, severities or costs (Table 2.2). The measurement methods for lagging indicators require mainly log and report assessment and analysis through statistical methods. Leading indicators, on the other hand, include approaches such as safety audits and hazard identification (Ghahramani, 2017). Limitations include indicator follow-up, selection and interpretation, as well as related workload and access to sharp-edge information.

Table 2.2. OHS indicator and Definitions (extracted from, SafeWork Australia Website)

INDICATOR	DEFINITION
Lost time injury frequency rates (source: safework-1, 2019)	"A lost-time injury is something that results in a fatality, permanent disability or time lost from work. It could be as little as one day or shift."
Cost of injury (source: safework-2, 2019)	"Work-related injuries, illnesses and deaths impose costs on employers, workers and the community. These include both direct costs and indirect costs: • Direct costs include items such as workers' compensation premiums paid by employers or payments to injured or incapacitated workers from workers' compensation jurisdictions. • Indirect costs include items such as lost productivity, loss of current and future earnings, lost potential output and the cost of providing social welfare programs for injured or incapacitated workers". "The level of costs borne by each economic agent varies with the severity of the injury or disease. While measures of direct costs are understood and reasonably simple to measure, these costs cover only a fraction of the total cost of work-related injury and disease".
Fatality rates (source: safework-3, 2019)	"Includes fatalities that result from an injury sustained in the course of a work activity (worker fatality) and because of someone else's work activity (bystander fatality)".

Positive Performance Indicators (PPIs) are a new type of indicators proposed by the Department of Employment and Workplace Relations of the Government of Australia, which measure the performance of workplace health and safety processes, with the purpose of identifying areas for improvement strategies. They are limited by the fact that they are tailor-made indicators, developed specifically for each organization and only work in conjunction with an OHSMS (Safework, 2005). They are co-developed indicators, in that they are identified in conjunction with organizational stakeholders around three areas: input (relating to commitment and effort), process (relating to risk monitoring) and output (relating to goal achievement). Examples include percentage planned risk assessments completed, percentage of workplace recommendations, employee perception of management commitment, percentage of managers/employees, percentage of contracts with OHS clauses etc. The main measurement methods are workplace inspections/audits, employee/manager questionnaires/surveys, observation, examination of logs and reports.

All in all, OHS measurement is presented as being influenced by knowledge management, stakeholder management and more globally OHS climate. Knowledge management influences indicator definition and interpretation as both are highly dependent on the acquaintance with the sharp-edge and the hazard identification process. The hazard identification process is subjective as risk gravity is subject to individual and social understanding and acceptance, which induces the necessity to manage the internal stakeholders' awareness and acceptance of hazards and subsequent mitigation processes. Consequently, OHS climate plays an important role to the extent to which indicator follow-up is time and resource consuming and without strong managerial leadership and impulsion of employee implication, it can become an empty shell.

2.1.7 Preliminary conclusions on OHS

In the present chapter, recent bibliographical studies on Occupational Health and Safety were compiled to obtain the state of the art of current research streams in the field, as well as identifying future research areas or gaps.

It was concluded that the field of Occupational Health and Safety is very vast and tangent to many other fields such as legal, ergonomic, medicine, management, HR, education and training, communication, research is widespread and touches upon numerous research streams. These include, but are not limited to:

- Employee participation (Bhattacharya and Tang, 2013; Frick, 2011);
- Scientific models to evaluate and mitigate workplace risk based of fuzzy logic or analytical hierarchy process (AHP) (Bhattacharya and Tang, 2013);
- The role of management in inciting employee participation in the management of OHS (Bhattacharya and Tang, 2013; Bluff, 2003);
- Occupational Health and Safety Management Systems (Makin and Winder, 2008). Among the issues concerned by this topic: OHS MS for SMEs, OHS MS customization, mandatory vs voluntary (Frick, 2011);
- Risk management process (Makin and Winder, 2008);
- Psycho-social hazards (Makin and Winder, 2008);
- Cause-consequence mechanisms and the role played by the human factor;
- The influence of management system certification on OHS performance;

- The influence played by leadership and safety culture on safety performance and management system implementation.

An overall conclusion that can be drawn from the bibliographical research is that key issues are situated at the interfaces between stakeholders, among which communication, responsibility, or culture.

It was also concluded that, regarding OHS, knowledge management strongly influences individual and community behaviour, responsibilities, workplace and managerial specifications, organizational culture. Knowledge management is particularly problematic regarding pertinent professional OHS knowledge identification, capturing and implementing in relation with other stakeholders. This research conclusions have also been considered in the reviews of the OHSAS 18001 and the ILO guidelines (Fargnoli et al., 2011).

The use of traditional indicators in conjunction with the advent of new ones has proven beneficial in alerting that OHS performance is a proof of a sustainability-oriented organization.

Regarding OHS, knowledge management and stakeholder management are highly intertwined. Firstly, OHS professional knowledge influences individual and social interest for OHS: employees are more willing to participate in OHS processes, communicate more easily on OHS issues and implement more actively OHS measures, whereas managers are more active in promoting OHS within the organization, are more prone to collaboration rather than sanctioning and will pull OHS improvement. An organization that understands the benefits of OHS professional knowledge shall invest in identifying, codifying, diffusing, and enhancing this knowledge which will generate a new climate between internal stakeholders, as well as between internal and external stakeholders.

Moreover, knowledge management related to OHS is not limited to professional OHS knowledge but also to knowledge of stakeholders (contextualization). The answers to questions such as who should be involved in the OHS process? at what point of the OHS process? and for what reason/competency? are pivotal in diminishing the limitations of risk assessment approaches arising from limited contextual or technical knowledge requiring expert assistance, as well as identifying and implementing new hazard mitigation tools and methodologies.

One element of Stakeholder management that seems to impact OHS performance is the relationship with regulatory bodies. In this regard, organizations are presented as either being at the fore front of OHS, in which case they can be legislative pushers by contributing to the shaping of OHS legislation, therefore acquiring an important competitive advantage or endure and implement a legislative framework that they did not contribute to. Also, regarding stakeholder management, it is to be noted that in the hyper-connected society of today, in which social pressure is high, organizations award particular attention to managing perception by focus and customer groups to limit social impact. Finally, from an internal perspective, the organization needs to manage its internal stakeholders such as unions, managers and employees to ensure OHS performance and collaboration.

2.2 Sustainability-Oriented Innovation

The present chapter shall identify, analyse and synthesize relevant research with the purpose of creating a bibliographic review on Sustainability Oriented-

Innovation. Figure 2.4 summarizes the methodology used to research the subject, and the key research axes.

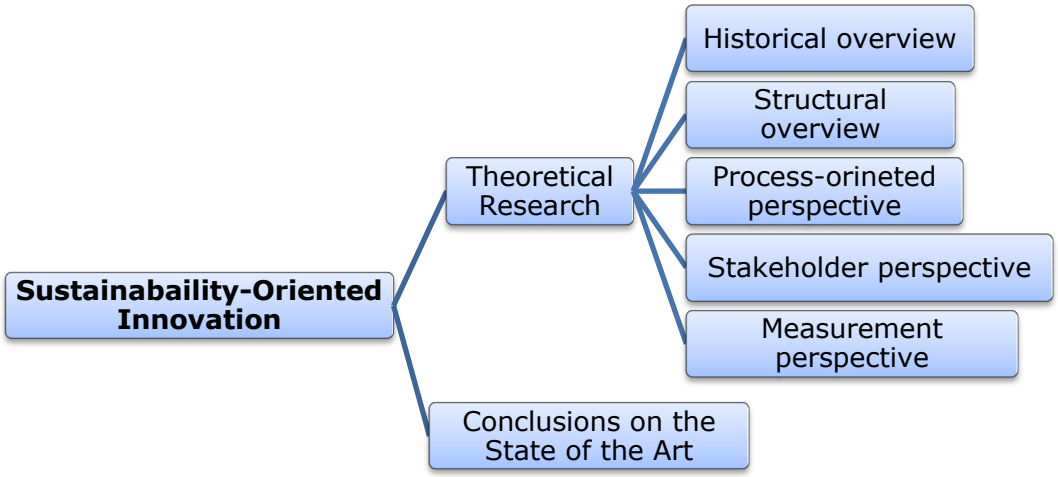


Figure 2.4: Research Methodology for Sustainability-Oriented Innovation

2.2.1 A historical overview

The concept of Sustainability-Oriented Innovation derives from the combination of two fields: sustainable development and innovation. Sustainable development is recognized as the preoccupation of the 21st century. First attempts to enlighten about the consequences of human action on the environment can be dated back to 1948 and the publication of Fairfield Osborne's "Our Plundered Planet" (Adams et al., 2016). Later, actors of civil society, NGOs and international organizations came together, in 1980, in conceiving the World Conservation Strategy, which was the first to upheld, the compatibility between economic development and the conservation of the Earth (Adams et al., 2016). A milestone was set through the commonly acquainted and widely acknowledged definition of the 1987 Bruntland Report, which stated that "sustainable development is a development that meets the needs of the present without compromising the ability of future generations to meet their own needs" and has been accepted as over-arching (WCED, 1987).

The United Nations' 2030 Agenda was developed in 2015 around 17 Sustainable Development Goals (SDGs) the attainment of which is to contribute to joint social, environmental, and economic balance and equity. From the 2030 Agenda, everyone as part of business, authority, scientific community, or civil society can contribute separately or jointly to the actions that will enable a common tomorrow (SDG Report, 2019).

Sustainable development is a co-optimization of its three constitutive dimensions: economic, social and environmental (Jay and Gerand, 2015). From an economic perspective, the aim is to provide for all humans' basic needs in terms of products (food, medicine etc.) and services (access to dental care, education, drinkable water etc.). The social dimension gravitates around the societal means to attain basic economic equality (i.e., fulfilling, and safe jobs or provision mechanisms for those who cannot work). Finally, the environmental dimension discusses how to ensure that human activities (economies) do not surpass Earth's carrying capacity. This conception of sustainable development implies that one activity simultaneously advances the three dimensions; although widely accepted,

many initiatives included in the sustainable development arena are concerned with only one or two dimensions.

Table 2.3. SOI Definitions - Chronological literature compilation

SOURCE	DEFINITION OF SOI
Hansen et al., 2009	Innovations which are individually perceived as adding positive net value to the overall firm's capital stock.
Adams et al., 2012	"Address technological change and involve evolutions in processes, practices and business models" […] the sustainability orientation incorporates social and environmental dimensions alongside economic ones.
Klewitz and Hansen, 2014	The blending of ecological and social aspects within products, processes and organizational structures.
Jay and Gerand, 2015	"In line with the works of Adams et al. (2012), SOI is an umbrella term describing the obtention of positive change through a multi-faceted, multi-stakeholder transformation of sustainability tensions".
Adams et al., 2016	SOI involves "making intentional changes to an organization's philosophy and values, as well as to its products, processes or practices to serve the specific purpose of creating and realizing social and environmental value in addition to economic returns".
Behnam et al., 2018	"… compared to other terminologies covering social aspects, sustainability-oriented innovation has been chosen because the focus is on innovations, which are intended to contribute to sustainable development, independent from the actual sustainability performance of a business (as is the case of sustainable/eco/green innovations)".

Contemporary historical (wars, regime changes, migrations), environmental (floods, droughts, deforestation) and social (inequity, education, access to basic commodities or healthcare) conditions combined with the rapidity of the access to information and vulgarization of research literature have shed a strong light onto sustainable development. Interestingly, the transposition of the derived term sustainable has been interpreted in two ways in research literature (Calabrese et al., 2018): the first deals with sustainability as the long-term existence of business or long-haul competitive advantage, while the second derives from Elkington's (1997) Triple Bottom Line (TBL); the TBL synthesizes a business approach which gives an equal place to environmental, social, and economic dimensions. To this day there is no real consensus regarding the structuring, conceptualization, and operationalization of sustainability (Hansen et al., 2009; Adams et al., 2016; Jilcha and Kitaw, 2017) at industry level. Cascading from these dissensions, are the numerous terms gravitating around sustainability and the dispersion over numerous research fields (Adams et al., 2012; Klewitz and Hansen, 2014; Adams et al., 2016), all rendering a holistic approach difficult. Nonetheless, academia agrees that sustainability can be pivotal in creating competitive advantage (Hansen et al., 2009; Tepic et al., 2011) such as cost and/or risk reduction

(Przychodzen and Przychodzen, 2018), planning reliability (Prasanthi and Sundari, 2016), legitimacy (Hansen et al., 2009; Adams et al., 2012; Przychodzen and Przychodzen, 2018), retaining or tapping into customers (Adams et al., 2016; Mousavi and Bossink, 2017) and new products and/or business segments (Segarra-Oña et al., 2016).

Resultingly, industry is paving the way to sustainable growth by joggling with pulls and pushes from governments, NGOs, customers, and the market itself (Hansen et al., 2009; Adams et al., 2016). One of the pillars contributing to sustainability as a competitive advantage is innovation. Conventional innovation is used to denominate those types of innovation that have been practiced in past years and which enhance economic benefit through technological change and/or evolutions in products, processes, practices, and business models (Schumpeter, 1939; Adams et al., 2012; Adams et al., 2016). The innovation process, comprises contriving, developing and diffusion of a solution to a problem (Jay and Gerand, 2015). On the other hand, sustainability-oriented innovation is most described as innovation that is concerned with sustainability as a new direction (Klewitz and Hansen, 2014).

SOI stems from either public or private needs and encounters traditional obstacles relating to funding, culture, innovation, and training, to which specific ones shall be added: directional risk, definition and evaluation, knowledge regarding innovation management. Of these some are critical to success such as knowledge management (interdisciplinary, sustainability), communication, adequate economic, environmental, and social tools (Jay and Gerand, 2015).

In their works Adams et al. (2016), conclude that SOI academic literature points to a burgeoning field lacking solid theoretical foundations. Research regarding SOI is dispersed (Calabrese et al., 2018), oriented on empirical research to understanding and describing the phenomena. It is also characterized by many concepts and (partially) overlapping definitions, around which there is limited consensus (Calabrese et al., 2018). Resultingly, Table 2.3 resumes in chronological order, some of the most widely acknowledged definitions, which proves that to this day, SOI remains an "umbrella-term" (Calabrese et al., 2018).

The plethora of definitions can be explained also through the multitude of research angles for SOI. Consequently, difficulties with the SOI concept include:

- The positioning of SOI generated value in comparison with another state (Hansen et al., 2009);
- The concept of directional risk, which assesses whether an SOI has positive or negative sustainable impact (Hansen et al., 2009);
- The creation of an unattainable mirage due to the consequent efforts related to advancing on social, environmental and economic dimensions through one innovation (Hansen et al., 2009);
- The inclusion/exclusion of context dependency criteria in innovation assessment (Behnam et al., 2018);
- Exclusion of innovations that have a negative or null impact one of the three dimensions (Hansen et al., 2009);
- Integrated patterns for stakeholder management, knowledge management, capabilities and leadership (Adams et al., 2012);
- Conceptualization based on negative impact reduction vs positive impact generation (Adams et al., 2012);
- Conceptualization based on sustainable vs non-sustainable (Adams et al., 2016);
- Dynamic process (Adams et al., 2016; Klewitz and Hansen, 2014);

- Time lag due to exclusion of grey evidence (Adams et al., 2016).

2.2.2 A structural overview

Stemming from the misalignments in conceptual definition, literature also discusses several classifications for SOI. The works of Ashford and Hall (2011) have synthesized the structure of SOI in discussing sustainability orientations, dimensions of innovation, natures and innovation and rates of change. Building on this, Jay and Gerand (2015) adapted from Ashford and Hall (2011) a multi-dimensional framework that includes all structural components of SOI.

According to Ashford and Hall (2011) and Jay and Gerand (2015), there are four dimensions to innovation: technological, organizational, institutional and social.

Technological innovation is one of the first types of innovation and which has been used as a curative, environmentally oriented application of a new technical idea/invention aimed at increasing economic benefit, while diminishing environmental impact (Jay and Gerand, 2015). It can be further divided into:

- Product SOI refers to notable improvement of environmental and/or social performance through the modification of existing or the development of new goods/services;
- Process SOI occurs through the introduction of sustainability criteria in the improvement of the way a product is manufactured without significantly changing the final product;
- Infrastructure SOI are used to reconceive the entire production and consumption chains.

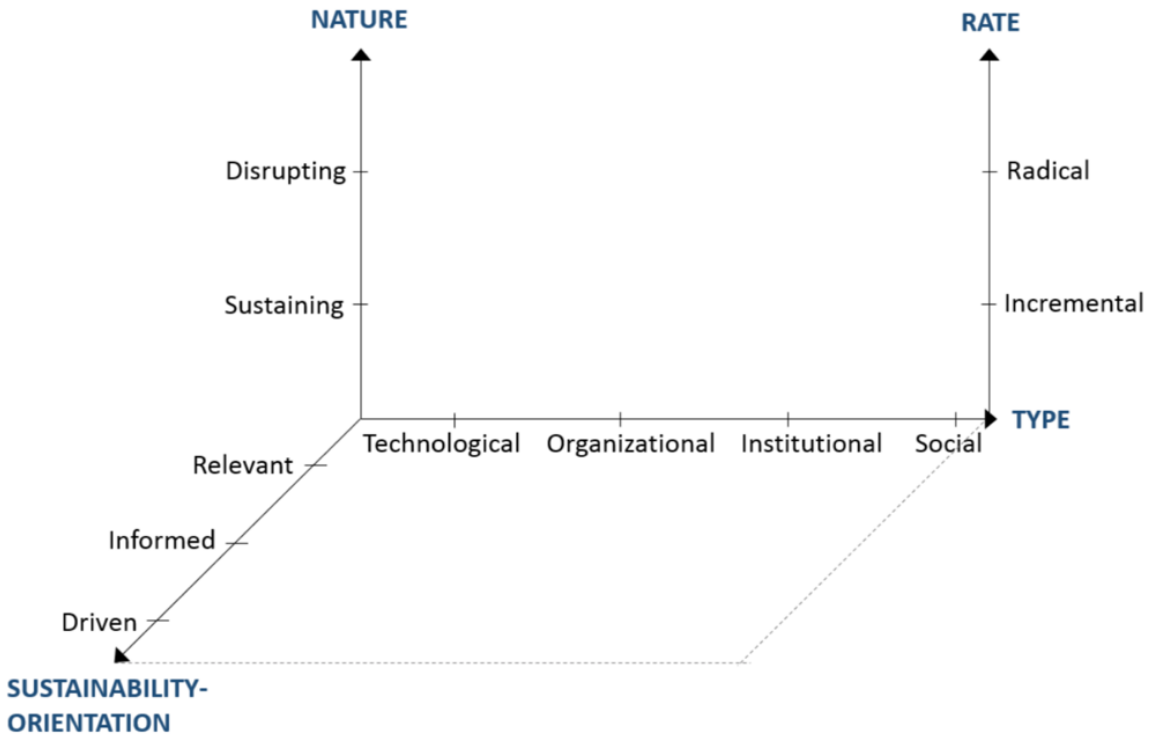


Figure 2.5. SOI Dimensions by Jay and Gerand (2015) adapted from Ashford and Hall (2011)

One of the main drawbacks of technological SOI is that as it is mainly internally oriented, it addresses consumer/leadership concerns without aiming at going beyond or remodelling these concerns. It can therefore be considered as an adaptation mechanism to maintain competitiveness. Other key limitations are:

- Understanding consumer concerns;
- Developing new expertise;
- Developing stakeholder management;
- Rebound effects.

Organizational Innovation is defined as any innovation at the level of the delivery or the "need fulfilment" model (business model, marketing, R&D, OHS, stakeholder relationships), of which the redesigning of the relationship with the customer, called product-service innovation, is most focal. Difficulty to diffuse in isolation from other SOIs is one of the strongest barriers facing Organizational Innovation.

Institutional Innovation is defined by Ashford and Hall (2011) as changes in the preferences of consumers, citizens, and workers and/or changes in the processes by which these preferences are shaped. Social innovation is about changing habits and actions of individuals or collectivises, while institutional innovation deals with change in the mechanisms of the market by governmental and social stakeholders (i.e., incentives, standards, cultural pressure). The numerous representatives among NGOs, governments, interest groups, civil society make Stakeholder management the primary difficulty of Institutional Innovation.

Regarding sustainability orientation, innovations can be classified into:

- Sustainability-relevant innovations which are conventional innovations which have unintended environmental benefits (a plus to competitiveness enhancement);
- Sustainability-informed innovation is an innovation process in which sustainability aims are integrated, but not primarily target at;
- Sustainability-driven innovation aims first and foremost at solving an environmental or societal goal, while benefiting from the economic opportunity.

The main characteristic that distinguishes the three above mentioned subcategories is the intensity that guides the innovating organization in the solving of a problem and the shaping of decisions.

The final two dimensions of SOI, nature and rate of innovation are somewhat linked. According to Ashford and Hall (2011), innovation can take place in 2 ways: incremental (i.e., evolutionary) or radical (i.e., revolutionary). According to their nature, innovations can be sustaining, reinforcing the present business model, or disrupting, breaking with the existing business model.

This model defines SOI as a complex concept that can be characterized according to nature, type, or rate, while improving on the short and/or the long-term environmental and/or social performance in comparison to the present situation. SOIs therefore require that organizations rethink their traditional model of customer orientation and core business, engage in market transformation by investing both on the short and the long term in different types of SOIs. The fundamental bricks of such a Sustainability-oriented transformation are stakeholder and knowledge management.

2.2.3 The process-oriented perspective

As concluded previously, SOI is an emerging field which translates to numerous research articles regarding SOI structure, especially regarding departure/end point, transitions or stages, static/dynamic view, focus on product/technology/organization (Adams et al., 2016). According to Jay and Gerand (2015), the innovation process refers to the tryptic invention – innovation -diffusion. While keeping in mind that there is no consensus regarding SOI, the following paragraphs will review some of the SOI processes that are most cited in literature. Adams et al. (2016) contribute to the SOI field through a conceptual framework which maps SOI practices and processes through an iterative process. The SOI framework was built through a review of 100 scholarly articles and 27 grey sources spanning over the period 1992-2012.

The underlying principle is that the framework allows a categorization of the SOI activities of the organization, thus diagnosing the sustainable development approach of the organization. It can be considered as a sustainability maturity assessment model based on SOI dimensions (technical vs. people, stand-alone vs. integrated and insular vs. systemic) and SOI contexts (building systems, operational optimization, and organizational transformation). This model is characterized by a dynamic view on sustainability, in which sustainable business is the final goal.

SOI activities were identified through a systematic review of SOI, following which they were ventilated regarding the framework. Innovation activities that were regrouped under Operational Optimization have an internally oriented perspective on sustainability, which means reducing impact through reactive and gradual improvements. These characteristically technical, stand-alone, and insular improvements proactively aim at compliance or efficiency.

The innovation activities relating to Organizational Transformation are "more people-oriented, more deeply integrate sustainability within the organization and are less insular"; this involves a new state of mind which is reflected "in creating shared value and delivering wider benefits for society" through revisited stakeholder management (internal and external) while remaining primarily internally focused (Dufour et al., 2020).

The last type of innovation activities relates to Systems Building, which is the final stage of organizational evolution regarding SOI. It is a state characterized by thinking beyond the firm and positioning business with a purpose in society. The underlying principle is that sustainability can only be achieved through networks, and individual value creation is insufficient, which transforms the innovation process into a co-creation process, outside of the purely competitive sphere.

The advantage of this 3-step model is that it situates SOI activities as enablers for reaching business sustainability. The dynamic construction of the framework implies that organizations can become sustainable only as systems builders and efforts up to that point are "mere" milestones. Although the authors conclude that an organization can work on SOI activities from one or several contexts, their modelling of SOI activities points to an incremental approach in complexity, resource consumption, knowledge management and stakeholder management. All in all, the journey that Adams et al. (2016) propose is resource intensive, long-term oriented and requires a certain economic stability, elements which characterize incumbents rather than SMEs or start-ups. In this regard its down-to-earth, almost operational approach through focus on daily SOI activities

seems inadequate for most of the industrial tissue which is preponderantly made-up of SMEs.

The SOI process model proposed by Jay and Gerand (2015) revolves around five stakeholders (Private-problem holders, Public-problem holders, Innovation champions, Knowledge holders, Infrastructure holders) and four iterative phases.

The four iterative phases are Need identification, Problem definition, Solution generation and selection and Solution delivery and diffusion. Need identification deals with identifying private and/or public needs. It then leads to the next phase, which is problem definition or the identification of the gap between the need and existing solutions/knowledge/infrastructures. To bridge the gap, the next phase is solution generation and selection from an ensemble of multiple potential initial solutions. The thus selected final solution(s) respond to the initially identified need while proposing a socially, environmentally, and financially enhanced end-situation. Finally, the solution is delivered and diffused, which leads to new infrastructures and knowledge.

As SOI is characterized by numerous stakeholders, the influence of which differs among the four stages, the SOI process model highlights roles and capacities. Among these, as SOI fulfils both a private need and a public social and/or environmental need, public problem holders such as governments, NGOs, industry, citizens, etc set the perimeter for potential solutions.

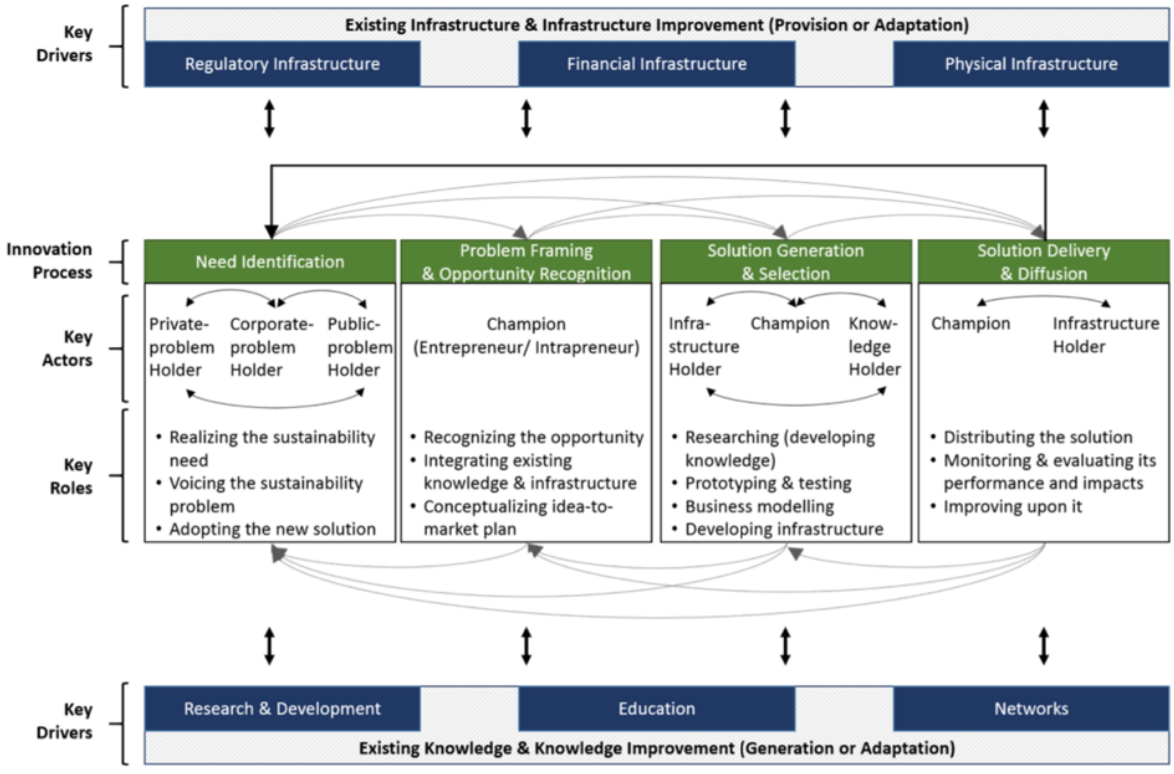


Figure 2.6. SOI Process according to Jay and Gerand (2015)

2.2.4 The stakeholder perspective

Regarding stakeholders, two perspectives (Figure 2.7) were identified in literature and were classified by considering the focus of the perspective: the problem to be solved or the organization that is solving. Thus, the first and most

widely discussed, is the organizational-oriented perspective which considers the organization's one-to-one relationship with regulatory authorities, customers, experts, NGOs, or the problem-oriented perspective, which requires the organization to find a balance between the demands and constraints that flow from all stakeholders (Adams et al., 2016; Behnam et al., 2018; Calabrese et al., 2018; Cancino et al., 2018).

This second perspective is problem-oriented and was introduced by Jay and Gerand (2015); the focus is on the problem to solve, rather than on an organization, which causes a subtle shift in perspective, as the organization is not necessarily the one modulating the conflicting interest. Stakeholder and knowledge management are particularly linked from this perspective as it can be seen in Figure 2.6. This problem-oriented perspective is particularly interesting as it diminishes the influence of boundaries on interorganizational cooperation as roles can be overlapping.

The private-problem holder is any among individuals, business or government who can express or adopt an SOI. As SOIs imply by construction societal change, a key element for the impulsion of change is the public-problem holder (government agency, NGO or civil society). This actor, that is typical of SOI, is at the forefront of rendering the social dimension dynamic and inclusive as it plays the political role which renders the problem visible.

Figure 2.7. Sustainability-Oriented Innovation – Stakeholders' Perspectives in Literature (author's contribution)

Innovation champions lead the innovation stages by optimally coordinating multiple stakeholders rather than through technical know-how. Know-how is the field of knowledge-holders (academia, research and consulting, start-ups) who are at the forefront of knowledge, technologies and demand-pulled, regulatory-pushed or technology-pushed solutions. Regarding SOI, knowledge-holders also contribute to knowledge-transfer and education regarding science, technology, business, management, and sustainability.

Infrastructure-holders or enablers include all entities providing physical, legal, regulatory, or financial help thus ranging from banks to governments or even other organizations. They are key contributors to a viable solution for the problem-holder as they enable access and background for development.

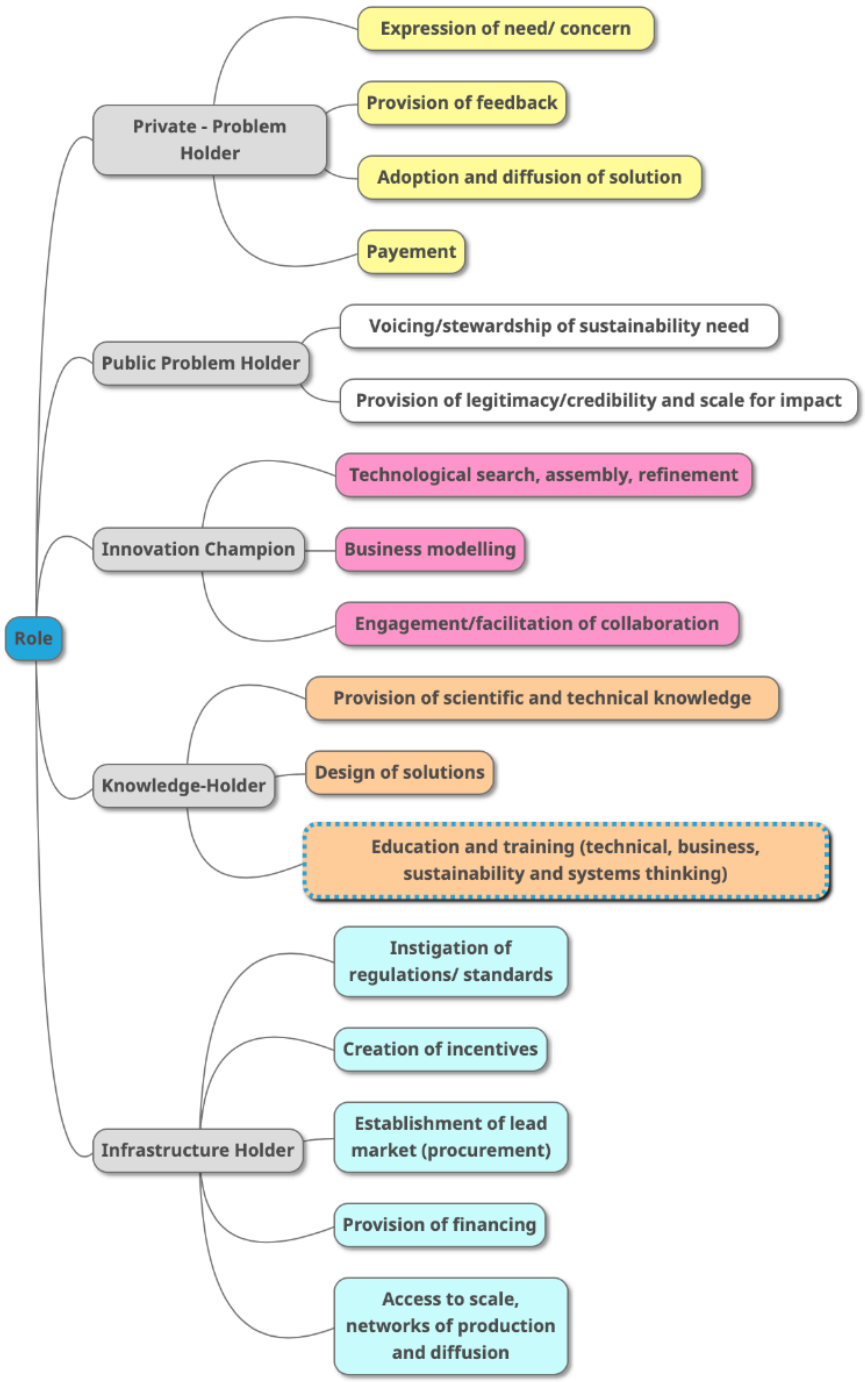


Figure 2.8. Key roles and their contributions to the SOI process – adapted from Jay and Gerand (2015)

It is to be noted that the role of stakeholders has also been investigated in conventional innovation through the externality problem (the diffusion of innovation beyond the boundaries of the investing organization). While this is also true regarding SOI, the issue is enhanced by the fact that the investing organization diffuses the innovation and the knowledge throughout the social tissue as well as competitors. To mitigate this risk and associated costs, research

proposes that stakeholders such as policy makers create the necessary conditions for SOI (Tepic et al., 2011; Moussavi and Bossink, 2017) this conclusion joins that of the model of Jay and Gerand (2015) through which SOI requires specific enablers for problem solving - Figure 2.8.

It can therefore be concluded that SOI opens new perspectives to stakeholder management by redesigning roles and positions in the innovation process and knowledge management.

2.2.5 The measurement perspective

In recent times, sustainability is to a lesser extent perceived as a cost (Calabrese et al., 2018), which has raised interest into how businesses can measure sustainability, and more precisely the costs and impacts associated with sustainability-oriented innovations. The measurement of Sustainability-Oriented Innovation depends on the capacity to blend sustainable development metrics and innovation ones. As previously discussed around other aspects of SOI, measurement is also at an incipient stage, especially as research is mainly focused on defining and understanding the concept and the process of SOI. Considering the dependence of SOI on context, scientific literature if presently mainly focusing on general assessment frameworks rather than detailed methodologies and associated metrics. Nonetheless, a few noteworthy initiatives are reviewed hereafter.

SOI evaluation is a burgeoning subject in literature. Therefore, there are a lot of perspectives for SOI evaluation, the most encountered dimensions were summarized in Figure 2.9. The considered evaluation dimensions impact decisions regarding the organizational capital: human, financial, structural, and intellectual capital. The main drawback of most evaluation frameworks is their generalization, which then requires further tailoring regarding metrics and success factors. Clearly such an effort can be difficultly undertaken by an organization.

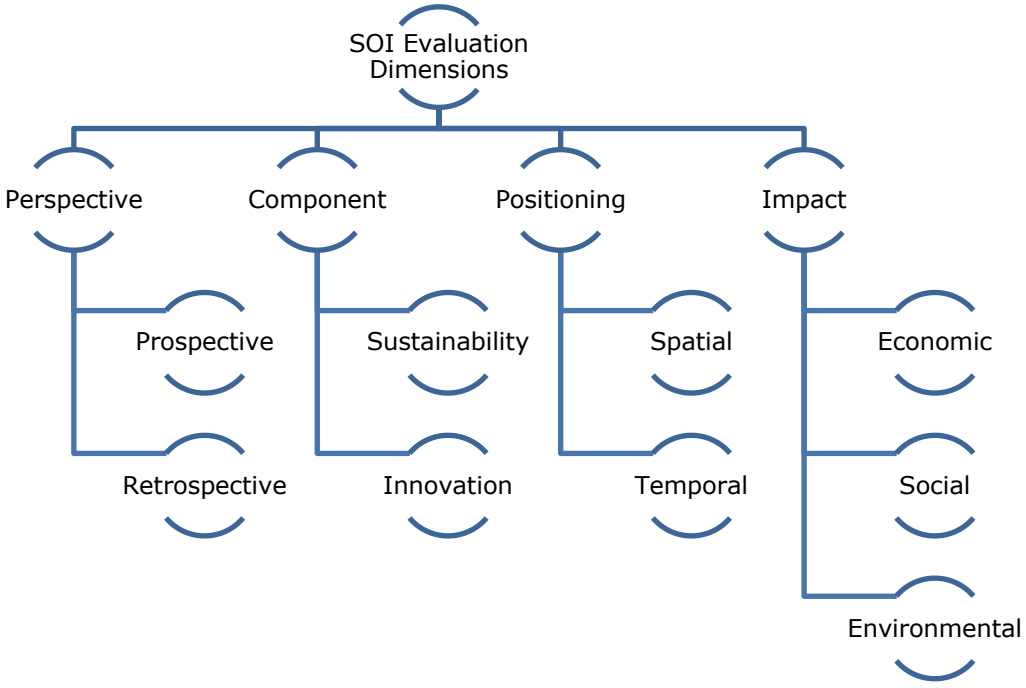


Figure 2.9. Possible SOI Evaluation Dimensions (author's contribution)

The SIC, illustrated in Figure 2.10, was proposed by Hansen et al. (2009) in a ground-breaking study regarding sustainability product innovation evaluation. The SIC is not an evaluation method but a meta method for identifying appropriate evaluation methods through the identification of the sustainability focus to assess.

The underlying principle is that any sustainability-oriented innovation comes with a risk regarding the three sustainability dimensions (social, environmental and economic). This specific SOI risk is called a directional risk for which "à priori" evaluation is time dependent and can be assessed as positive, negative, or null. Therefore, the SIC proposes to evaluate SOIs according to 27 focus areas, which derive form three evaluation dimensions: need, lifecycle and target. Followingly, for each area defined at the intersection of 2 dimensions (Figure 2.10), the model orients towards assessment tools and methods extracted from literature (Figure 2.11). Although it proposes assessment tools and methods, the SIC does not engage in any criteria discussion, as the authors consider that criteria selection varies according to the innovation to assess, the organization, and the considered assessment method. Therefore, SIC implementation is not self-sufficient.

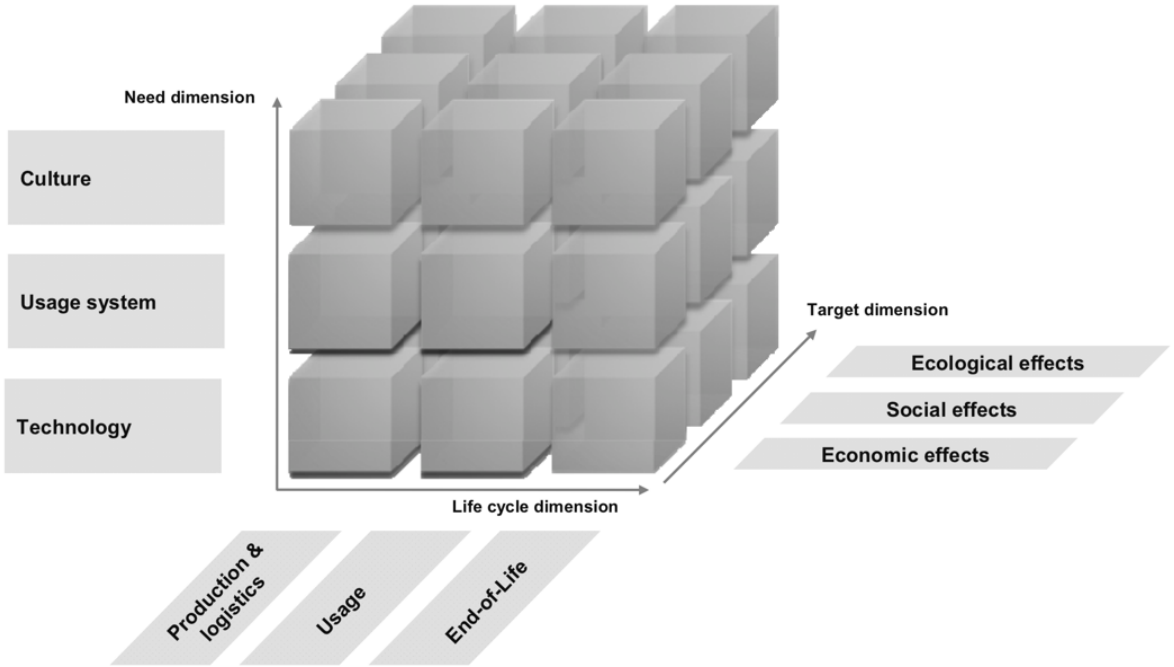


Figure 2.10. The Sustainability Innovation Cube - extracted from Hansen et al. (2009)

The main advantage is that it proposes a holistic approach which can be used by business for orientation regarding sustainability effects. This approach may be particularly beneficial for SMEs, who cannot afford time and resource consuming sustainability assessments, but prefer a more focal approach. Another application of the SIC can be its use for internal training as an initiation to sustainability for employees.

The construction of the SIC model as a guiding tool is useful for sustainability assessment but does not impact the creative process of SOI. In overlooking the sustainability criteria that guide and enhance sustainability in the innovation process, while ensuring the understanding of sustainability potentials, the SIC does not address one of the major difficulties of SOI management. What

is more, its applicability is restrained by inherent assessment cost, as assessing the SOI around these 27 focus areas is very resource consuming. This can be counterbalanced, by a cost-benefit-analysis the result of which defining a restraint number of focus areas.

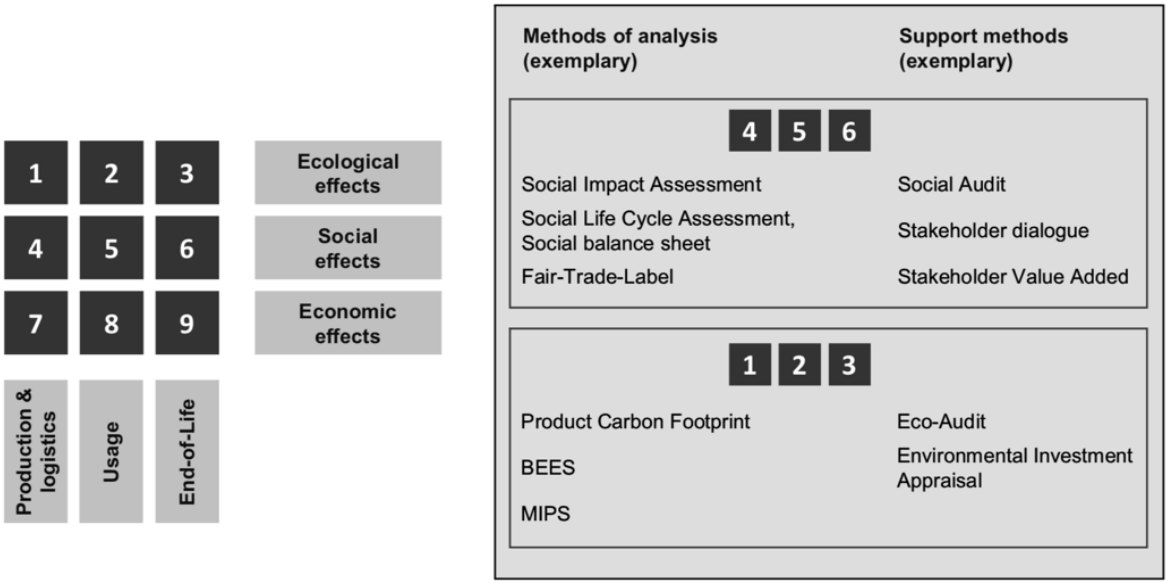


Figure 2.11. Assignment of sustainability assessment tool to SIC area – extracted from (Hansen et al., 2009)

While recognizing the difficulty of evaluating SOI, Jay and Gerand (2015) propose a framework which can be used for diagnosing SOI potential and to periodically assess, review, and improve SOI performance. The particularity of this framework is its implementation in and by new emergent structures called Centers of Excellence. Centers of Excellence are structures that could tap into both the entrepreneurial/business tissue and the scientific/academic tissue to stimulate the generation of new SOIs and support their development and diffusion. In doing so they would increase the success rate of SOI by facilitating the collaboration between all SOI actors: entre- and intrapreneurs, corporations, universities, government agencies and regulators, civil society organizations, and investors. Specific activities of COEs include development and dissemination of interdisciplinary knowledge, SOI process knowledge, design and evaluation tools and mediation/communication/leadership skills.

The framework proposes four dimensions (alignment of the SOI with COE objectives, suitability, scalability, and sustainability) as well as key elements and questions that should be considered under each dimension. In line with its purpose of identifying, selecting, incubating, and accelerating the best SOIs to be, the framework does not discuss specific metrics or innovation orientation/dimension/rate; the framework remains agile enough to be applied to any combination of SOIs, regardless of category or classification.

Regarding end-use, the framework remains general so that its use could be extrapolated to that of businesses, as it can be used for defining priorities, monitoring and decision-making (i.e., to set priorities when calling for innovation proposals); evaluate and select which SOIs to incubate and accelerate; and

monitor and review/ improve the solution design and delivery model during the prototyping and testing phases.

Suitability is considered as the capacity of an SOI to give a solution while solving a challenge and which can assess through metrics technical viability and user-stakeholder fit.

Scalability deals with the business model's capability to impact society within a supply-chain perspective. In turn, this involves an assessment of present and future necessary infrastructure (legal, regulatory, financial and physical). Another dimension of scalability is management's capability to respond to context change without abandoning the SOI process. A fundamental component of this dimension is the division of roles and responsibilities.

The final dimension for SOI evaluation is sustainability. This deals with economic, environmental, and social impacts, contribution to a need and governance for evaluation.

The previously exposed methods are limited by their extensive resource consumption and their need for precise and accurate knowledge of the impacts of an SOI inside and outside the organization throughout time and space. Therefore, it is interesting to overview qualitative methods, which although less complete are simpler to implement and therefore somewhat more appropriate for business implementation in the SOI process.

Value mapping for sustainable business modelling and thinking, is another method, this time oriented towards the creation of value for sustainability. Champions assess an innovation based on four types of value (captured, destroyed, missed, and opportunities) for four major stakeholder groups (customers, network actors, society and environment). It is an interesting tool for ideation, education as well as product/process design or collaboration across the supply chain (Bocken et al., 2015).

Two heuristics can be considered for adaptation to SOI: Design for Environment (DFE) and Simple Rules. DFE is based on goals and derived guidelines based on current knowledge of the supply chain, including recovery at the end-of-life. On the other hand, Simple Rules heuristics is derived from the finding that the more complex the parameters of a decision process, the more difficult it is to reach a decision, which is time and resource intensive. Defining simple rules allows alignment with corporate objectives without excluding local circumstance; coordination is enhanced which facilitates decision-making and decision implementation.

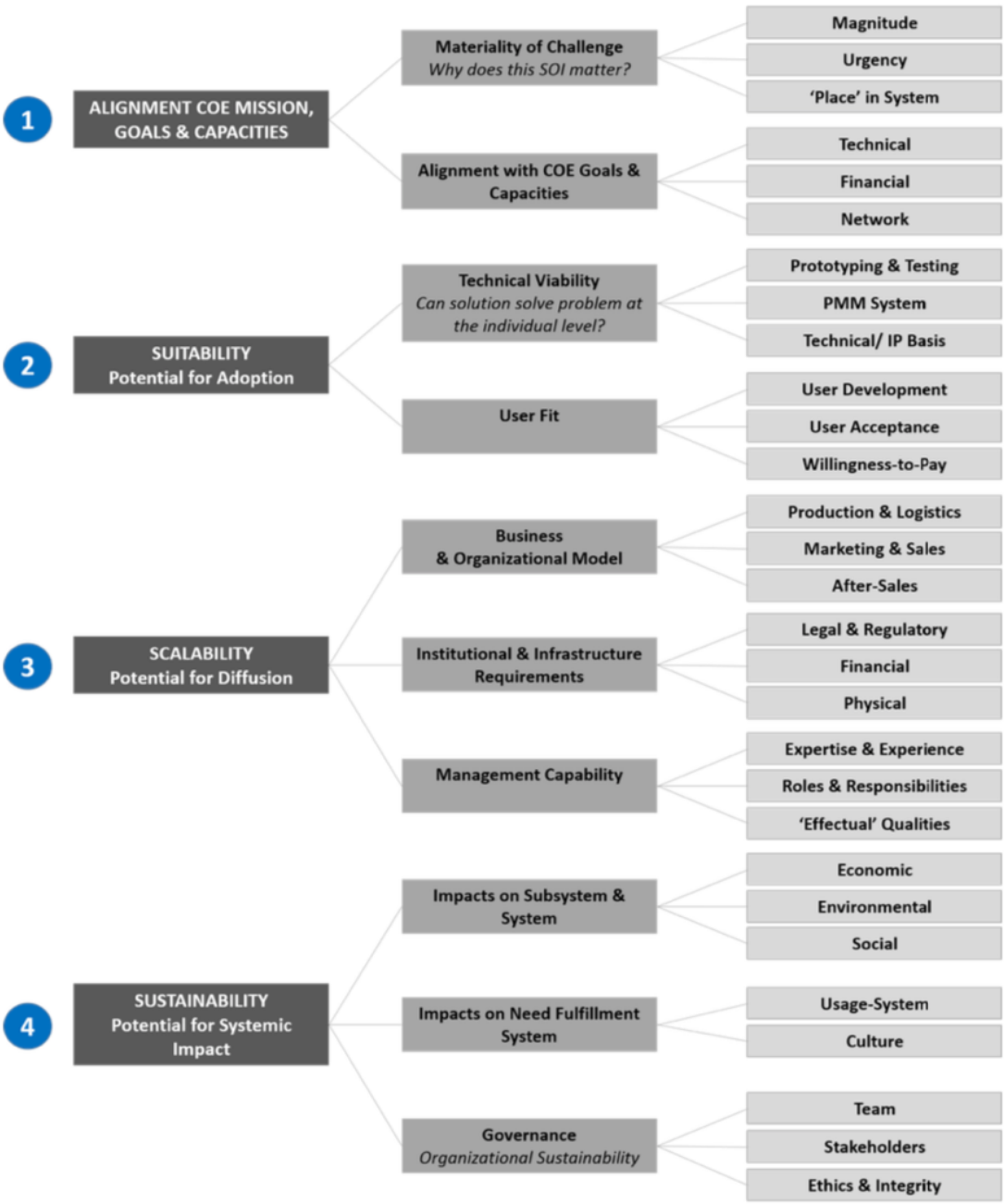


Figure 2.12. SOI Evaluation Framework (Dimensions & Aspect levels) - extracted from Jay and Gerand (2015)

2.2.6 Preliminary conclusions on SOI

The present chapter has reviewed recent works in the field of Sustainability-Oriented Innovation and aimed at proposing a state-of-the-art of current research streams in the PhD topic field of interest.

It was concluded that SOI is a rather novel field of research. Current literature research areas concern definition, implementation, evaluation, and assessment. The main research areas to date are summarized in Figure 2.13.

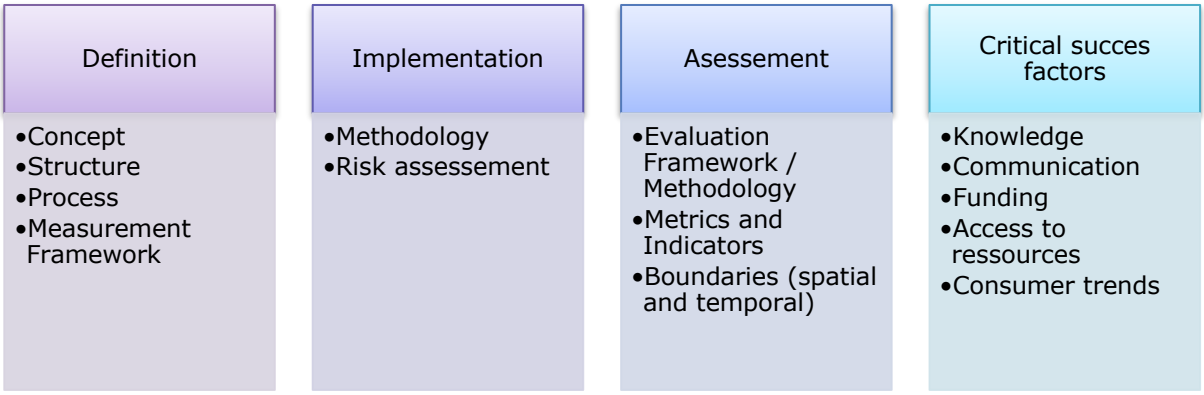


Figure 2.13. SOI research streams (authors' contribution)

Given that SOI is still a young field, the first obstacle is concerned with research of strategic and operational methodologies that are coherent with the definitions and structures of SOI. Research dissensus on fundamentals such as definition, process structure, implementation or assessment methodologies render sustainability-oriented innovation management very challenging. In turn this can be a deterrent for existing organizations to invest in and/or adopt SOI, as well as for newcomers who are limited in successfully managing external knowledge and stakeholders' conflicting interests, as well as directional risks.

Inherent to the identified research areas are major obstacles to SOI which relate, individually to innovation and sustainability and concurrently to sustainability-oriented innovation. Among these can be cited the inclusion of multiple sustainability dimensions (social, environmental, and economic), the temporal and spatial spread of SOI or the individual-community-organization relationship.

Figure 2.14 proposes a synthesis of critical obstacles to SOI which have emerged from the literature review and were regrouped into two categories, based on recurring umbrella terms. The first encompasses obstacles relative to **knowledge management** regarding SOI, specifically integrating science and technology, sustainability, systems theory, business and management, human resources. The second group retraces the pivotal role of **stakeholder management**, which can be considered from two perspectives: purpose or governance. From a purpose perspective, mains issues revolve around external stakeholders (consumer trends and market-viable product development, compliance with regulation and regulation-shaping in relation to regulatory bodies) and internal stakeholders (signal detection, agility, and mindset regarding balance between financial, social, and environmental viability).

The governance perspective deals with solving stakeholders' potentially conflicting interests and aims, which are enhanced by stakeholder's different timespan and resource-consumption constraints. Therefore, as opposed to conventional innovation, SOI is not limited to value creation for the business model but is extended to optimizing stakeholders demands and synergies to create value for sustainability and the business model.

By extension to the findings of Jay and Gerand (2015) and Ashford and Hall (2011), it is concluded that both knowledge management and stakeholder management are constitutive parts of organizational risk management, as organizational activity is dependent on internal and external stakeholders, both influence business value. Consequently, a viable approach to SOI requires efficiently selecting, engaging, and negotiating with stakeholders, to achieve an

optimal blend of private benefits, public benefits, and knowledge at each step of the SOI process. Attaining this optimal blend requires extensive knowledge on stakeholder management itself: which stakeholders should be involved, in what manner and at which point in time, what leverage should be actioned to ensure long-term engagement, how can stakeholders' willingness, opportunity, and capacity to change and innovate, be influenced. Each of these impact stakeholders' ability to use the present knowledge base to modify their own activities or generate sustainability-oriented ones. This blending of stakeholder interests is a specific component of stakeholder management that characterizes SOI.

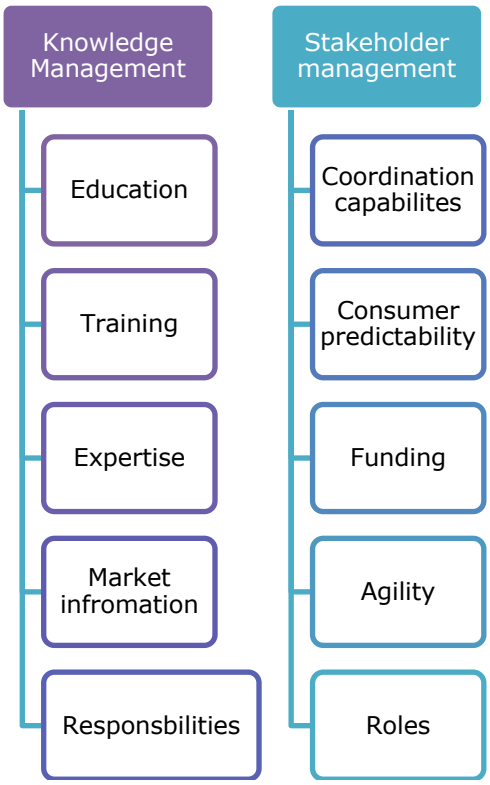


Figure 2.14. Classification of obstacles to SOI (authors' contribution)

Regarding assessment, no universally accepted evaluation method has been identified. The difficulties of SOI assessment are multiple:

- SOI can be evaluated either prospectively or retrospectively.
- Inclusion of SOI directional risk assessment.
- Assessing the market with the SOI and without the SOI.
- Assessing beforehand, the human and financial capitals necessary.

Particularly, shall be discussed a stance that has been encountered several times during the literature review (Hansen et al., 2009; Klewitz and Hansen, 2014; Jay and Gerand, 2015), namely that indicators and metrics are specific to each SOI and should be tailored for each case. Such a position is to be put in the perspective of that of researchers in the early days of sustainable development, when it was considered that proposing general indicators that would measure sustainability across industries and business models was a chimera. Similarly, to the field of sustainable development, efforts should be made into proposing general indicators, rather than tailor-made. This could be fruitful in facilitating organizations' endeavours to engage into SOI, while providing a work base and common language across industry-academia-public/private interest groups.

In their efforts to define SOIs, scholars propose a lot of efforts into categorizing SOIs and then deciding which of these are or are not SOI. As it has been pointed out by Hansen et al. (2009), the lack of a consensual definition for SOI, makes such choices arbitrary. For this reason and in line with Carrillo-Hermosilla et al. (2010) and Jay and Gerand (2015), it is considered in the present works that all innovations if they contribute to the advancement of the three sustainability dimensions are SOIs. As directional risk is difficult to assess, it is fundamental to acknowledge that any SOI can turn out to be a stand-alone game changer or to need further conjunction with other SOIs.

Finally, the current research is limited by dissensions into definition, assessment and implementation methodology, but is united to conclude that stakeholders and knowledge are key enablers of SOI.

2.3 General conclusions

The main conclusion of the bibliographical study is the acknowledged diversity of research trends/concepts/definitions with regards to OHS and SOI respectively but unified with regards to the pivotal influence played by Stakeholder Management and Knowledge Management.

Secondly, the bibliographical study highlights that both OHS and SOI belong to the wider family of sustainability. Despite extensive academic, industrial, and legislative efforts there is a threshold that seems impassable for OHS. New avenues of research are needed, and an understanding of the underlying mediating factors can help advance OHS. As OHS is fundamentally included in sustainable development as dealing with the equilibrium of economic, environmental and social dimensions, sustainability-driven innovations can be hypothesized to also advance OHS. Consequently, the existence of an interrelation between OHS and SOI can be hypothesized. Yet, the absence of a recognized structure or of a mere list of components renders research contours blurry and represents an important obstacle to the study of interrelations between SOI and OHS.

3 SEQUENTIAL THEORETICAL RESEARCH ON THEMES CONVERGENT TO THE DOCTORAL RESEARCH TOPICS

The purpose of the present chapter is to discuss the issue of interconnection between OHS and SOI.

The chapter is constructed as a synthesis of the author's research publications during the doctoral program.

The development of operational objectives OP1 and OP3 is done as follows:

- Bibliographical research of the state-of-the-art knowledge regarding OHS and SOI interconnections based on themes convergent to the research theme;
- Identification of theoretically mediating factors between OHS and SOI;
- Development of the Mutual Influence Model.

Considering the scarcity of research jointly addressing OHS and SOI and the complexity of the interconnection issue, the author adopted an innovative research approach through the direct study of the interconnections between the phenomena.

3.1 Synthesis of theoretical findings

The Australian Standard AS 5037–2005 defines Knowledge Management (KM) as "a trans-disciplinary approach to improving organizational outcomes and learning, through maximizing the use of knowledge. It involves the design, implementation and review of social and technological activities and processes to improve the creating, sharing, and applying or using of knowledge. Knowledge management is concerned with innovation and sharing behaviours, managing complexity and ambiguity through knowledge networks and connections, exploring smart processes, and deploying people-centric technologies" (SA 2005:2, in Ferguson, 2013).

Knowledge Management theory is anchored in the works of Nonaka who introduced the concept of the Knowledge Spiral (Nonaka, 2007). The Knowledge Spiral theorizes that two forms of knowledge (tacit – skills, "know-how", beliefs and explicit – rules, procedures) coexist in the organization and undergo a transformation in four steps: socialization, articulation, combination, and internalization (Dufour et al., 2021).

If today KM is a widespread concept, high-risk industries were the first to seek potential gains in implementing KM for OHS (Dufour and Draghici, 2018a). For high-risk industries, research confirmed the necessity of desk training (including computer-based courses), but also underlined a need for complementary approaches to enhance knowledge internalization and organizational access to tacit knowledge, which is part of the employee's experience, individual values, and organizational values (Davenport and Prusak, 1998; Nonaka, 2007; Podgórski, 2010). For instance, the use of narratives has been shown to be an effective means for disseminating tacit knowledge anchored in local and historical contexts (Davenport and Prusak, 1998; Podgórski, 2010).

In a broader context, KM is a means of mitigating risks stemming from technological, informational, or generational turnovers (Dufour and Draghici, 2018a).

Generational turnover deals with the process of ensuring the knowledge continuity in an organization from retiring employees to newly employed ones, up to the operational maturity of the new employee. Employee training requires specific financial, temporal, and human resource investments to achieve technical and OHS operational maturity. Without the necessary predispositions, organizations can find themselves bare of their core competencies in a performance diminishing knowledge gap. Generational turnover coexists with technological and informational turnover; new technologies, methods, methodologies arise, and the use of older ones becomes limited or obsolete, partially condemning pertinent knowledge to obsolescence. Obsolete knowledge is either transmitted, under implicit or explicit conjectures, or lost. This process requires a process of constant recategorization (Figure 3.1) of knowledge by all stakeholders.

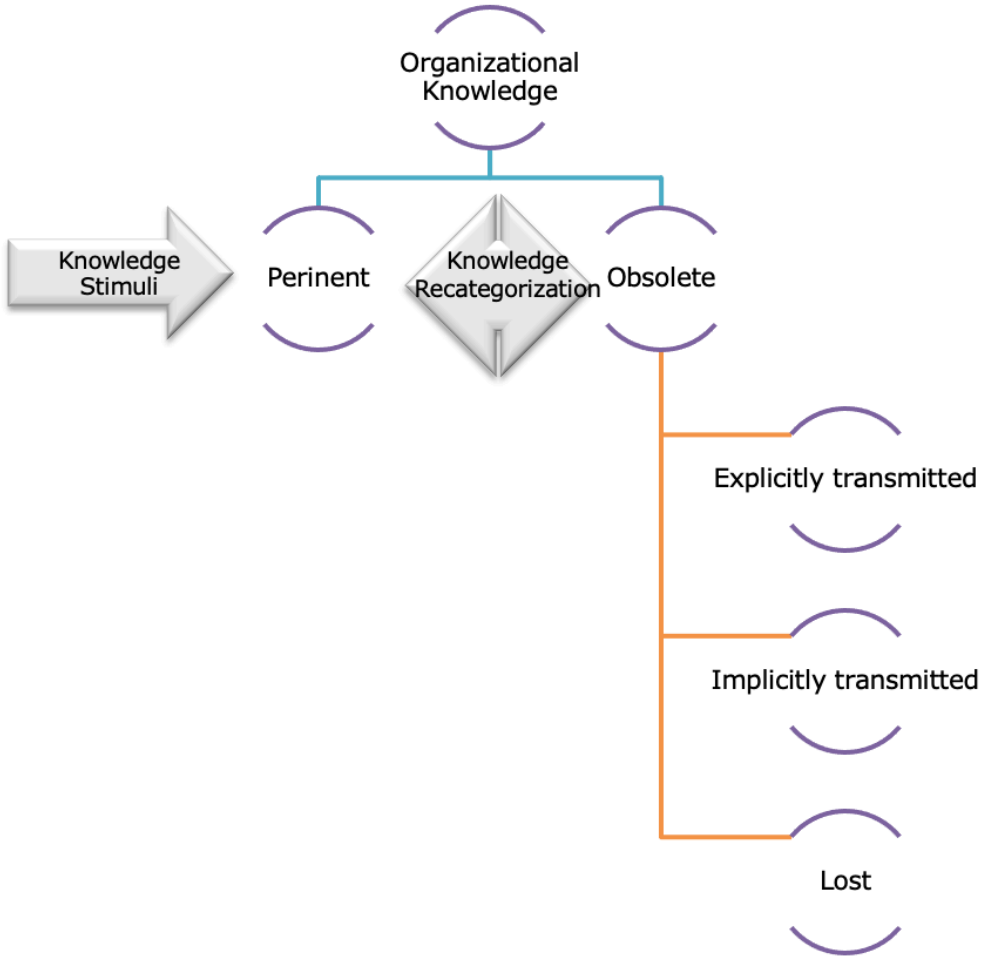


Figure 3.1. The Impact of the Knowledge Obsolescence Spiral on knowledge Categorization (author's contribution)

Risks emerge from the temporal dimension of recategorization as it is not instantaneous for all stakeholders, but is a process, the duration of which depends on time and organizational resources as represented in Figure 3.2. The temporal dimension is concerned with the time duration of the knowledge recategorization

process to be successfully completed. The resource dimension influences the moment of the identification of the knowledge stimuli and the organizations' capacity to start the recategorization process as close as possible to the identification of the knowledge stimuli. An organization's capacity to identify easily and early in time the knowledge stimuli can lead to competitive advantage if the organization also has the will and the available resources to trigger the recategorization process. Early integration of new knowledge and development of consequent strategies before competitors are the basis of business success. This can be even more salient as the knowledge stimuli of one stakeholder can be the result of the knowledge recategorization process of another stakeholder. This induces a cascading relationship of knowledge flows among stakeholders.

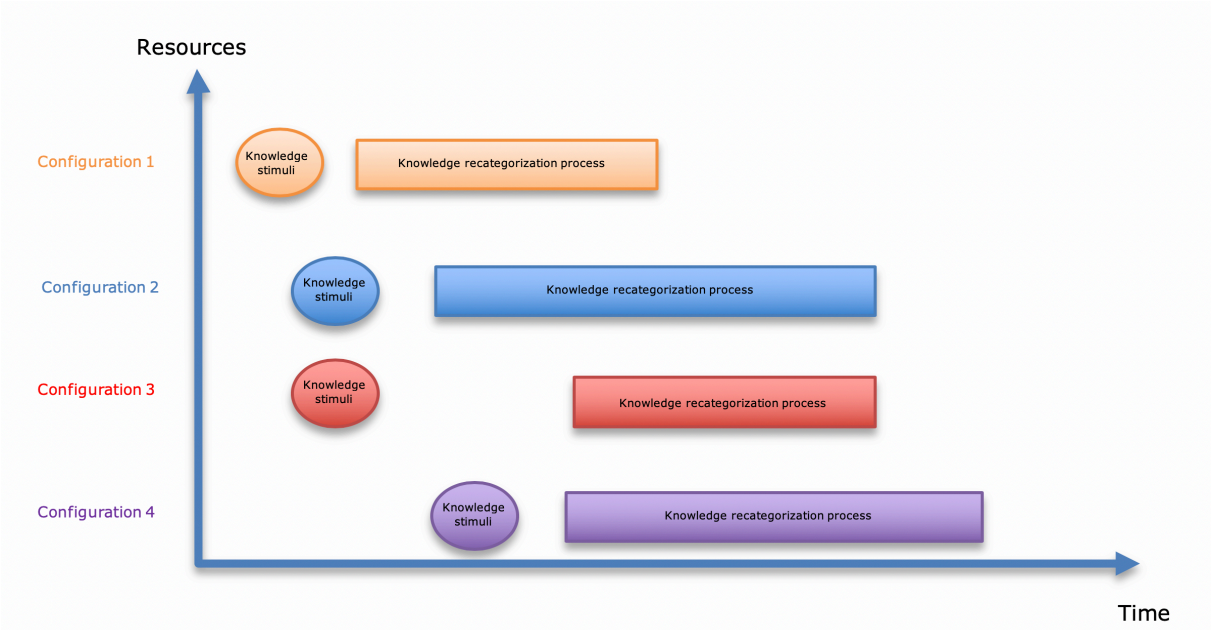


Figure 3.2. Representations of the knowledge recategorization process as a time and resource function (author's contribution)

This recategorization of knowledge due to the obsolescence of technologies and information is represented in Figure 3.3 and was termed the obsolescence spiral of OHS knowledge (Dufour and Draghici, 2018a)

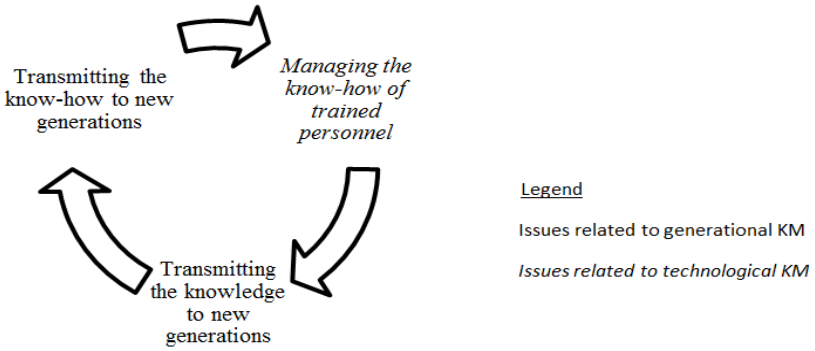


Figure 3.3. Obsolescence Spiral – extracted from Dufour and Draghici (2018a)

Given that present days are often named the knowledge era due to the fast pace of technological change and information communication, technological and informational turnover are quite common; technological or informational bumps

(new technologies, new laws) create a punctual influx of knowledge requiring employee training and assessment of subsequent internalization. Generational turnover is a constantly pending KM issue, requiring strategic KM in conjunction with HR management. Consequently, KM regarding OHS requires a structured approach dealing with the specific organizational context, while responding to the challenges of technological, informational, and generational turnover. KM should therefore be included in the OHS management system to ensure competitive edge, resilience, and adaptability.

Dufour and Draghici (2018a) concluded that there is a real need to create managerial tools for the conversion of tacit knowledge into explicit knowledge therefore rendering OHS management technologically, legally, and managerially viable in a time span that is compatible with that of the frequency of OHS occurrences. Focusing on high-risk industries, they proposed an approach for OHS-oriented KM based on Standards Australia AS 5037-2005, in which three enablers were selected from the AS 5037–2005. Knowledge-literacy covers the spectrum of personal development by considering the evolution of basic, technological and information literacy into skills (storytelling, mentoring, openness, and willingness to share knowledge). Share-fairs are a wide social agora where knowledge is shared on a particular subject. Finally, narrative management is chosen for conveying knowledge and elements of understanding for the transformation of information into knowledge.

To respond to the operational challenges of dissemination and use of knowledge, the approach is based on organizational redundancy between the managerial line and the expertise line at structural and cultural levels. This redundancy translates into knowledge transfers (socialization and combination) regarding competence and responsibility.

The knowledge transfers regarding responsibility ensure a coherent and unified stand of the organization regarding OHS in terms of both duties and rights, whereas regarding culture, knowledge transfers facilitate operational organization, feedback communication (top-down and bottom-up), refreshment and development of skills and alignment between organizational strata.

The organization is highly dependent on knowledge (Wiig, 1997) and therefore on the conversion of tacit knowledge of the individual into its own explicit knowledge. Consequently, if OHS knowledge is recognized as being one of the core values of the organization, its positioning in the broader organizational capital is debated. In coherence with, Nuñez and Villanueva (2011) it is argued here that OHS draws on intellectual capital through human capital ("*the stock of knowledge and skills that belong to firm's employees but are at the firm's disposal for the duration of their contracts", Nuñez and Villanueva, 2011, p. 61*) and through structural capital ("t*he set of knowledge, procedures and practices that remain in the firm, even when the employees have left it ", Nuñez and Villanueva, 2011, p. 61*). By adding social capital to intellectual capital and consequently, safety capital, Nuñez and Villanueva (2011), follow in the footsteps of Bontis (1999), by incorporating stakeholder management to IC as social capital is "*the value of the relationships and networks formed by organization's internal members"* (Nuñez and Villanueva, 2011, p. 61). This stance is coherent with the approach of Dufour and Draghici (2018a) as OHS management incorporates intangible resources (training, skills, communication, leadership) and the conclusions of Davenport and Prusak (1998) and Aase and Nybo (2002) regarding the necessity for new paths for acquiring and exchanging OHS tacit knowledge.

The implications of Knowledge Management on Intellectual Capital have been explored by Dufour et al. (2019b) through a crossover analysis of theoretical research in both fields. The research concludes that KM enhances human capital through the definition of the organization's knowledge focus and its impact on employee development. Regarding structural capital, particular vigilance must be had to the insidious enhancement of an organization's IT focus by encouraging measurement and indicator perspectives rather than the knowledge creating process (Paschek et al., 2017).

In limiting their analysis to the Skandia Navigator, Dufour et al. (2019) disregarded social capital. In considering social capital as part of IC, their conclusions will be extended here by inferring that regarding social capital, by facilitating communication, the organization enables socialization and articulation, and consequently internalization. Knowledge creation may, consequently, lead to innovation achievements such as new relationships, modes of reasoning and product/services.

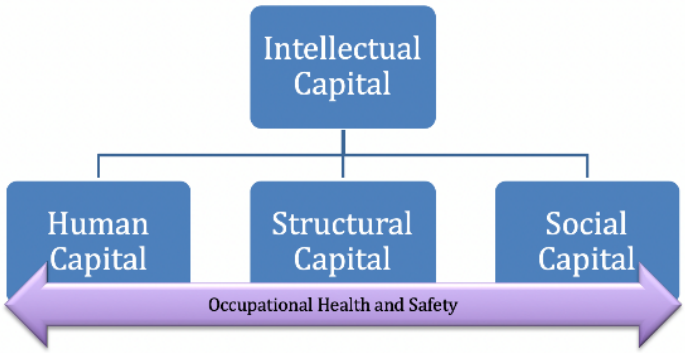


Figure 3.4. OHS as a cross-capital function (author's contribution)

All in all, OHS can be described as a cross-capital function as it contributes to and is influenced by all three forms of intellectual capital: it is part of individual knowledge and skills, of organizational processes and procedures and of the interactions within the organization and between the organization and external stakeholders (Figure 3.4). KM enables OHS through mechanisms such as key knowledge identification and structuring, innovation, skill, and competencies development. By construction, OHS is strongly linked to both social and environmental dimensions but is often "at the mercy" of the economic one. Consequently, OHS innovation emerging through KM is a form of sustainability-oriented innovation as it jointly considers all three dimensions, without prejudice to either of them.

The link between OHS and sustainability was investigated by Ivascu et al. (2019) who argued that the three sustainable development dimensions of an organization are influenced by employee education and engagement, which in turn influence the production process and the quality of products as well as on the job health and safety. Employee feedback is an innovation window, as the sharp-edge expertise into product and process design can contribute to hazard mitigation. Therefore, among the benefits of an integrated approach between OHS and sustainability there are those relating to innovation (supplier selection, cost reduction, improved stakeholder relationships, increased reuse etc.) and those relating to education (expert employment, better and more frequent communication, reduced stress or ergonomic issues etc.).

From a macro perspective, OHS and Sustainability issues are complex, because they involve numerous stakeholders (politics, global market, industry, lobby groups, NGOs, consumers, competitors etc.), interfaces (geographical, political, regulatory, customer/consumer etc.), material (raw materials) and dematerialized resources (data, information, knowledge). As reminded by Rennung et al. (2018a, 2018b), today, managing complexity is a central issue in which there is a subtle shift of perspective: constraints become drivers rather than pure limitations. For the organization to drive its constraints rather than be driven by them, it must be one step ahead of these complexities, by either responding to them or reshaping them; in either case, the organization must propose a new type of added value which will jointly respond to the issues raised by the three dimensions of sustainable development and the value of which will be accessible to all.

In this regard, and in the context of the manufacturing process, Dufour et al. (2019a) introduced the concept of Sustainable Value Added (Sus-VA) by extending the works of Faulkner and Badurdeen (2014) and Brown et al. (2014) on Sustainable Value Stream Mapping (Sus-VSM). Sus-VSM extends the traditional VSM approach for process mapping and "leaning", by including indicators for the environmental (process water consumption, material usage, energy consumption) and social dimensions (physical work and the work environment; job hazard and ergonomics). Sus-VSM cumulates traditional difficulties and those relating to collection of environmental and social indicators and their joint assessment. Dufour et al. (2019a) addressed this issue by considering that any environmental and social indicator has an influence on the value added of the final product and that this influence can be computed under a new measure of sustainability: Sustainable Value Added (Sus-VA). Sus-VA is the value added of any final product and which considers the environmental, social, and economic impacts of the manufacturing process. Extendable to the supply chain, the framework responds to the need of an integrated approach for sustainability assessment and can be implemented for any given indicators, under the condition that data respects stability and repeatability criteria. Usages include benchmarking, communication or decision-making.

In our interconnected society, communication in relation to stakeholders has become a method to respond to increasing pressure regarding the social, environmental, and economical dimensions (Dufour and Draghici, 2018b). To study this hypothesis, Dufour and Draghici (2018b) proposed a quantitative 20-year spanning analysis of communication efforts in the water utilities industry focusing on the evolution of reporting initiatives and the implementation of standardized reporting tools.

Interestingly, the study concluded that even in a very sensible sector such as the water utilities, the GRI database, which goes back to 1999, registered the first reporting initiative in 2001. Ever since, reporting initiatives have been increasing in number, and seem to have reached a plateau starting 2012 (Figure 3.5). An interesting finding is that sustainability reporting is above average in insular regions probably on account of their proximity to consequences.

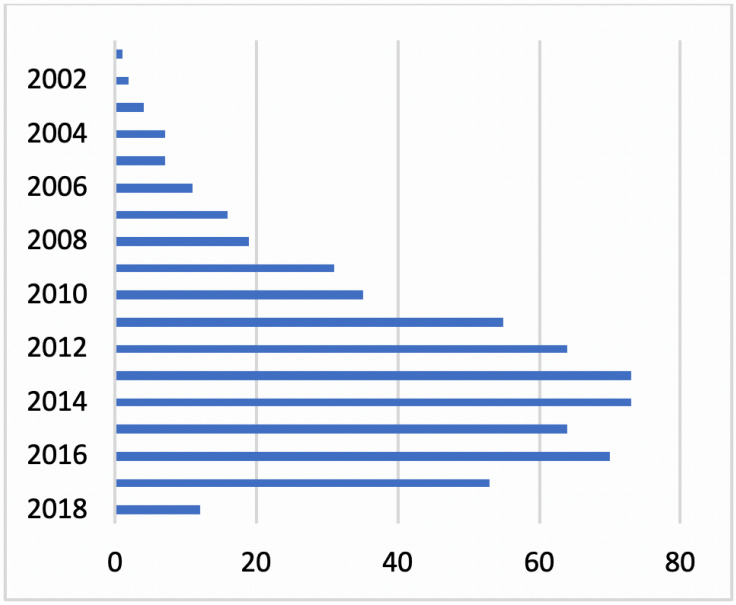


Figure 3.5. Quantitative evolution of worldwide reporting initiatives – period: 2001-2018 – extracted from Dufour and Draghici, (2018b)

As expected, large organizations are among the biggest contributors (Figure 3.6). Firstly, this type of organization is more common in the water utilities sectors as it is highly infrastructural and thus CAPEX-intensive and secondly, it has access to more resources and communication investment than SMEs.

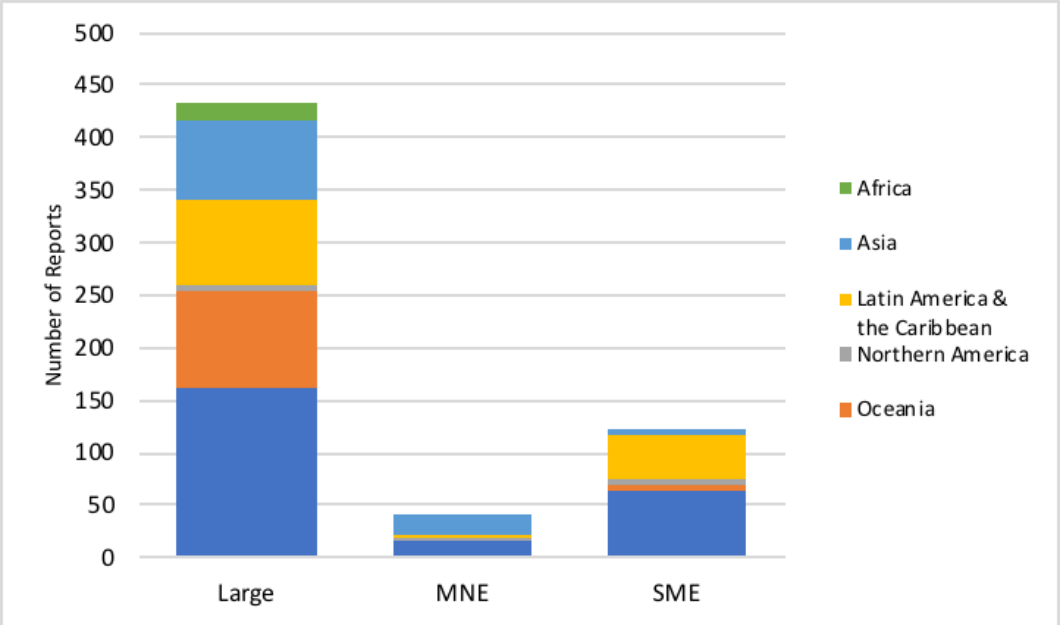


Figure 3.6. Quantitative evolution of reporting according to organization size – period: 2001-2018 extracted from Dufour and Draghici (2018b)

The study concludes that organizations in the water utilities sector are indeed reporting more on sustainable development as: "'Sustainability reporting is the practice of measuring, disclosing, and being accountable to internal and external stakeholders for organizational performance towards the goal of

sustainable development"[1] (Global Reporting Initiative, 2011 in Koskela, 2014). Consequently, reporting has become a tool aimed at external stakeholder management.

Education is a recurrent theme both regarding SOI and OHS. Education is concerned with the learning process and the transfer of knowledge.

Gaureanu et al. (2019) found that, in Romania, organizations highly rely on education, especially training as both preventive (a quarter of all preventive measures in PPP) and corrective measure (half, to two thirds of corrective measures following an accident, with an average of almost 1 training per 1 accident). This high recourse to training as both preventive and corrective measure, requires an inquiry into the extent to which the education of trainers influences the knowledge transfer process. It was concluded that similarly to the United States, OHS trainers in Romania, should benefit from preferably state-managed institutional training (i.e., university) with adequate and holistic curricula, to ensure a positive outcome on OHS accident/incident reduction.

In considering the contributions of university education to the training of employees and managers, particular focus was given to the contribution of the Prevention and Protection Plan (PPP) as pedagogical tool in higher education for appropriate OHS behaviour (Dufour et al., 2019) and for the creation of OHS professional knowledge (Dufour et al., 2021). Both studies are applied to the context of University Chemical Laboratory Courses and conclude that the PPP is an effective pedagogical tool for the generation of future engineers' OHS knowledge and appropriate OHS behaviour, as teachers link the educational content of the PPP to specific OHS topics and knowledge aims, which relate to steps of the knowledge spiral.

Resultingly, the Prevention and Protection Plan (PPP), is a part of basic education which blends theoretical knowledge, experimentation, skill/competence development, while incorporating prevention and risk mitigation. The internalization of all these elements leads to internalized OHS knowledge that is ready-to-use in the production environment, finding that reinforces the idea that knowledge transfers between university and industry contribute to more performant organizations through the OHS knowledge and behaviour of the future employees it educates. Adequate OHS behaviour builds on OHS professional knowledge; "better trained engineers contribute, through their own adequate behaviour, to the creation and/or consolidation" of organizational safety culture and followingly of a sustainable work environment (as supported by Dufour et al., 2019).

The safety culture concept is an inclusion of OHS promoting attitudes by and among the employees of an organization (adapted from Gaureanu et al., 2017). Cooper (2000), postulated that "*Safety culture is a sub-facet of organizational culture, which is thought to affect members' attitudes and behaviour in relation to an organization's ongoing health and safety performance*." (Cooper, 2000, p. 111)

The assessment of a safety culture aims at preventive risk control by creating policies, controls, and feedback of adaptation to the external reality (Gaureanu et al., 2017). In this regard, the role of communication and feedback between hierarchical strata is crucial to ensure appropriate action with the sharp-edge reality and not the perceived sharp-edge reality. These findings concur with

[1] Details given on: https://projekter.aau.dk/projekter/files/77158193/Sustainability_Reporting_and_SMEs (Access on 02-060-2021)

those of Ivascu et al. (2019) and Dufour et al. (2019b) in that managerial sensibility to OHS is pivotal in developing a safety culture.

The model proposed by Gaureanu et al. (2017, 2018) for safety culture assessment is based on three dimensions: knowledge, psychological influence and legal compliance, each dimension having 2 associated characterization issues (Figure 3.7).

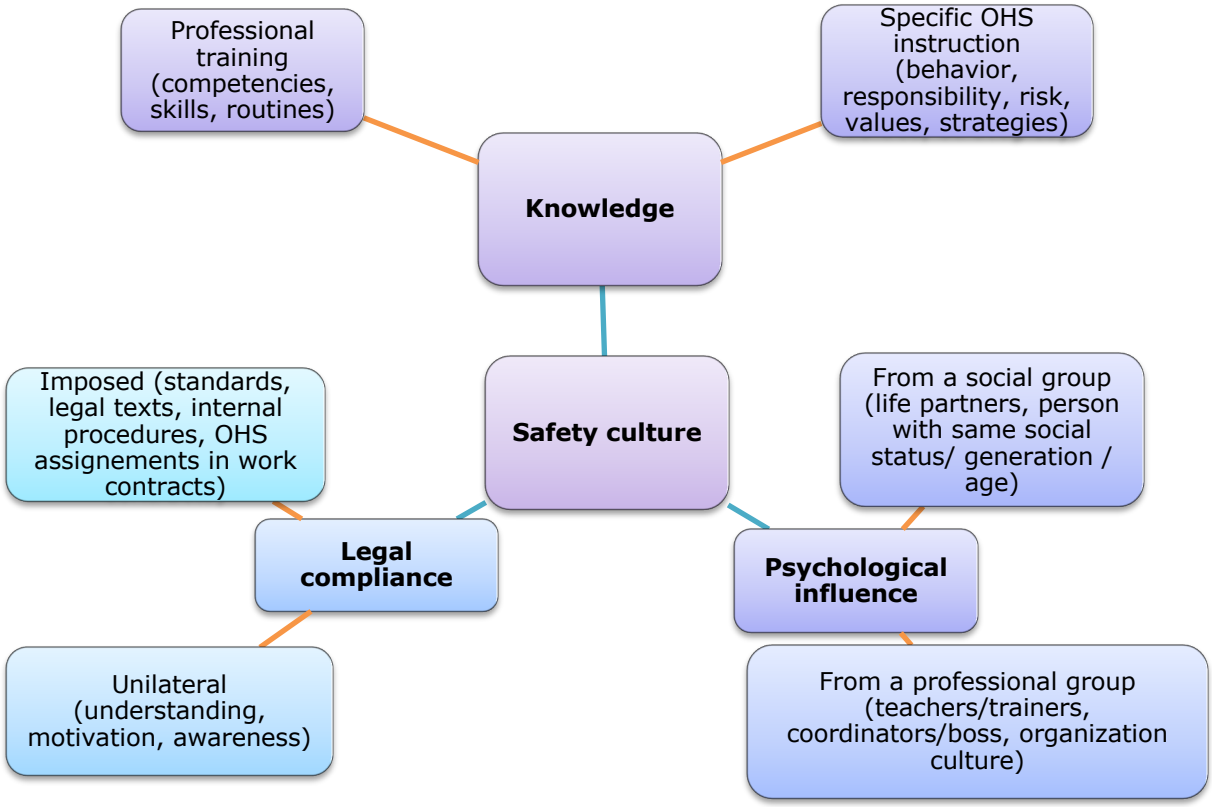


Figure 3.7. Model for Safety Culture Assessment - representation derived from Gaureanu et al. (2017, 2018) (author's contribution)

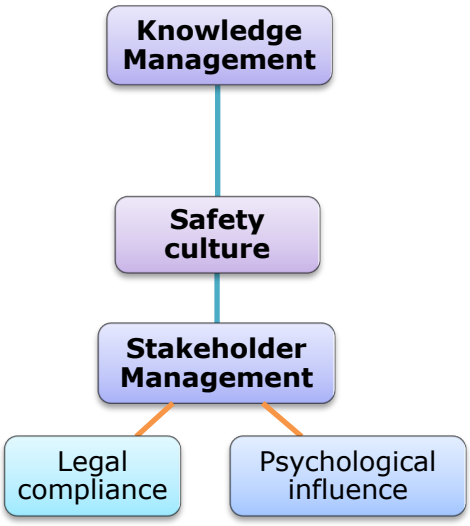


Figure 3.8. A Safety Culture Assessment Model derived from the model of Gaureanu et al. (2017, 2018) (author's contribution)

This model can be further generalized by perceiving that legal compliance and psychological influence are both facets of stakeholder management. To the same extent the influence of knowledge on the safety culture includes elements of experience gained from seniors in the profession or visions, strategies, which need to be managed. In this regard, and in conjunction with the denomination of "stakeholder management", the dimension "knowledge" should be termed "knowledge management". Consequently, the safety culture model of Gaureanu et al. (2017, 2018) shall be modified to include this new categorization of concepts and will be constructed as per Figure 3.8.

Stakeholder management emerged from managers' quest for strategies ensuring long-term success. The postulate was that in achieving its objectives, the organization needs the support of those gravitating around it (shareholders, employees, customers, suppliers, society, governments etc.); this implies that organizational objectives be in line with the concerns of these stakeholders (Freeman and McVea, 2001).

Vogwell (2003) proposed that stakeholders are individuals or organizations having an interest/stake in a project or strategy, on whom there will be an impact and who have an interest in positively/negatively influencing the project/strategy. Hillman and Keim (2001) concluded that primary stakeholder management can induce differentiating resources and capabilities, which in turn translate into competitive advantage. Primary stakeholders are vital to the sheer existence of the organization and are exposed to risk as they have invested in the organization any combination of capital, human or financial value. Primary stakeholders, include "capital suppliers (shareholders), employees, other resource suppliers, customers, community residents, and the natural environment" (Hillman and Kleim, 2001, p. 126) and "the public stakeholder group: the governments and communities that provide infrastructures and markets, whose laws and regulations must be obeyed and to whom taxes and other obligations may be due" (Hillman and Kleim, 2001, p. 126-127).

If an organization fails to respond to stakeholders' interests, it cannot survive the competitive market: customers disappointed of a product/service will turn to competitors, governments unsatisfied with legal compliance will impose penalties, society's dissatisfaction translates to bad publicity potentially leading to fewer customers, suppliers can turn to other organizations. Consequently, organizational relationships with stakeholders are a primary asset contributing to organizational value creation and performance.

Hillman and Kleim (2001) state that competitive advantage is most likely achieved if organizational resources respond to four criteria: "valuable, rare, inimitable and the organization must be organized to deploy these resources effectively" (Hillman and Kleim, 2001, p. 127 quoting Barney, 1991).

Regarding OHS, one of the major gaps to be bridged in relation to effective resource deployment is understanding roles and responsibilities for both internal and external stakeholders (Bluff and Gunningham, 2003; Pringle and Frost, 2003; Conchie et al., 2013; Tappura et al., 2014).The lack of clarity is due on the one-hand to the general legal and voluntary frameworks which refer mainly to the employer's duty of care and to weaving of OHS in everyday activities. In this regard, Dufour et al. (2020) proposed an internal chain of OHS responsibilities, based on the hierarchical structure of the organization and the requirements of the OHSAS 18001 which recognizes the accountability of the head of the organization. The conceptual framework is a multilevel model in which responsibilities cascade among internal organizational stakeholders: all internally and externally imposed

responsibilities can be broken down into ensued responsibilities from which can be broken down other ensued responsibilities. Followingly, "each hierarchical level is coupled with an ensued responsibility, thus constituting a theoretical internal chain of OHS responsibilities" as per Figure 3.9.

In this model, the granularity of each responsibility diminishes from one hierarchical level to the other, as does the perimeter of decision-making and responsibility, and consequently the impact on human, organizational or physical assets. Such an approach is coherent with the fact that responsibilities are corollaries to tasks, the safe accomplishment of which requires a specific OHS knowledge-baggage, which can be acquired through training, work-place based learning or higher education. The acquisition of the specific OHS professional knowledge is therefore a function of time and education.

In conclusion, according to the model of Dufour et al. (2020), OHS competitiveness depends on the interactions established over time between the human, organizational and physical resources (resource-based view) and on the organization's capacity to enhance knowledge creation and dissemination (institutional view). Thus, the model of Dufour et al. (2020) links two strands of organizational theory: the resource-based view and the institutional setting view.

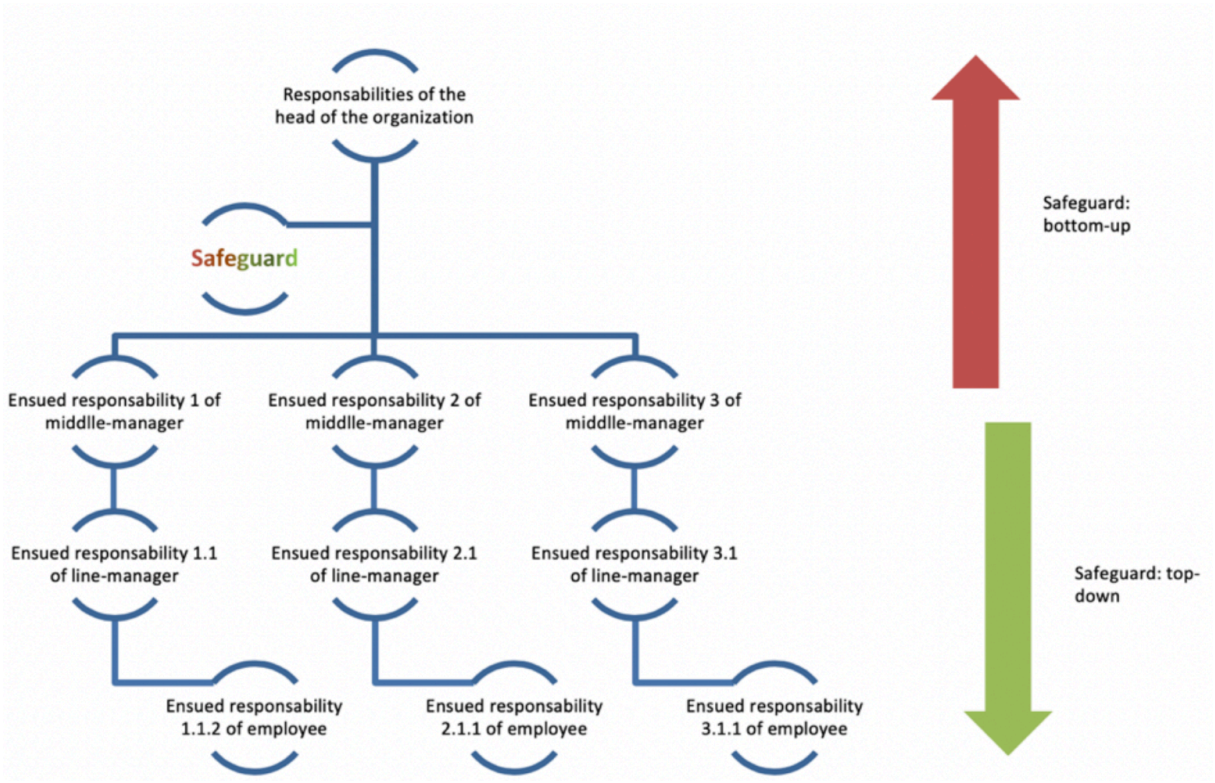


Figure 3.9. Occupational Health and Safety Responsibility Multilevel Model – extracted from Dufour et al. (2020)

The purpose of an internal chain of responsibility is to clarify and facilitate decision-making, with the ultimate objective of OHS performance; by extension to the postulate of Hillman and Kleim (2001), this will lead to long-term value creation through the relationships established among the organizations' internal stakeholders, but also with external stakeholders through the recognition and rewarding of positive OHS reputation.

3.2 Conclusions

The synthesis of sequential theoretical research on themes convergent to the research theme ensured a deeper insight in the roles played by Knowledge Management and Stakeholder Management regarding OHS and SOI.

Firstly, the chapter concludes that Knowledge Management (KM) and Stakeholder Management (SM) are, from a theoretical standpoint, influencing factors with regards to Occupational health and Safety and Sustainability-Oriented Innovation. Firstly, KM requires the social component of SM for the full enabling of the knowledge creating spiral. Indeed, in the socialization step of the knowledge creating spiral, individuals rely on sharing as a form of learning. Consequently, internal stakeholders such as employees or managers and external ones such as work inspectors or doctors can, through one-to-one exchanges contribute to the learning process of employees. Secondly, KM builds on SM to determine the limit of its competencies; in this regard, governmental or voluntary regulatory bodies, as external stakeholders, can provide useful input for identifying and bridging OHS knowledge gaps.

SM uses KM to build long-lasting and profitable relationships for the organization. These relationships are intangible assets protecting the internal stakeholders and responding to the expectations of external ones through long-term novel solutions that offer a competitive advantage and respond to social, environmental, and financial constraints. Such relationships incorporate as primary input the uncertainty of the result and require a continuous learning process based on trial-and-error, repeat-dealing, moral and ethical value. Stakeholder knowledge includes but is not limited to customers' requirements and expectations, regulatory obligations, suppliers' capacity of conforming to standards, competitors' positioning, societal trends.

Secondly, based on the distilled literature review and the author's own contributions, it was possible to establish, a list of theoretical key elements contributing to Occupational Health and Safety and to Sustainability-Oriented Innovation. The theoretical key elements about their source are listed in the Appendix, chapter 8.1. This was achieved by reviewing individually each of the co-authored articles and identifying key words/expressions that are explicitly or implicitly designated as mediating Occupational Health and Safety or Sustainability-Oriented Innovation.

The list of key elements is a starting point for identifying theoretical mediating factors. The considered mediating factors are hypothesized to establish a relationship between Occupational Health and Safety and Sustainability-Oriented Innovation. In considering the scarcity of research linking both OHS and SOI demonstrated by the literature review, the author chose not to hypothesis regarding the type of relationship, but only on its existence. As the potential mediating role of Knowledge Management and Stakeholder Management has been outlined in the previous chapter, both were purposefully excluded during the establishment of the list of mediating factors.

The establishment of the list of mediating factors was achieved by combining emergent and a priori coding techniques (Stemler, 2020). Emergent coding requires two reviewers examining the data, proposing two distinct lists of categories which will then be submitted to a separate analysis process to establish a unique list. In the present case, the list of mediating factors was established as follows:

1. The author reviewed the list of theoretical key elements and regrouped them into categories based on content or lexical resemblance (categories discussing OHSAS 18001 and ISO 31000 were regrouped under "standards");
2. A second reviewer was invited to independently review the list of theoretical key elements and regrouped them into categories based on content or lexical resemblance (categories discussing OHSAS 18001 and ISO 31000 were regrouped under "standards"). The second reviewer had the possibility to use the list of categories of the first author or propose a new category if needed;
3. The two reviewers analysed categorization results together: of 458 elements, 39 were categorized differently by the two reviewers. This corresponds to a 91.3% agreement rate. The differences in category regrouping were discussed, without bringing any change to the independent reviewing. The two reviewers agreed that a third recategorization was needed by regrouping the previously obtained categories into categories based on higher-granularity themes (for instance categories such as "method" and "standards" were regrouped into category "management systems");
4. The second recategorization led to 25 elements being categorized differently by the two reviewers. This corresponds to a 94.5% agreement rate;
5. Finally, the last step consisted in reviewing the key elements that were categorized differently at step 4. The two reviewers discussed each key element individually and concluded that two categories could be attributed to each key element, according to the approach of the organization and contextualized understanding is required for coding.

It is to be noted at this point, that only 3 key elements that were subject to reviewer disagreement at step 2, were also subject to reviewer disagreement at step 4. The remaining 21 elements were subject to reviewer agreement at step 2 but led to reviewer disagreement at step 4. As already pointed out at step 5, upon discussion the two reviewers agreed that certain key elements are subject to context and can therefore be regrouped under two themes. Similarly, the perception between the author and the second reviewer, also shows a difference in perception between the academic standpoint of the author and the practice-oriented one of the second reviewer, who has a purely industrial background. The results of the categorization of the key elements are given in the Appendix section.

The list of mediating factors and elements of contextualization emerging from the reviewer discussion are given in Table 3.1.

At this point, it is to be pointed out that the establishment of a list of mediating factors, and subsequent key factors, between Occupational Health and Safety and Sustainability-Oriented Innovation represents a research contribution.

The list of mediating factors cascades from theoretical research, which is limited as follows:

- The theoretical research that has been reviewed has pointed out to the scarcity of research regarding SOI and OHS;
- The theoretical research has also pointed out that although both knowledge management and stakeholder management are contributors to both OHS and SOI, in depth research regarding the particularities of these contributions are necessary;

- Due to the scarcity of the previous research in a combinatorial approach, the author has proceeded to a theoretical research convergent to the research theme to define a theoretical foundation for applied research;
- The author's own research, as the review literature, point out the diversity of opinions and the poor understanding at a theoretical level.

Table 3.1. List of theoretically mediating factors

Mediating factor	**Key factors**
1. Contextualization	Knowledge characteristics/communication Communication Stakeholder identification & involvement Relationships/influences
2. Leadership	Decision-making Initiatives
3. Responsibility	Responsibility
4. Education	Competencies Skills Trainers
5. Management systems	Standards Processes Measurement systems Risk assessment Working conditions
6. Organizational culture	Organizational values /beliefs Organizational aims Safety culture Values Stakeholder involvement & participation
7. External factors	Market volatility Globalization Dynamic environment Stakeholder expectations Legislation/ third party policy Climate change Food supply
8. Technology	Technological solutions

The author developed the Mutual Influence Model based on the analysis and synthesis of the bibliographical study and of the sequential theoretical research on themes convergent to the research theme presented in this chapter (see Figure 3.10).

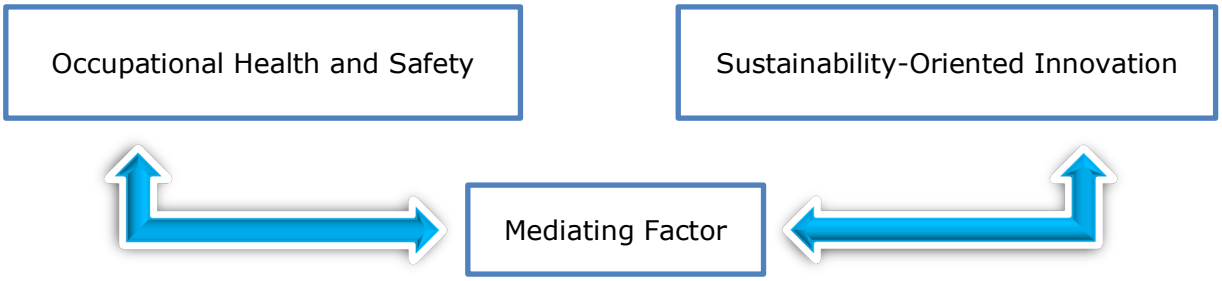


Figure 3.10. Mutual Influence Model (author's contribution)

The Mutual Influence Model (MIM) hypothesis the existence of one or more mediating factors that influence OHS and SOI. Based on the literature review, several mediating factors exist, but their interrelatedness is not established theoretically. Despite its unifactorial representation, the MIM model recognizes the mutual influence that mediating factors may have upon one another.

The following research questions shall be addressed through the applied research and in relation to the MIM model:

- Do current organizational practices confirm the theoretical hypothesis of the existence of mediating factors between sustainability-oriented innovation and occupational health and safety?
- Do current organizational practices confirm interrelations among mediating factors?

All in all, the literature review has pointed out that main issues regarding the fields of Occupational Health and Safety and Sustainability-Oriented Innovation relate to conceptual comprehensive definition. The absence of consensus and the subjectivity in defining meaning and/or perimeter opens the research area to vast concepts and approaches. Yet, theoretical research often acknowledges the existence of societal and organizational changes that respond to the challenges of sustainability and shifts in innovation "patterns", as well as an increasing focus on the health and safety. Therefore, organizations are already implementing non-economic practices to respond to non-economic changes. The reporting of non-economic practices is generally done through sustainability reporting. Consequently, the purpose of the applied research is to respond to the two research questions by analysing organizational practices with regards to OHS and SOI as self-reported in sustainability reports.

The individual complexities of Occupational Health and Safety and Sustainability-Oriented Innovation are multiple. Consequently, the study of mediating factors between OHS and SOI is a combinatorial problem. The first objective of the MIM model is to propose a simple approach to describing the connections between OHS and SOI, while establishing the mediating role of the theoretically identified mediating factors with regards to OHS and SOI, as well as identifying the existence of interrelations between mediating factors.

4 APPLIED RESEARCH

The purpose of the present chapter is to depict the methodological aspects required for the applied research.

The chapter is constructed around the presentation of the possible research approaches, the choice of the best-fit approach and the extensive presentation of the research design and data collection and analysis procedures.

The development of the operational objective OP2 is done as follows:

- Bibliographical research on research approaches (quantitative, qualitative and mixed methods);
- Development of a research approach selection tool;
- Selection of the best-fit research approach;
- Presentation of the research deign, as well as data collection and analysis procedures.

4.1 Theoretical considerations

The identification and understanding of similarities and dissimilarities among theoretical assumptions and real practices regarding Occupational Health and Safety and Sustainability-Oriented Innovation, can lead to a better understanding of the studied topics, as to the development of new theories and practices which effectively blend values and experiences with theoretical insight.

The first theoretical research result is the establishment of a list of theoretically mediating factors among Occupational-Health and Safety and Sustainability-Oriented Innovation. These are summarized in previous chapters.

Sustainability reports are self-established repositories of methods employed by organizations to transpose organizational attitudes and beliefs into initiatives which contribute to social, environmental, and economic dimensions. As sustainability reports are meant for third-party communication, they outline innovative approaches in support of the three sustainability dimensions. By integrating organizational practices relative to safeguarding employee health and safety and self-established innovative solutions, sustainability reports reflect organizational attitudes and beliefs in response to the challenge of sustainability.

When a researcher reads a sustainability report, this is analysed firstly through the researcher's own lens. The "set of beliefs and practices that guide a field" (Morgan 2007:47, in Doyle et al., 2009) is called a paradigm. According to Hanson et al. (2005), paradigms are defined by epistemology (how we know what we know), ontology (the nature of reality), axiology (values) and methodology (the process of research).

The divergence of opinions relative to these characteristics has led to the emergence of two research paradigms: the positivist paradigm, relating to quantitative research and the constructivist paradigm, relating to qualitative research. Adherence to one paradigm or another will impress the research process both regarding the questions asked and the methods used.

Positivism argues the existence of a unique reality, from which an objective researcher can establish large samples to test hypothesis meant to identify causal relationships. Constructivism on the other hand defends the existence of multiple

realities, leading to a multitude of interpretations, which are in turn influenced by the subjectivism of the researcher himself. The two paradigms have a long tradition of being opposed, if not incompatible.

In recent years, pragmatism has emerged as a third path. Pragmatism combines the two traditionally adversarial paradigms and argues that research methods, concepts and reasoning must be chosen in relation to the research question rather than fitting to the research process (Johnson and Onwuegbuzie, 2004). Consequently, the pragmatic paradigm opened the path to a middle-ground research approach: mixed-methods, which builds on both qualitative and quantitative research.

The following paragraphs are dedicated to the overview of qualitative, quantitative and mixed-methods research.

Qualitive research is a broad field, emerging mainly from social sciences, and covering numerous philosophies and techniques, the purpose of which is the identification and understanding of issues from the perspective of the participants to the study (Hennik, Hutter and Bailey, 2020). Qualitive research is permeable to contextualized interpretations of the research issues, by accounting for social, economic, and cultural contexts. As reminded by Tesch (1990), most phenomena are not naturally quantifiable but are characterized by concepts (such as motivation or interest) and for which specific measuring methods and instruments needed development to ensure compatibility with quantitative methods (such as statistics). An example of such a measurement system is the Likert scale, which allows the conversion of opinions or interests into numerical formats.

Qualitive research is not characterized by breadth, but by depth (Thomas and Magilvy, 2011; Hennik, Hutter and Bailey, 2020). As it is focused on knowledge building, it requires few study participants, the experiences of which are mined to collect data ("qualitative data") through flexible procedures such as observations, interviews, focus groups or from a creative process (such as paintings, drawings, videos etc.). The grasp on qualitive data is not a unique truth, as it is permeable to the researchers' own references on the subject (understanding) or to the grip on "the life of the people whom you study from their own perspective, in their own context and describing this using their own words and concepts" (Verstehen in Hennik, Hutter and Bailey, 2020, p. 17).

Contrary to qualitive research, which gives meaning by contextualizing, quantitative research requires the conversion to numerical formats, which is an impoverishment of the breadth of understanding because of context elimination. Quantitative research aims at quantification of the research problem through variables that can be studied numerically and then be extrapolated to a population. This generalization requires a large sample for the study and that is also statistically representative of the population at large (Hennik, Hutter and Bailey, 2020).

Mixed methods research combines quantitative and qualitative research. If there is consensus regarding the use of both qualitative and quantitative approaches and/or methods in each study, the articulation of the qualitative and quantitative elements is matter of debate (Doyle et al., 2009). Indeed, it is difficult to obtain a 50-50 blend of quantitative and qualitative methods within a mixed methods research, knowing that quantitative and qualitative methods relate to data set sampling, construction of the research process, choice and implementation of research methods (Johnson et al., 2007; Doyle et al., 2009). Consequently, Johnson et al. (2007) classified mixed methods as being qualitative

dominant, quantitative dominant or "pure mixed" (equal part of quantitative and qualitative).

Notwithstanding the issue of the quantitative-qualitative proportion, the integration of qualitative and quantitative methods poses questions relative to the combination of quantitative and qualitative methods. Onwuegbuzie and Johnson (2006) proposed the following combinations: concurrent, sequential, conversion or fully mixed, the description of which is given in Table 4.1.

Mixed research being a rather new field, the concept of validity of the research is also submitted to the debate of mixing quantitative and qualitative approaches. The term "validity" itself comes from the field of quantitative research, in qualitative research, the term "trustworthiness" being used (Lincoln and Guba, 1985). Researcher's choice of one term or another is anchored in the paradigm underlying the quantitative or qualitative schools and in the different currents of thought within each school. For the present research, we are preoccupied with the concept from the perspective of mixed research, while considering that validity/trustworthiness applies to both the research process and the research results. In this regard, Onwuegbuzie and Johnson (2006) stated that as mixed methods fundamentally combine quantitative and qualitative methods, by building "combining complementary strengths and nonoverlapping weaknesses" (p. 48), the validation of the findings is an issue relative to integration and should be termed "legitimation" (p. 48). Indeed, legitimation is a term of the middle ground, as it can be used by both qualitative and quantitative researchers, and although referring to "findings and/or inferences that are credible, trustworthy, dependable, transferable, and/or confirmable, remains a neutral term to both quantitative and qualitative paradigms.

The legitimation of mixed research must consider specific issues of representation and integration. Representation issues are concerned with the difficulty in expressing lived experiences using text, words, and numbers. They form the main separation point between qualitative and quantitative schools.

Table 4.1. Mixed design - Typology according to qualitative - quantitative combination (adapted from Onwuegbuzie and Johnson, 2006) – Author's contribution

Mixed methods design	**Description**
Concurrent mixed design	Quantitative and qualitative data are collected separately, but at approximately the same moment of time. Separate data analysis and interpretation for the qualitative and quantitative component are done. Meta-inferences are drawn based on the separate inferences made from the distinct quantitative and qualitative studies
Sequential mixed design	Data analysis starts before completing the data collection stage; for instance, data from quantitative analysis will be used as input for the qualitative analysis or using qualitative approaches to collect data as input for quantitative analysis.
Conversion mixed designs	Data is converted from one format to another; then analysis are run on both data types and inferences.
Parallel mixed designs	Data is collected and analysed separately, without drawing of meta-inferences, leading two separate sets of conclusions.
Fully mixed research designs /Fully integrated research designs	Quantitative and qualitative approaches are combined throughout the entire research process, with mutual influences existing at each stage.

Integration issues are concerned with the additive or multiplicative problems derived from quantitative and qualitative approaches, respectively. According to Greene et al. (1989), integration issues are the extent to which combining quantitative and qualitative approaches can address each of the five general purposes of mixed research studies[2]:

- "Triangulation (i.e., seeking convergence and corroboration of findings from different methods that study the same phenomenon);
- Complementarity (i.e., seeking elaboration, illustration, enhancement, and clarification of the findings, from one method with results from the other method);
- Development (i.e., using the finding of one method to help inform the other method);
- Initiation (i.e., discovering paradoxes and contradictions that lead to a re-framing of the research question)
- Expansion (i.e., seeking to expand the breadth and range of inquiry by using different methods for different inquiry components)".

Another approach to mixed-methods legitimation was proposed by Onwuegbuzie and Johnson (2006). These are summarized in Figure 4.1 as an extract from their works.

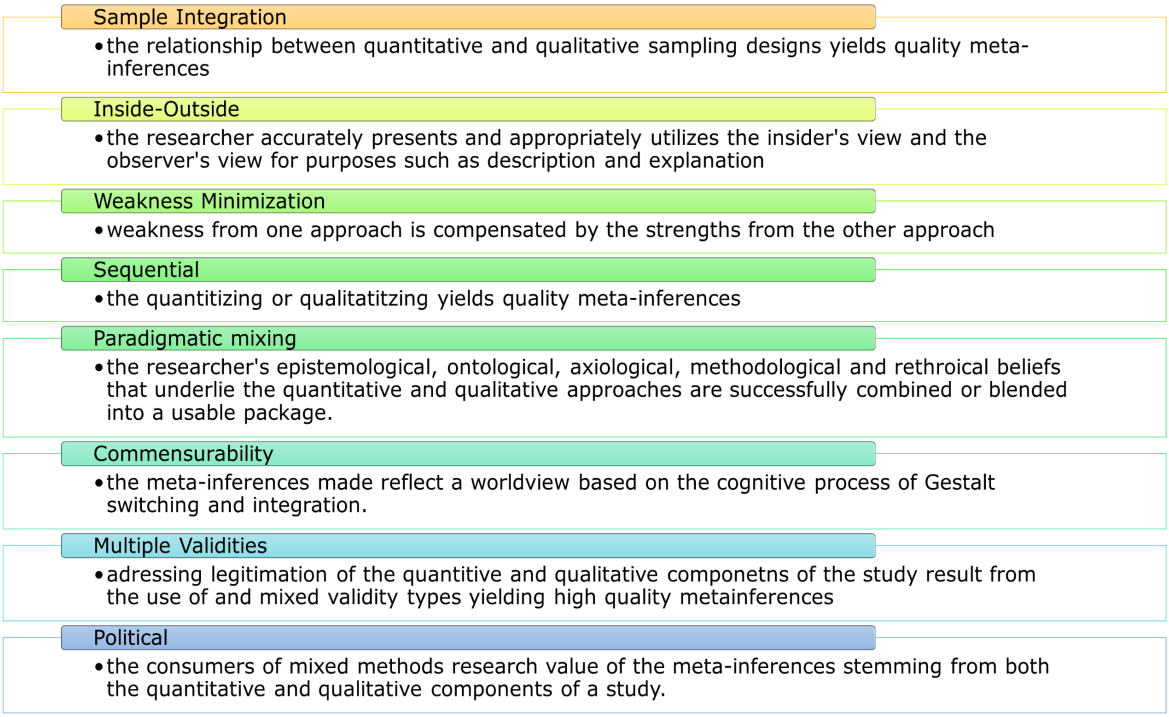


Figure 4.1. Legitimation types for Mixed Methods adapted from Onwuegbuzie and Johnson (2006)

Although further research is necessary into the legitimation of mixed methods, it is not the purpose of the present works to expand on the subject. The author will rely on the current state of advancement in the field, with regards to legitimation of the applied research.

[2]As developed and applied by Hurst (2013). Retrieved from: http://eprints.staffs.ac.uk/2003/1/Hurst%20G.PhD%20Thesis.pdf (Access 02-06-2021)

4.2 Research design

Consequently, and although initially, the constructivist paradigm, seemed most appropriate, upon closer consideration of the research objectives, a pragmatic approach imposed itself.

The following paragraphs are dedicated to the justification of the best fit of mixed methods to the research scope.

Building on the works of Hennik, Hunter and Bailey (2020) regarding key differences between quantitative and qualitative research, the author proposes a scale for characterizing the mixed research approach, as to the quantitative - qualitative components. The left arm of the scale is attributed to quantitative research, while the right arm of the scale is attributed to qualitive research. Each arm has 4 weights, corresponding to the characteristics of each research approach: objective, purpose, data (type and collection) and analysis and outcome. Each weight corresponds to a predefined answer of a set of 4 questions, as per Table 4.2.

Table 4.2. Research Approach selection - Question set and predefined answers adapted from Hennik, Hutter and Bailey (2020) – Author's contribution

QUESTION	ANSWER	WEIGHT POSITIONING
What is the objective of my research?	quantification and extrapolation	"Quantitative Research" arm
	contextualized understanding of behaviour, beliefs etc. for a few participants	"Qualitative Research" arm
What is the purpose of my research?	quantification of an issue through statistical methods	"Quantitative Research" arm
	understanding of the process and of the influences through in-depth auto-reporting	"Qualitative Research" arm
What kind of data and analysis do i deal with?	statistical analysis of large data samples	"Quantitative Research" arm
	interpretative analysis of mainly textual data	"Qualitative Research" arm
What is the outcome of my research?	identify predominance	"Quantitative Research" arm
	identify perceptions and compare to theoretical models	"Qualitative Research" arm

For each question, the researcher must choose the most appropriate answer and then places the weight on the scale. The scale then tilts in favour of one research approach or the other, according to the self-characterization of the research.

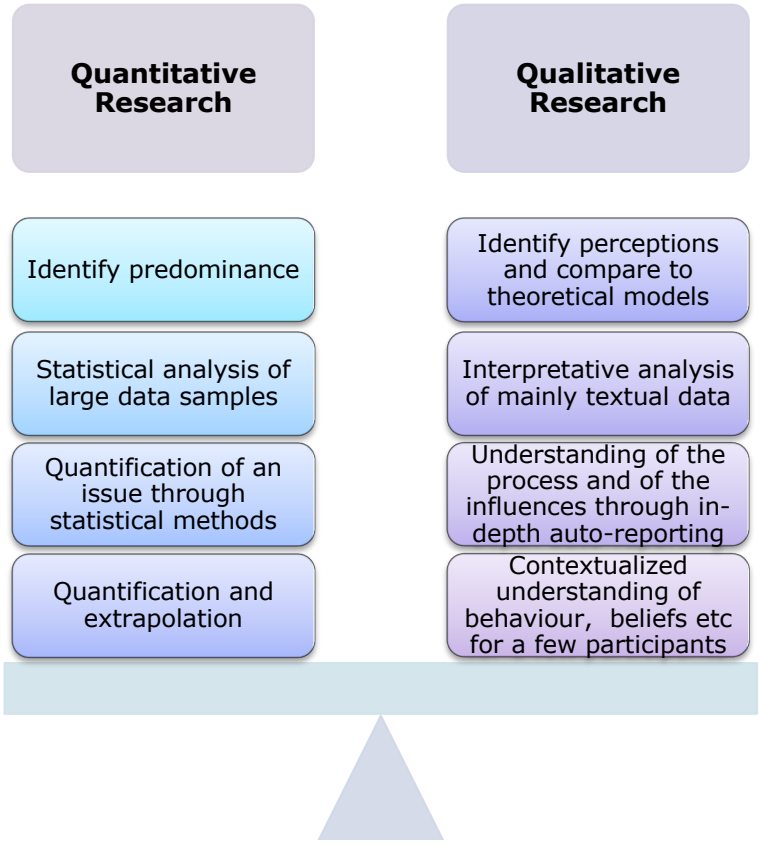


Figure 4.2. Scale for Research approach selection adapted from Hennik, Hutter and Bailey (2020) – Author's contribution

The author applied the previously described selection process for the definition of the most appropriate research approach, by considering the previous considerations and that:

- The studied population will be constituted of a small number of participants (5 organizations);
- The research data is constituted of sustainability reports (1 report/studied organization), i.e., self-written narrative of each organizations' efforts on the road to sustainability;
- The objective of the research is Verstehen: to understand the interrelations between Occupational Health and Safety and Sustainability-Oriented Innovation, from the perspective of the organizations and by using their own words and concepts;
- The outcome of the research is to identify the perception that organizations have of mediating factors between Occupational Health and Safety and Sustainability-Oriented Innovation and to compare them with the proposed theoretical model;
- The introduction of complementary numerical and/or binary variables to identify predominance.

It is necessary to point out that, if interpretative text analysis of mainly textual data is the most appropriate data analysis method, it is undeniable that there is a possibility to propose a certain number of statistical analysis by defining complementary variables. As such both these weights have been placed on the scale, as it is visible in Figure 4.3.

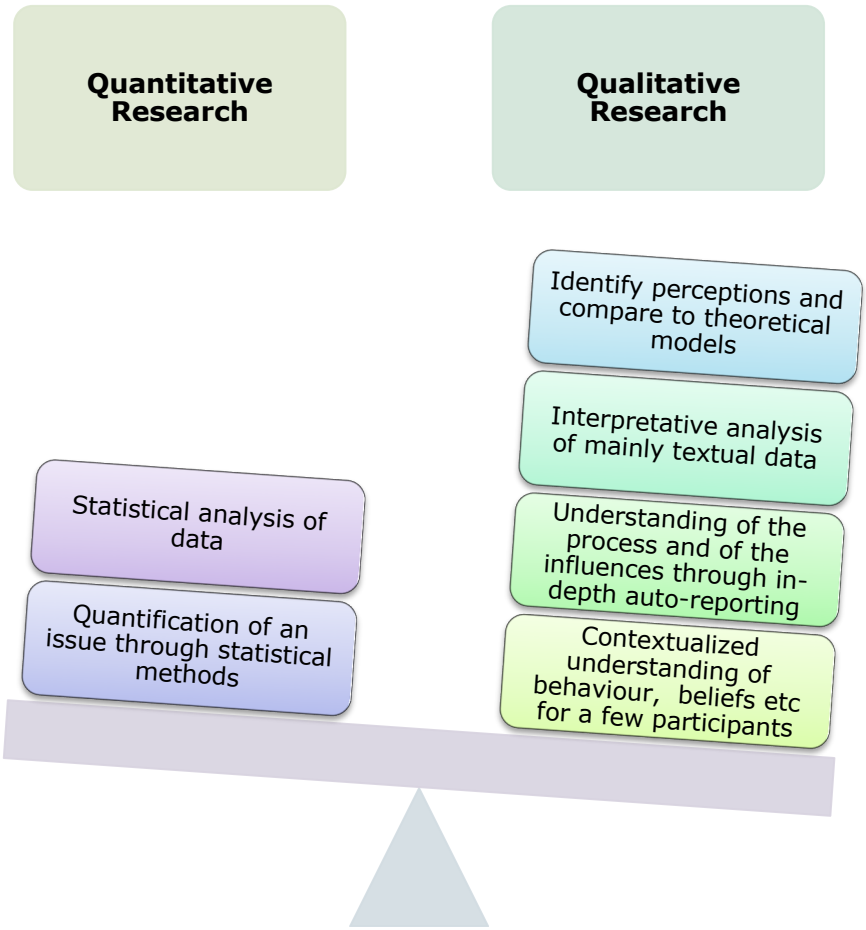


Figure 4.3. Scale for Research approach selection – Application to the PhD research

It is clear from this analysis, that although there is a clear tilting of the scale in favour of qualitative research, a complementary quantitative approach is necessary.

In the given context, qualitative research would be limiting in the exploration of complementary studies requiring quantitative methods. On the other hand, a purely quantitative method, would pose issues regarding the quantification of qualitative data, and would undermine the variation in practices and perceptions. If quantitative methods can highlight differences between organizational practices and the theoretical model, qualitative methods can provide insight into these differences. Given the above and considering the depth and breadth of the study (Halcomb and Hickman, 2015), the use of mixed methods research is chosen by the author.

Furthermore, a mixed methods approach may lead to the identification and explanation of inconsistencies or contradictions regarding the research question, as research results are convergent, inconsistent, or contradictory (Denzin, 1978).

As stated in the research purpose the objective is to identify similarities and dissimilarities between a proposed theoretical model and organizational practices. Consequently, neither qualitative, nor quantitative approaches seem fully satisfactory for the research objective and the choice of mixed methods, as the incarnation of the pragmatic paradigm (Johnson et al., 2007) is confirmed.

The combination of research approaches within mixed methods reinforces the completeness of the study and the legitimation of results. The joggling between quantitative and qualitative methods may potentially provide explanations for

unforeseen findings and a more intuitive illustration of the data. Finally, the use of mixed research can help provide insight into purely qualitative or quantitative further research avenues (Doyle et al., 2009).

4.3 Data collection

For the present research, the population sample is made up of five organizations. The data set is constituted of one sustainability report for each of the five organizations. Sustainability reports are characterized by report length, proportion of text versus tables or pictures, topic construction and presentation. By combining text, images and tables, sustainability reports depict self-declared practices, values, or beliefs in textual or visual formats. The research scope is to identify the presence of theoretically identified mediating factors in the data set, to quantify the presence of these mediating factors and to allow for a qualitative and quantitative interpretation of the relationships between mediating factors and mediated concepts.

The data collection procedure must be justified by the research approach (Krippendorff, 1989); in the case of mixed methods, it is firstly characterized by the timing of the collection of quantitative and qualitative data (Creswell, 2009). In the case of the present research, data collection took place in two steps:

1. Collection of the sustainability reports based on sample population;
2. Collection of data relative to each mediating factor and for each sustainability report.

With regards to the data set, the following criteria was applied for the selection of the organizations and their sustainability reports:

- Tradition of publication (at least one previous sustainability report);
- Variety of industrial fields;
- Variety of organizational sizes (medium companies, large companies, subsidiaries, mother companies);
- Variety of activity types (B2B and B2C);
- Unity in legislative framework (limited to European companies);
- Unity in publication language (limited to English).

As already discussed in previous paragraphs, a sustainability report includes mainly textual, but also numerical and visual data. The preference for sustainability reports over other organizational communication mediums is aimed at constructing a data set which responds to Krippendorff's criteria of replicability and relative stability in meaning within a group of individuals (1989); indeed, all sustainability reports describe organizational endeavours contributing to sustainability.

The data set is composed of five sustainability reports, belonging to 5 different organizations, selected among five different industrial sectors: energy, education, food, consulting, IT and presenting differing business models, i.e. principles according to which value is created, delivered, and captured by the organization (Osterwalder, 2010). It was therefore necessary to create a sample that is representative of the diversity of business models of the current economical tissues but also of the magnitude and interconnections of today's organizational structures. Thus, the selected organizations are stand-alone (ETH Zurich and Oatly), large groups (Ericsson) or sub-companies of large groups (Distributia Oltenia, PWC Hungary). The diversity of the organizational typology translates into the sustainability reports by the extent of the inclusion of geographical and

regional specificities and by the granularity of the description of implemented sustainability steps and measures.

Other criteria employed in the selection of the organizations was that their sustainability report covered a period stretching back to latest 2017, regardless of the frequency of publication (annual, bi-annual) and that the organization had published at least another previous sustainability report, too. The criterion of publication of a mandatory previous sustainability report was included to ensure continuity on and determination to the sustainability path. It was purposefully decided not to limit the population to organizations having a long track of sustainability reporting. In selecting companies that have been providing sustainability reports for several years, the sample would have been excluded more recent organizations which are representative of a new vision and market positioning.

Table 4.3. Overview of the Sustainability Reports in the Data Set

Organization	Reporting period	Report length (pages)	Compliance to sustainability reporting frameworks
ETH Zurich	2017-2018	102	1. Global Reporting Initiative 2. ISCN Sustainable Campus Charter[3]
Distributie Oltenia	01.2019-12.2019	54	Global Reporting Initiative
Oatly	2018	46	-
Ericsson	01.01.2019-31.12.2019	32	1. Global Reporting Initiative 2. AA1000APS[4] 3. UN Global Compact Communication on Progress 4. UN Guiding Principles Reporting Framework Index
PwC Hungary	01.07.2018-30.06.2019	45	Global Reporting Initiative

Based on the above criteria, the author proceeded to a google research of several organizations of her acquaintance (PwC, ETH Zurich). This was completed by a review of several up-to-date articles on sustainability reporting trends and analysis, for the identification of organizations that are innovative in their reporting style (Oatly). Finally, the GRI database was researched based on country to select an Eastern-European organization in an industrial sector not covered by the already selected organizations (Distributie Energie Oltenia SA).

Each organization was characterized through an organization chart. Organizational charts were compiled by the author and are given in the Appendix section, chapter 8.2.

Followingly, the latest available sustainability report of each organization was downloaded from each company website in PDF format at the end of 2020. Table 4.3 is an overview of the retrieved sustainability reports for each organization.

It must be noted that the although the reporting is done on a period of one year, this does not necessarily correspond to the civil year. For instance, ETH Zurich sustainability reports span over 2 civil years (2015/2016, 2017/2018 and the foreseen publication in 2021 of the 2019/2020 report), while PWC Hungary

[3] ISCN : International Sustainable Campus Network
[4] AccountAbility's AA1000 Series of Standards

models on the Hungarian fiscal year. The three other organizations propose a report in connection to the civil year.

4.4 Data analysis procedure

The analysis of each sustainability report is undertaken through the lens of the theoretical mediating factors between OHS and SOI and as such the research is theory driven. Their presence within each sustainability report will be researched through a coding process; consequently, qualitative data will be identified first, and conversion to quantitative data will be done in a second time. Therefore, the data collection timing strategy will be sequential-qualitative first.

With regards to weight of the qualitative and quantitative components, there is no a priori emphasis on one or the other. Nonetheless, given that the identification of the qualitative data is an input for the quantitative data and given that quantitative and qualitative research respond complementary to the research problem, a sequential mixed design was considered most appropriate. As pointed out in literature it is well-fitted for theory-driven evaluations, as in the case of the present research.

The mixing of qualitative and quantitative data occurs at two levels: firstly, as the qualitative themes will be transformed into quantitative data (such as counts), the mixing of the data is done in an integrative manner; secondly, an initial qualitative approach is necessary for data contextualization, which will also facilitate the interpretation of quantitative data findings. In conclusion, a contextual overlaying strategy, as part of a concurrent mixed design approach is most pertinent.

With regards to legitimation, the author rallies to the term legitimation rather than validity regarding mixed methods. Indeed, the model proposed by Onwuegbuzie and Johnson (2006) proposes a process-oriented legitimation which allows a step-by-step validation, and this throughout the entire research process, and not only regarding the outcomes; of the nine legitimation types proposed by Onwuegbuzie and Johnson (2006), the present research is concerned with two types: Weakness Minimization and Multiple Validities.

Through Weakness Minimization, there is a compensation of the weaknesses of one method through the strengths of the other method. Through Multiple Validities, the validity of each method employed in the study contributes to the overall inferences, and therefore to high-quality conclusions.

The two legitimation types were selected as both qualitative and quantitative methods yield specific results, the validation of which is a prerequisite for the legitimation of preliminary conclusions. Moreover, the present research is concerned with the equilibrium between the use of quantitative and qualitative methods in the research design. As discussed in previous chapters, the divide between researchers with regards to the use of one method or the other has been historically based on its underlying paradigm, and the limitation that it induces.

As it has been pointed out by the chapters on state-of-the-art, up-to-date research and initiatives have looked upon specific aspects of OHS and SOI but have only partially led to advancements into providing in-depth understanding of the underlying mechanisms. The use of mixed methods contributes to a validation and rebalancing of each component of the study and therefore to the creation of a comprehensive picture of the research issue. Weakness Minimization and Multiple Validities legitimize the study by expanding the research issue according to

Eisenhower's principle: *"Whenever I run into a problem I can't solve, I always make it bigger. I can never solve it by trying to make it smaller, but if I make it big enough, I can begin to see the outlines of a solution."*

As mixed methods include numerous analysis methods, the author found more suitable to present each method employed in relation to the obtained results in the Research results section.

4.5 Analytical tool selection

If in the past, qualitive date research implied hand categorization; nowadays the emergence of computer based qualitative data analysis software, has revolutionized the field of qualitative data analysis by rendering the process less laborious (Wong, 2008). Indeed, the coding process, i.e., grouping data into categories, is quicker and more effective with the help of computer-based software, and facilitates the preliminary work of data analysis.

Qualitative data analysis can be achieved by using several Computer Assisted Qualitative Data Analysis Software – CAQDAS. The most renown on the market are Atlas.ti, MAXQDA or NVivo. The present chapter is dedicated to the brief presentation of the previously mentioned three softwares and to the software selection process. Several bibliographical resources were included in the selection process, among which software documentation, software tutorials, scholar bibliographical research on CAQDAS as well as soft resources such as forums discussing user experience with the software.

Preliminary to software presentation, the author must underline that the methodological implication of using a given software has been a matter of debate for many years, as some researchers argue that CAQDAS impose a method or at least a direction to the user (Glaser, 1992), whereas others claim the freedom of the user in the choice and use of a software (Kelle et al., 1995), with a suitability of CAQDAS for grounded theory, discourse analysis or qualitative content analysis.

CAQDAS propose a diverse range of analytical functions that can be used according to the construction of the research process and methods. Therefore, the analysis of the three considered software (Atlast.ti, MAXQDA and Nvivo) aims at identifying strong points and limitations for each one, while keeping in mind that the central feature of CAQDAS is the assignment of codes to data, independently of format.

Although there is no one fit, the choice of the software is a trade-off among its characteristics such as compatibility with the hardware of the researcher, user friendliness or compatibility with the research approach (qualitative, quantitative, or mixed).

MAXQDA is a German software, widely used in social science, with strong coding capacities for large volumes of text with functionalities for qualitative and mixes methods research. Many users describe it as not having been developed without a Grounded Theory orientation (Medium, 2016).

With regards to use, MAXQDA is acknowledged as having an easy-to-use user-interface and coding functionalities (via drag and drop or colour assignment) and segment retrieval. Finally, it is recognized as being capable of complex analysis, even when dealing with large data sets and having extensive and free-of-charge user support. Quantitative data can be obtained through data conversion, and this can be easily transferred for more extensive mining in quantitative software such as SPSS (G2, 2021).

MAXQDA proposes an extensive 30 day-free trail, with subsequent affordable student license, as well as equal quality MAC and PC compatibility without external database requirements (MAXQDA, 2021).

Atlas.ti is a highly praised software for analysis and structuring of unstructured data, through location, coding, weighing and visualization functionalities. Many researchers consider it as best-fit software for grounded theory research (Medium, 2016; Atlas.ti, 2021). One of the drawbacks that are pointed out by users is that the main working code list has a flat structure as opposed to a code tree. This is particularly interesting where research theory is built alongside the applied research and where codes are identified while going through the data set (inductive approach).

Users also point out that Atlas.ti has an intuitive interface due to limited visualization options and requires care in manipulation due to the use of an external database system (NYU, 2021).

NVivo is produced by QSR International and is oriented towards deep level analysis on rich, unstructured data sets (Medium, 2016) without being method specific (Zamawe, 2015). Importation of large datasets is acknowledged as lengthy or even faulty for some formats. Furthermore, some functionalities are not available under the Mac version (Kent, 2021)

"Additionally, NVivo also has in-built facilities that allow people from different geographical spaces to work on the same data files at the same time through a network. Moreover, the strength of NVivo lies in its high compatibility to research. The key message to take home is that unlike statistical software, the main function of CAQDAS is not necessarily to analyse data, but rather to aid the analysis process, which the researcher must always remain in control of. In other words, researchers must equally know that no software can analyse qualitative data"[5] (Zamawe, 2015).

Finally, NVivo requires a rather lengthy learning process due to design and layout (Godau, 2004), complicated interface and challenging data classification (NYU, 2021).

A comparison of the three CAQDAS is proposed in Figure 4.4 with the help of the comparison functionality of SourceForge, a website dedicated, among others, to software reviewing oriented for IT projects. With the SourceForge comparison tool, the user can select up to 4 software indexed in the SourceForge database; the comparison result consists in a comparative table reviewing platforms supported, pricing, features, training etc. In the context of the present study only the indications relative to the supported platform and the features were selected, as bringing a synthetic overview of the research potential.

Considering the above characteristics of the three software, the researcher had to select the one to be implemented for the applied research.

Firstly, the researcher uses a Mac environment, for which NVivo functionalities are not optimal in comparison to those of MAXQDA and Atlas.ti.

As the author was not previously acquainted with either of the three software, the extensiveness of software documentation was an important criterion to ensure easy and fast software handling. In this regard MAXQDA proposes extensive online documentation, but also books on the use and construction of research projects. On the other hand, Atlas.ti benefits from a strong user community on informal resources such as forums. In this regard the lengthy trial

[5] As supported by the explanations of (Zamawe, 2015). Retrieved from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4478399/ (Access 20-04-2021).

period of MAXQDA as opposed to Atlas.ti consisted of an important advantage to discover and test functionalities.

Moreover, MAXQDA is not driven by a specific methodological construct, is considered by users as widely compatible with mixed methods as it presents a wide range of quantitative and qualitive functionalities. Finally, data can be easily exported for more extensive quantitative research. All in all, the software MAXQDA was selected for the research as considered as best-fit to the research purpose and objectives.

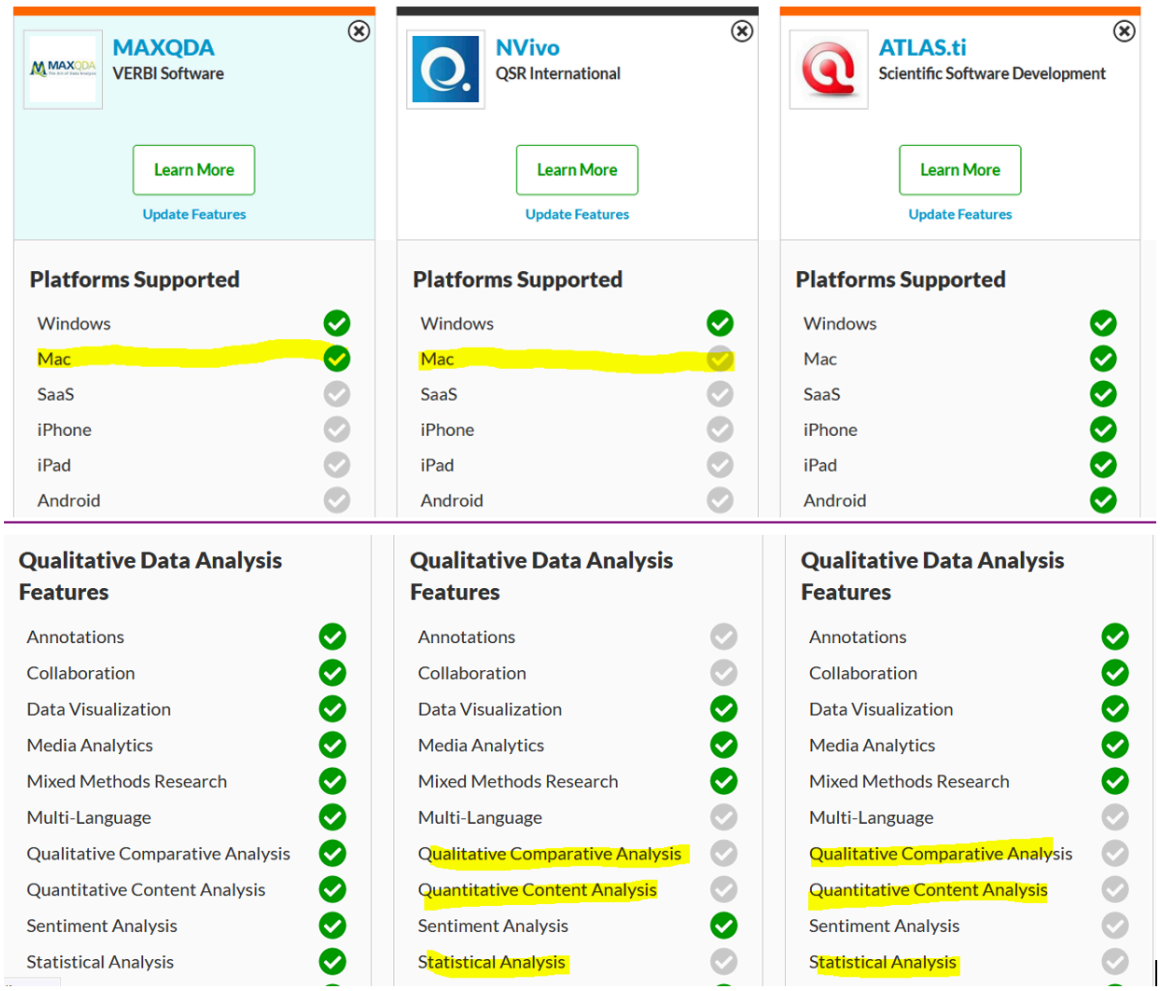


Figure 4.4. MAXQDA vs. Atlas.ti vs NVivo Comparison Chart (SourceForge, 2021)

4.6 Conclusions

The present chapter was dedicated to the definition of the applied research method in terms of design, data collection and procedure, as well as analytical tool selection.

In conclusion, a mixed methods research approach was considered as most appropriate in identifying convergence to and divergence with the theoretical assumptions; it compensates for both qualitative and quantitative research limitations (Kelle, 2008) and allows for in-depth understanding of complex phenomena (Halcomb and Hickman, 2015). Indeed, both Occupational Health and

Safety and Sustainability Oriented Innovation are complex issues due to technological change, economical constraints, social and political pressure, and environmental challenges. As such, current research, as proven in the literature review, has showed its limitations, and mixed methods research is a new avenue for the understanding of the contextualized understanding of the relationship between Occupational Health and Safety and Sustainability-Oriented Innovation.

5 RESEARCH METHODS AND RESULTS

The present chapter is dedicated to the presentation of the research results.

From a structural perspective and as stated in previous chapters due to the adoption of a mixed methods approach, and the inherent diversity of research approaches, each section opens with methodological considerations before results presentation and discussion.

The development of the operational objectives OP2 and OP3 is done as follows:

- Application of the mixed-methods research approach to the data set: processing using the MAXQDA software for both quantitative and qualitative analysis and complementary quantitative analysis undertaken using Excel;
- Theoretical and experimental development of the Mutual Influence Model;
- Identification of similarities and dissimilarities between the theoretical hypothesis and organizational practices and critical discussions of the findings.

5.1 Semantic analysis

Semantic analysis is an interesting starting point for textual data analysis, as it is conducted on the raw data, providing an insight into the data based on the analysis of the frequency of use of the vocabulary employed. Semantic analysis requires a light processing of the results to exclude words such as conjunctions, prepositions, or adverbs (e.g., "a", "the", "here", "there", "near", "always") as well as frequent verbs such as "do", "does", "is", "written" etc.), which are inherent to the construction of the discourse without being relevant to the main themes explored.

The outputs consist of tables of word frequencies and corresponding graphical representations, named word clouds. Word clouds are a common tool (Tessem et al., 2015), more appreciated than tables of frequencies as more evocative for large volumes of raw data and prone to facilitated interpretation. Word clouds attribute font size in relation to frequency in the data, providing an interesting starting point for exploratory analysis.

Word clouds are limited in that attention is drawn to word frequency rather than importance, while also neglecting literary stylistic phenomena such as use of synonyms in the data. Finally, word clouds decontextualize the vocabulary, limiting the in-depth understanding of the vocabulary employed.

5.1.1 Word frequency

The MAXQDA word cloud function was used to extract word frequencies and obtain word cloud visual representations, based on one analysis unit (in this case the sustainability report) or on the data aggregated from all the units of analysis.

Initially the word cloud function was set up to show the most frequent 100 words. This required a processing of the initial list to exclude those words that are not significant to the document scope. In MAXDA, the exclusion process requires the establishing of an exclusion list; the words on the exclusion list are not included in the frequency counts. The establishment of the list was done through an iterative process of going through the word cloud and word frequency list, identifying the words to be added to the exclusion list, adding the words to the exclusion list, refreshing the word cloud. After a few iterations, it appeared that the number of words in the word cloud was too permeable to the inclusion of an array of non-significant words. Therefore, the number of words in the word cloud was limited to 50 words. The exclusion process was particularly lengthy for the first two documents for which the word clouds were generated. As the exclusion list is common to all documents, subsequent documents required much less exclusion of non-significant words. No limitations were imposed with regards to the minimal frequency, as the purpose was to have a comprehensive picture of the vocabulary used for sustainability reporting.

Once this exclusion process was concluded, the "Lemmatize words" function was employed. This function allows a by-passing of declension or case distortion of basic words, by returning the words in their basic forms. For instance, in the Distributie Oltenia sustainability report, the word "customers" was found 61 times and ranked 17, whereas its singular form "customer" was retrieved 41 times and ranked 38. Consequently, both appeared in the word cloud. By using the "Lemmatize words" function, it was possible to regroup these two forms into one occurrence in the word cloud for a total of 102 times.

As a comparison, strictly for the Distributia Oltenia sustainability report, two word-clouds are presented in the Appendix section, one using and one without using the „Lemmatize" function. It is possible to see that the ranking of the words in their basic form increases the ranking of words like „report" through the inclusion of other forms such as "reporting", "reports", "reported" but decreases for words such as „energy" or „gri" (which are less permeable to morphological modification).

Table 5.1. Distributie Oltenia word cloud - Examples of word ranking modification with and without the "Lemmatize words" function

Word	Without lemmatize	With Lemmatize words function
Report	Frequency 89, rank 6	Frequency 150, Rank 3
Energy	Frequency 112, rank 5	Frequency 112, rank 6
Gri	Frequency 119, rank 4	Frequency 119, rank 5
Management	Frequency 143, rank 1	Frequency 143, rank 4
Employees	Frequency 137, rank 2	Employee Frequency 158, rank 1

In its final form, each word cloud is constituted of exactly 50 words, ranked decreasingly according to frequency. If two or more words have the same frequency, they are assigned the same rank, and the rank attribution will jump to the current rank plus the number of words with the same rank. For instance, in the word cloud of Oatly, words like "ingredient" and "start" both have a frequency

of 31 occurrences and were therefore both ranked 47. The following word having a different frequency was "now" (30 occurrences) and was ranked 49.

The analysis of the top 5 most frequent words used highlighted industry-specific words such as "oat" (Oalty), "service" (PWC Hungary) or "research" and "education" (ETH Zurich). This is an expected result as sustainability reports are intimately related to the core activity of each organization. More general terms such as "sustainability" appeared in the top 5 most frequent words for Oatly, Ericsson, ETH Zurich and PWC Hungary, whereas the word "report" appeared in the top 5 list for Distributie Oltenia, Ericsson, ETH and PWC Hungary. It is interesting to note that there is no word that appears in the top 5 most frequent word list of all 5 organizations.

A "data set word cloud" was generated based on the 5 sustainability reports. Unsurprisingly, the 2 most frequent words were "report" and "sustainability". The words "company", "employee" and "energy" completed the top 5 ranks, despite them not belonging to the top 5-word list for Oatly, ETH Zurich or PWC Hungary. Indeed, the word "employee" ranks 27 in the word list for Oatly, 12 on the one of Ericsson, 18 on that of ETH Zurich and 10 on that of PWC Hungary. This result is interesting with regards to the validity of inferences made from cumulative processing of the analysis units as opposed to those made for the individual analysis unit. Indeed, as the data set is made up of sustainability reports reflecting practices within different industrial sectors, a cross-sector analysis only partially fits the results of an organization or industrial sector. As such inferences made on cumulative data are biased, conclusions are decontextualized and therefore impoverished of advances and preoccupations set forward by each analysis unit.

5.1.2 Expression frequency

The word-frequency analysis is limited in that expressions are separated into their individual components, the frequency of which is then determined. Consequently, a complementary vision is necessary, which would encompass expression (i.e., word combinations) frequencies.

An expression list was generated by using the MAXQDA, MAXDictio – Word Combination function. It was set up to find 3-words combinations, by using the previously defined exclusion list and by merging the analysis units into one merged unit. The Lemmatize function was activated to ensure the aggregation of frequencies regardless of any morphological modification within the sentences. Only word combinations used within sentences were considered, which implied that punctuation separating successive words delimitates the creation of expressions. This allows to preserve the relation to the meaning intended by the author and not to bias by hazardous juxtaposition within the text.

The results showed that there is no common 3-words expression across the 5 sustainability reports. The top 3 ranks expressions are given in the Table 5.2. This frequency is a cumulative one across documents. Consequently, if an expression appears frequently in one report, and only a few times in other reports, it can find itself among the top ranks. This limitation is inherent to the merging of the analysis units as in the case of word frequencies and can be exemplified by the expression "greenhouse gas emissions" (2 occurrences in the Ericsson sustainability report, 6 occurrences in the Oatly sustainability report, 12 occurrences in the ETH Zurich sustainability report), while ranking as most frequent 3-words combination in the merged analysis units.

Table 5.2. Top 5 - 3 words combinations

Word combination	Words	Frequency	%	Rank	Documents	Documents %
Greenhouse gas emission	3	20	0.40	1	3	60
Sustainable development goal	3	16	0.32	2	3	60
Report compliance concern	3	15	0.30	3	1	20
Electric utility sector	3	11	0.22	4	1	20
Main risk included	3	11	0.22	4	1	20
Utility sector disclosure	3	11	0.22	4	1	20

Table 5.3. Expression according to co-occurrence in analysis units

Word combination	Words	Frequency	%	Rank	Documents	Documents %
Greenhouse gas emission	3	20	0.40	1	3	60
Sustainable development goal	3	16	0.32	2	3	60
GRI content index	3	10	0.20	7	3	60
Global report initiative	3	3	0.06	48	3	60

5.2 Content Analysis

Content analysis emerged from social sciences and was widely employed in journalism for understanding public opinion, politics or emerging ideas. It is used to make inferences based on data that needs to be understood from a perspective different than that initially intended. With the aid of CAQDAS, the researcher codes the text in view of its analysis.

Content analysis has a wide range of definitions, among which:

- "Any technique for making inferences by systematically and objectively identifying special characteristics of messages" (as mentioned by Holsti, 1968, on Columbia, 2020);
- "An interpretive and naturalistic approach. It is both observational and narrative in nature and relies less on the experimental elements normally associated with scientific research (reliability, validity, and

generalizability)" (as supported by Ethnography, Observational Research, and Narrative Inquiry, 1994-2012, on Columbia, 2020)[6];
- "A research technique for the objective, systematic and quantitative description of the manifest content of communication" (as supported by Berelson, 1952 in Columbia, 2020);
- ''Process of categorizing qualitative textual data into clusters of similar entities, or conceptual categories, to identify consistent patterns and relation- ships between variables or themes'' (SAGE Encyclopedia in Koskela 2014)[7];
- "A systematic and objective quantitative summary of a given text" (Neuendorf (2002), in Koskela, 2014);
- "A research technique for making replicable and valid inferences form text (or other meaningful matter) to the contexts of their use" (Krippendorff, 2018);
- "A research method making replicable and valid inferences from data to their context, with the purpose of providing knowledge, new insights, a representation of facts and a practical guide to action" (Krippendorff 1980);
- "Content analysis has been defined as a systematic, replicable technique for compressing many words of text into fewer content categories based on explicit rules of coding"[8] (Stemler, 2000);
- The goal of content analysis is "to provide knowledge and understanding of the phenomenon under study" (Downe-Wamboldt, 1992, p. 314).

The previous definitions outline the following about content analysis:
- Needs to be replicable, and consequently, can only be applied to data that is of lasting nature (Stemler, 2000);
- Involves a systematic manner of going through large volumes of data (GAO, 1996);
- Allows inferences to be made.

The main advantage of content analysis is that it can be used on large volumes of communication content to highlight patterns or differences (Columbia, 2020) in a condensed yet broad manner (Elo and Kyngäs, 2008) relative to a research context, while going beyond the immediate awareness of the group to which it belongs to (Krippendorff, 1989). Content analysis has suffered from criticism of both qualitative and quantitative researchers (Elo and Kyngäs, 2008). Initially, the debate turned around fitting content analysis in either the family of qualitative or of quantitative methods. This has led to a separation into quantitative and qualitative content analysis (Hsieh and Shannon, 2005), which Krippendorff (2018) questions in considering that the input of content analysis is qualitative data (text, photos, videos etc.) and as such the introduction of quantitative variables derived from the initial data does not justify such a division. In this direction, contemporary schools of thought propose that content analysis be considered as either conceptual or relational (Columbia, 2020), where "conceptual analysis determines the existence and frequency of concepts in a text and

[6] Retrieved from: https://notesmania9.blogspot.com/2019/12/content-anaylsis.html (Access 20-04-2021)

[7] Retrieved from: https://epdf.pub/the-sage-encyclopedia-of-qualitative-research-methods.html (Access 20-04-2021)

[8] Retrieved from: http://novoverse.nuigalway.ie/wp-content/uploads/2017/08/ICIS-Magical-Realism-Camera-Ready.pdf (Access 20-04-2021)

relational analysis develops the conceptual analysis further by examining the relationships among concepts in a text"[9].

In the continuity of the position expressed by Krippendorff (2018), the author defends that a separation of content analysis into qualitative or quantitative is not justified, but rather that content analysis belongs to the larger family of mixed methods approaches. Indeed, content sensitivity (Krippendorff, 1989) and flexibility of the research design (Harwood and Garry, 2003), arise through the combination of both quantitative (frequencies, occurrences…) and qualitative methods (mapping, pattern identification, idea descriptions…) (Griffiths, 2016). One of the characteristics of content analysis, is the inclusion of context in the research approach, which would not be possible to establish with an approach based only on frequencies. Moreover, according to Columbia university (Columbia, 2020), content analysis is a mixed methods approach "used to determine the presence of certain words, themes, or concepts within some given qualitative data (i.e., text)" and allows for both quantification in terms of presence or meaning, but also a qualitative interpretation of relationships among themes or concepts, inferences regarding practices, habits, messages, culture etc. The inclusion of content analysis in the mixed methods category is also justified by the issues emerging from the historical "quantitative" or "qualitative" approaches that were highlighted by Stemler (2020). Indeed, historically content analysis was seen as quantitative because it was based on statistical treatments such as frequency and occurrence results; this induced a correlation between frequency and concern or importance. Yet, the use of textual data, involves also stylistic considerations, which pertain to the field of qualitative methods. Can be quoted the use of synonyms for purely stylistic reasons (to avoid repetition), which negatively impacts frequency and occurrence measurements. Also, the multiple meanings of one word, also induce a limitation in the correctness of occurrence or frequency measurements.

Finally, context is an important part of content analysis as it is of communication. Indeed, in relation to social and political contexts, communications may be limited or more numerous, thus biasing the considered population. The above considerations regarding the qualitative aspects influencing the quantitative ones of content analysis also reinforce the conclusion that instead of dividing content analysis into qualitative or quantitative, it is more appropriate to view it as a mixed method. As simply put by Gheyle and Jacobs (2017), content analysis is a "continuum of qualitative and quantitative approaches". In this regard, the author departs form the position of Elo and Kyngäs (2008) regarding the validity of content analysis through the prism of qualitative research design and will adhere to the principle of legitimation as discussed in the case of mixed methods.

In conclusion of the above, the author's position is that content analysis is a technique belonging to the family of mixed research methods. As highlighted in previous paragraphs, content analysis is characterized by the absence of systematic rules for the analysis process. Consequently, specific attention must be given to the description "in sufficient detail so that readers have a clear

[9] As supported also by the approach of Content Analysis described at: https://www.publichealth.columbia.edu/research/population-health-methods/content-analysis#:~:text=Content%20analysis%20is%20a%20research,words,%20themes,%20or%20concepts (Access 20-05-2021)

understanding of how the analysis was carried out and its strengths and limitations"[10] (GAO 1996).

In the case of the present research, the objective is to compare a theoretical hypothesis and current organizational practices. Thus, the objective is to analyse the content of sustainability reports, to understand the connections and usages that organizations have with regards to Occupational Health and Safety and Sustainability-Oriented Innovation. The declared purpose of sustainability reports is not related to that of the author in the present research. The research objective is to unearth relationships that are not readily observable in the given textual data regarding the mediating role played by preidentified factors in relationship to OHS and SOI. As such, based on the works of Krippendorff (2018) content analysis seems an appropriate research technique; indeed, the research aims at unearthing relations that are not readily discussed within the data set and for which there is no direct source of data. Consequently, the questions asked are those of the researcher and not those of the authors of the data set while the answers will emerge from legitimate inferences based on the data set.

Content analysis has been long considered as a flexible method, in that there is no one correct way to implement it. According to Weber (1990), each researcher must consider the research question and adapt the content analysis to best answer the research question.

Krippendorff (1989) set six steps for content analysis: design, unitizing, sampling, coding, drawing inferences and validation. One of the characteristics that is highlighted in this procedure is the equal treatment of all units of analysis, regardless of the entry time in the analysis process.

The design phase is concerned with constructing the framework for analysis: context definition, knowledge aim, identification of data sources, and providing the necessary justifications for drawing inferences regarding the research question.

The unitizing phase involves defining and identifying the units of analysis, i.e., what will be included in the analysis, which are independent and on which variables are measured.

The sampling phase involves drawing a representative selection of units (for instance a selection of newspaper articles), a subset of units from the population chosen based on a random or non-random selection process.

Coding is the phase through which units that are independent are described or categorized. This can be achieved by the attribution of one or several codes or categories by human or machine coding. The distinction between the nature of the coder induces rather different results in terms of semantic interpretation (high for human coder, low for machine coder) and inter-coder reliability or speed (low for human coder, high for machine coder).

The following and most important phase consist in Drawing inferences, i.e., establishing the connections between the coded data, the context and the current state of the knowledge and their not-obvious relation to the research question.

The sixth phase is Validation. This step is a very difficult one as it deals with validating indirect conclusions from indirect evidence.

Building on this, later research has proposed other models, with specific focus on a given phase of the content analysis research process or by regrouping certain phases of the research process. For instance, Elo and Kyngäs (2008) propose three main phases preparation (decision regarding what to analyse,

[10] Retrieved from: https://dohwan.tistory.com/category/Articles%20%28Etc%29 (Access 18-04-2021)

sampling, selection of the unit of analysis, immersion in the data), organizing (coding) and reporting (rendering account of inferences and findings).

Special attention has been given to the coding process, which is a milestone of content analysis. Coding is the division of data into smaller categories than can be analysed (Columbia, 2020); categories are themes that are directly or indirectly expressed in the data (Hsieh and Shannon, 2005). Krippendorff (1989) limits coding distinction to the nature of the coder. Other methods of distinction among coding approaches can be found in later literature, such as deductive or inductive categorization (Gheyle and Jacobs, 2017; Elo and Kyngäs, 2008). The inductive approach is adopted in the absence of a pre-existing theoretical framework and categories/codes derive from the data itself. The existence of a theoretical framework or the desire to test a theoretical framework will justify the use of a deductive approach, which uses predetermined categories or codes. Deductive content analysis is particularly useful to test existing data in a new context (Elo and Kyngäs, 2008).

Finally, it must be underlined that the selection of the unit of analysis is a delicate process as regards physical delimitation (word, sentence, page, etc.) or meaning (Neundorf, 2002; Elo and Kyngäs, 2008). Stemler (2020) identified four possibilities: physical delimitation (the analysis unit – newspaper article, book, picture), syntactical delimitation (word, phrase, paragraph), referential delimitation (the way in which the author represents the same notion) or propositional delimitations (underlying assumptions). Once again, each question raised has supporters and detractors, with no "one good way", but rather more complex ways.

5.2.1 Coding process

The purpose of the present research is to determine similarities and dissimilarities between the organizational practices and the theoretical hypothesis.

As pointed out by the semantic analysis, an in-depth understanding of organizational practices is also necessary. Indeed, although sustainability reports list innovative approaches through which organizations contribute to sustainability, the lexical field of innovation is not frequently used. To the same extent, the lexical fields relative to health and safety are parsimoniously used although organizations strongly focus on workplace improvement, work benefits, work-life balance, accident reduction etc.

Given these lexical limitations, neither of the coding approaches proposed by Koskela (2014) for content analysis seem pertinent. Indeed, word-level coding, as highlighted by the semantic analysis is inadequate due to the poor frequency of the lexical fields of innovation or health and safety. Moreover, word-level coding leads to isolation form contextual meaning, which is at odds with the in-depth approach recommended previously. Sentence level coding can be interesting as it allows for a coherent approach, with little loss of meaning. Nonetheless, coding at the level of the sentence induces a bias where a certain theme is developed throughout several paragraphs or even chapters. Paragraph-level coding can be considered for specific research subjects as it proposes a balanced amount of detail independent of editorial considerations. Finally, page-level analysis is relatively easy to implement especially where the analysis unit is made up of an entire document but is not coherent on account of editorial considerations (font size, graphical vs textual explanations). Indeed, some reports propose extensive graphical representations, which are more condensed, yet sometimes richer in

meaning, other propose purely textual approaches, leading to extensive code segments relative to one subject; finally, mixed text and graphical approaches can also appear. Consequently, the same bias as in sentence-level coding is induced, where the number of coded segments is biased by the method of expression.

Based on the above and in coherence with the proposal of Stemler (2020) propositional delimitations (underlying assumptions) will be applied throughout the coding process. In the case of propositional delimitations, the coding granularity is determined by the subject discussed, regardless of extensiveness of development within the analysis unit. Indeed, a chapter may discuss stakeholder interactions, in which case at page-level, the topic discussed is "Stakeholder Management", yet within the page, multiple paragraphs develop on the implementation of a management method or its results, whereas only one or two sentences discuss the flowing from an organizational goal, which can be categorized under organizational culture. The coding unit is consequently the topic, or the subject discussed. Firstly, a code unit based on the text itself would not be suited as the same paragraph can deal with several mediating factors, whereas several sentences can deal with one mediating factor.

This approach is supported by the conclusions of the semantic analysis, but also with regards to the theoretical model, presupposing the existence of mediating relations which are not immediately visible. Moreover, the proposed theoretical model does not hypothesise a hierarchy of the mediating factors. Consequently, subject coding also counterbalances one of the major drawbacks of both sentence and paragraph level coding, which is the introduction of a bias relative to textual development.

In conclusion, the chosen coding unit is the subject-matter. The codes that can be attributed to each coding unit derive from the list of mediating factors of the theoretical model: Knowledge Management, Stakeholder Management, Technology, External factors, Organizational culture, Education, Responsibility, Management systems, Leadership, Contextualization, Health and safety and Innovation. Each mediating factor is then converted into a code, as are the 2 researched phenomena; for the code description we will refer to section 3.

Table 5.4. Code system – total code units over the data set sorted by descending frequency

Code System	Frequency
management systems	764
organizational culture	369
SM	287
education	266
external factors	237
contextualization	227
responsibility	217
health safety	201
KM	123
technology	110
leadership	84
innovation	110
Total Coded segments	2995

Based on the above, the coding process was executed as follows: firstly, the author read each report, and determined the code unit based on the subject matter only for codes "knowledge management" and "stakeholder management", "occupational health and safety" and "innovation". A second rereading of each report was done to determine coding units and attribute remaining codes: "technology", "external factors", "organizational culture", "education", "responsibility", "management systems", "leadership", "contextualization". As the coding process advanced, the author went back and forth through the analysis units to ensure coding consistency throughout the diversity of organizational practices and the multitude of reporting frameworks, the variety of business models and geographical contexts requires a flexibility of the analysis. The coding process led to a total of 2995 coded units. The detail of code frequencies within the code system is given in Table 5.4.

5.2.2 Document portrait

The document portrait is a visual representation of the coded and uncoded content in each analysis unit. Mathematically, the document portrait is a matrix composed of squares, the number of which is customizable. For the present research, the format is a 1200 squares matrix (30 rows of 40 squares) in which all the coded areas are grouped together according to the attributed code and scaled to a uniformed size; followingly they are distributed proportionally to their relative use in the coded document. Moreover, if each code in the code system was previously assigned a colour, this can be used in the visual representation of each document. The document portrait can be achieved through the MAXQDA Document Portrait function.

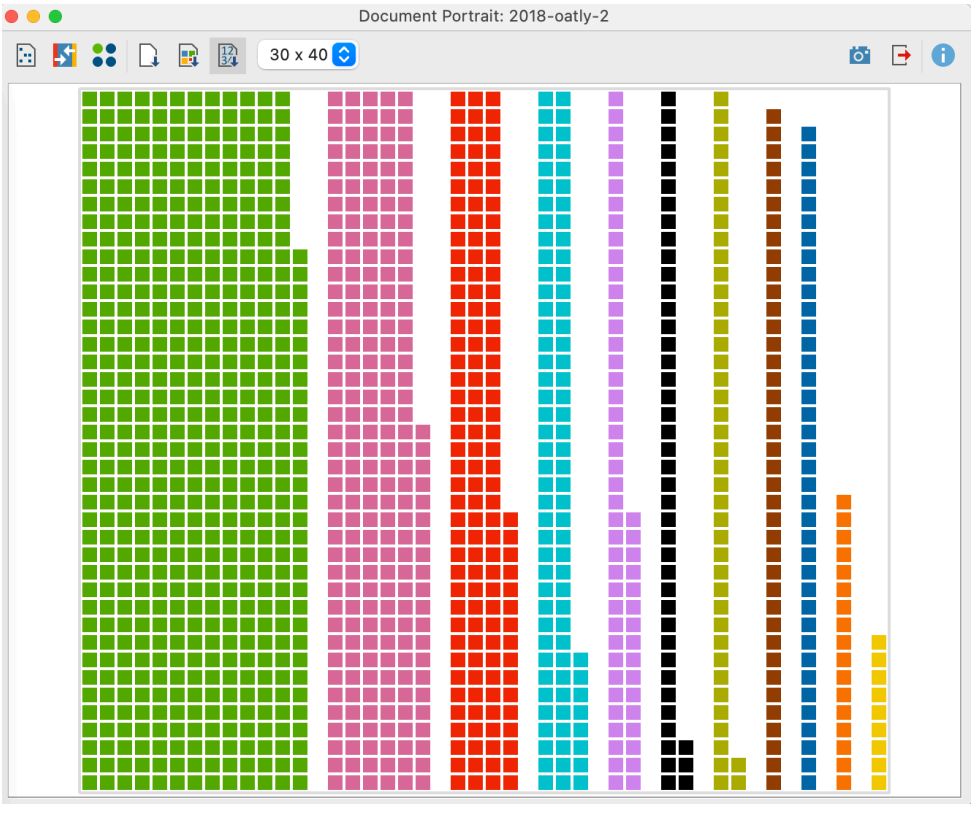


Figure 5.1. Document Portrait – Oatly

The document portrait is a facilitated insight into the order, breadth, or length of each coded section. Several displays are available: by code order or by code frequency. For the present research two document portraits were generated for each analysis unit:

1. Document portrait derived from a 30-row by 40-square matrix, with a display by code frequency, as this allows for a straightforward understanding and display, and facilitates document comparison (Figure 5.1).
2. Document portrait based on a - 30 rows by 40 squares matrix, displaying coded and uncoded segments in order of occurrence. This representation allows for a more in-depth visualization than the code cloud, as it allows to situate more easily codes relative to one another and also to view the proportion of coded segments relative to uncoded segments. This representation allows for a visualization of the structure of each unit of analysis (Figure 5.2).

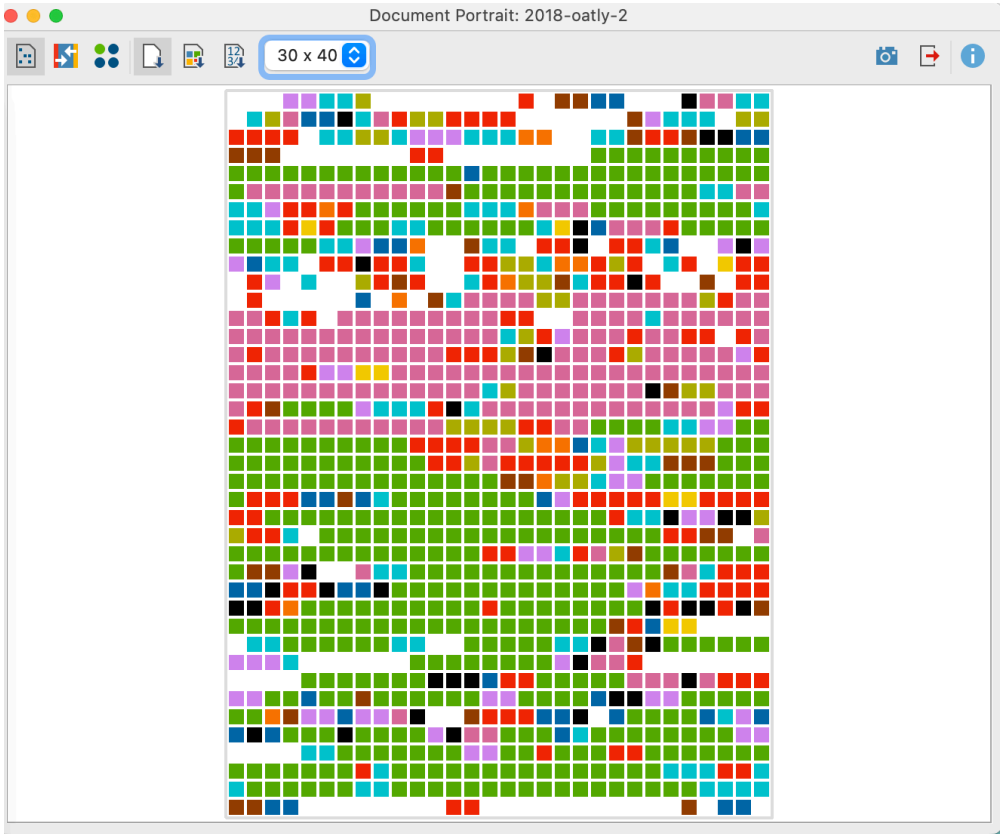


Figure 5.2. Document Portrait – Oatly

The limitation of the document portrait in the present case is that it does not render account of simultaneous coding. Indeed, as the coding was done according to the developed idea, some segments were attributed several codes. It can be observed that, inherent to the structure of the sustainability reports, most uncoded parts are at the beginning and at the end of each analysis unit. Indeed, the introductory parts comprising table of contents or introductory lines, as final parts such as glossaries or appendix were not coded unless specific textual development. For instance, the ETH Zurich sustainability report, discusses specific actions implemented in the university in relation to external factors. This action is mentioned in the text but with an envoy to the Appendix for further development.

The document portraits for the remaining four documents are given in the Appendix section, chapter 8.2.3.

5.2.3 Codeline

As already discussed, due to the coding process, coded segments can be simultaneously attributed several codes. The document portrait is a representation fitting to see the proportion and spread of codes throughout the analysis unit but is unfit for simultaneous occurrence of several codes.

The MAXQDA Codeline function was used to this end. Its output is a table, for which the column headers are the page numbers of the selected document (non-configurable parameter of MAXQDA), while the codes in the code system are listed in the leftmost column. The presence of each code within a page is represented through a horizontal stripe coloured with the same colour as the codes. The length of the stripe is determined according to the number of characters coded.

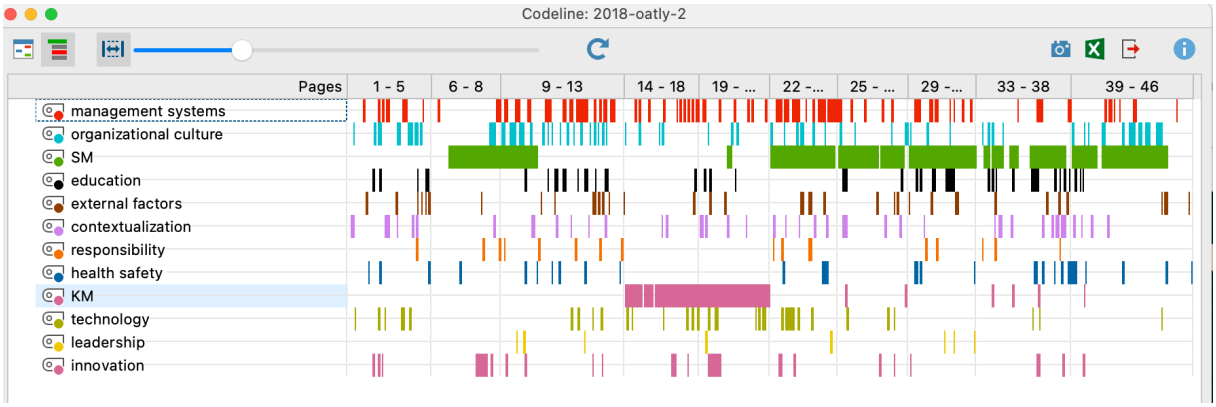


Figure 5.3. Codeline - Oatly

As all reports include paragraphs relative to all topics, the Codeline representation is interesting to get an overview of the contributions of each organization to each mediating factor or studied phenomena.

As the data within each analysis unit is freely structured by its author, a representation of simultaneous coding across multiple documents was not considered appropriate. Firstly, this poses a structural issue as the sustainability reports do not present the same number of pages. Secondly, subjects are approached in different orders within each analysis unit and their spread across the documents is not only dependent of the formatting options (font size or visual displays) but are also tributary to more or less extensive development regarding historical background (new, continuing or envisioned initiative) or industrial sector.

The Codeline representations for the remaining 4 documents are given in the Appendix section, chapter 5.3.1.

5.3 Descriptive statistics

5.3.1 Code matrix browser

The analysis of the occurrence of codes within multiple analysis units was done with the help of the MAXQDA Document Matrix browser function. This function can be used for individual documents or across a set of documents.

Documents are listed in columns while codes are listed in rows: the coded segments are clustered and the symbols at the conjunction points represent the size of the cluster, i.e., the number of coded segments in each analysis unit that are coded with a particular code. The larger the symbol, the more coded segments are assigned to the code, i.e., the larger the cluster of the code. Consequently, the smallest number is given by the smallest square and the largest number by the largest square. The symbols are standardized squares, in corresponding sizes.

It is possible to analyse the occurrence relative to an individual column, i.e., the coded segments within an analysis unit or relative to all coded segments.

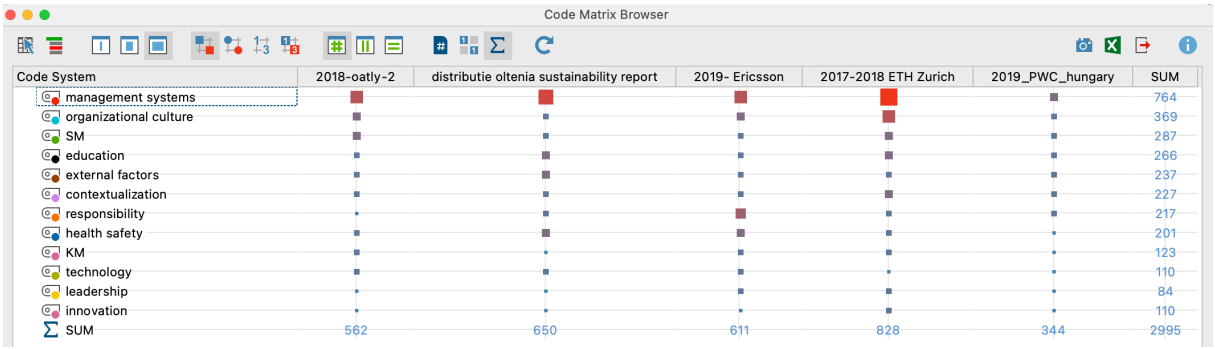


Figure 5.4. Calculation of symbol size refers to all coded segments – qualitative representation

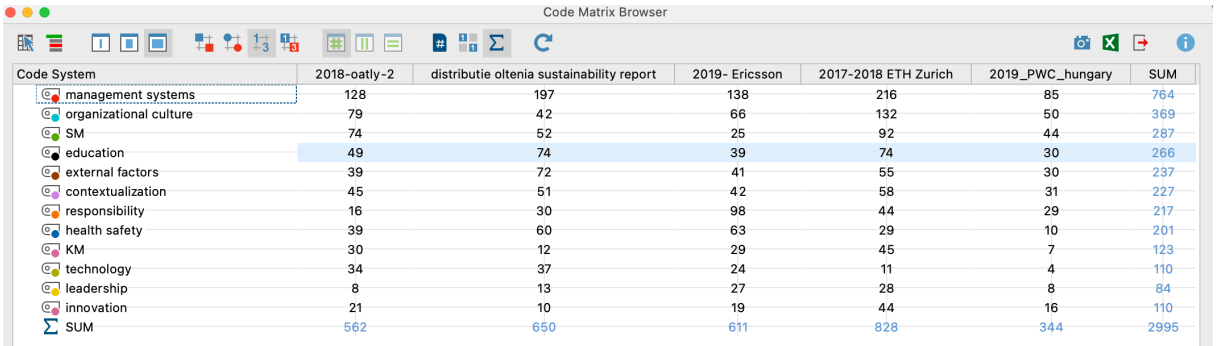


Figure 5.5. Calculation of symbol size refers to all coded segments – quantitative representation

The graphical representation with standardized squares allows a visual representation of code frequencies with respect to different contents, thus allowing increased clarity.

The clustering about the analysis unit, is pertinent to display codes having the highest frequency within a document. It is a complementary view to those in the previous analysis, with the advantage that besides the qualitative representation, it is possible to have the quantitative one.

Finally, it is also possible to analyse occurrence relative to the code. This allows a simple and evocative display of the usage of each code across the documents. Contrary to the Document Portrait, the clustering is done based on the number of coded segments, without introducing any resizing of the analysis unit. Consequently, the comparison is biased by the length and the formatting of each analysis unit. Longer documents can induce more coded segments; the use of tables and figures rather than text can reduce the number of coded segments.

Consequently, the two analyses must be seen as complementary to one another. Quantitative and qualitative code matrix browsers in reference to column or row are given in the Appendix section, chapter 8.2.5.

5.3.2 Code relations browser

The next step of the analysis is to research the existence of relations between the codes themselves with the help of the MAXQDA Code relations browser function. The output of this function is a table of code co-occurrence, showing the number of coded segments with any two codes attached to each segment.

The function was set up to include all codes, and to analyse code intersection within coded segments. This allows to have a complementary representation of code occurrence to that obtained with the Codeline function, in that it does not consider spread over the document pages, but only existence. A quantitative representation is also possible.

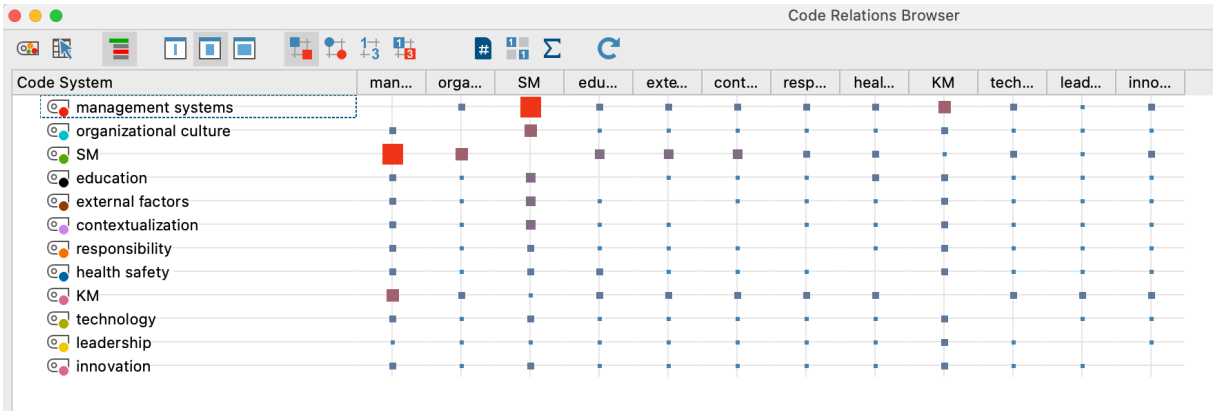
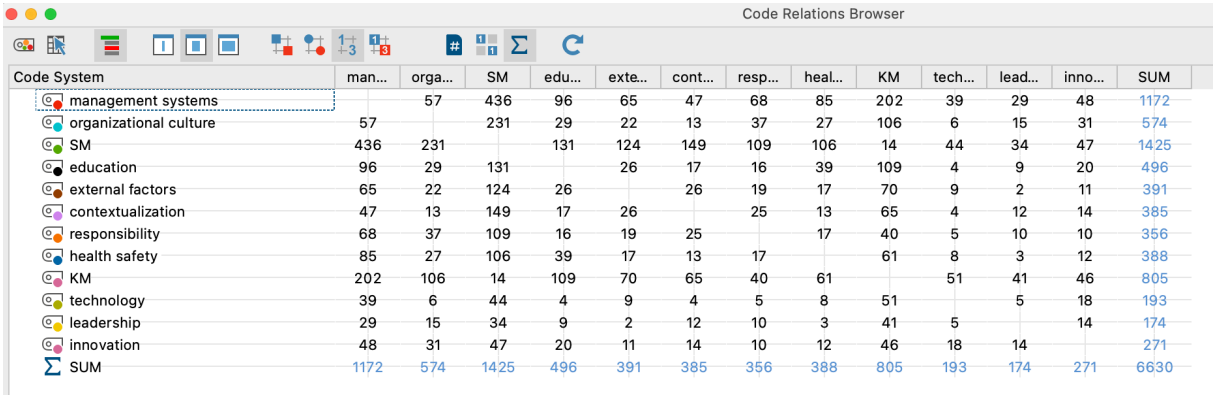


Figure 5.6. Code relations over the 5 units of analysis– co-occurrence over coded segment – qualitative representation

As all codes were used across all analysis units, the co-occurrence over the document does not bring any further information to the research. Code co-occurrence can also be analysed based on proximity in the analysis unit, i.e., how often two codes are present at a defined distance from one another, the distance being configurable in number of paragraphs for textual documents or rows for tables. Nonetheless, due to the unstructured baseline of the analysis units and to the difference in length for each analysis unit, this set up was considered as inducing to much bias due to the inherent structure of each analysis unit.

Consequently, co-occurrence over a coded segment was investigated.



Code System	man...	orga...	SM	edu...	exte...	cont...	resp...	heal...	KM	tech...	lead...	inno...	SUM
management systems		57	436	96	65	47	68	85	202	39	29	48	1172
organizational culture	57		231	29	22	13	37	27	106	6	15	31	574
SM	436	231		131	124	149	109	106	14	44	34	47	1425
education	96	29	131		26	17	16	39	109	4	9	20	496
external factors	65	22	124	26		26	19	17	70	9	2	11	391
contextualization	47	13	149	17	26		25	13	65	4	12	14	385
responsibility	68	37	109	16	19	25		17	40	5	10	10	356
health safety	85	27	106	39	17	13	17		61	8	3	12	388
KM	202	106	14	109	70	65	40	61		51	41	46	805
technology	39	6	44	4	9	4	5	8	51		5	18	193
leadership	29	15	34	9	2	12	10	3	41	5		14	174
innovation	48	31	47	20	11	14	10	12	46	18	14		271
SUM	1172	574	1425	496	391	385	356	388	805	193	174	271	6630

Figure 5.7. Code relations over the 5 units of analysis – co-occurrence over coded segment – quantitative representation

Figure 5.7 points out that the highest co-occurrence appears for code "Stakeholder management" (1425 co-occurrences), followed by codes "management systems" (1172 co-occurrences) and "knowledge management" (805 co-occurrences). These results are rather intuitive, in considering that sustainability reports are communication tools oriented at internal and external parties (stakeholders) and therefore are often oriented to respond to stakeholder claims (questions, interests, concerns etc.). Similarly, the way in which organization's internal structure, functioning and response to internal or external claims are reflected in the management system that is built within the organization. Finally, given the importance of knowledge within the organization and its inclusion in the organizational competitive advantage, the high co-occurrence of "knowledge management" reflects increasing interest in preserving and enhancing organizational knowledge beyond the core knowledge, but in all aspects of the organizations.

5.3.3 Code Map: position codes according to similarity

The MAXQDA Code Map function proposes a visual representation according to code similarity, in terms of overlapping within the data. It is constructed by representing codes as circles, placed at a distance of similarity from other codes. The circles can vary in size according to the number of assignments. It is also possible to display connecting lines to represent which codes co-occur. As with the circles, the thickness of the line can be a displayed as a measure of co-occurrence between two codes.

The Code Map can be generated with all or part of the code system. The measure of similarity is done either as the intersection of codes in a coded segment or as proximity of codes in each analysis unit (measured in numbers of paragraphs or rows) or occurrence in the same document. The intersection of codes is defined by the mutual assignment of codes to a segment, but without them necessarily fully overlapping. Proximity of codes in the same document is obtained by counting the number of attributions of 2 codes at a given distance. As in previous analysis, code proximity within the document was not considered as a relevant analysis level. The co-occurrence of codes was therefore considered as the level of analysis.

The Code Map is obtained by placing codes closely to one another according to similarity. If 2 or more codes co-occur very frequently, they can be aggregated to the same spot on the code map.

The positioning of the codes on the map is done through multidimensional scaling. Multidimensional scaling is a method of representation of relationships or patterns in data based on measures of similarity or dissimilarity between objects. As pointed out by Kruskal and Wish (1978) multidimensional scaling can be used to uncover individual viewpoints on specific issues. The numerical data obtained in the Code relations browser function is used as input. The Code relations browser function is a symmetric matrix which shows the relationships between the codes as represented by the number of co-occurrences of any two codes. This matrix is converted into a distance matrix as follows: for each code, the sum of co-occurrences is computed, and the maximum value is defined as the maximum similarity; followingly the maximum similarity is subtracted from the similarity of any two codes, i.e., from all co-occurrence values in the initial matrix. Consequently, the distance between two codes ranges from 0 (two codes only come about together) to maximum (equivalent to codes never occurring together).

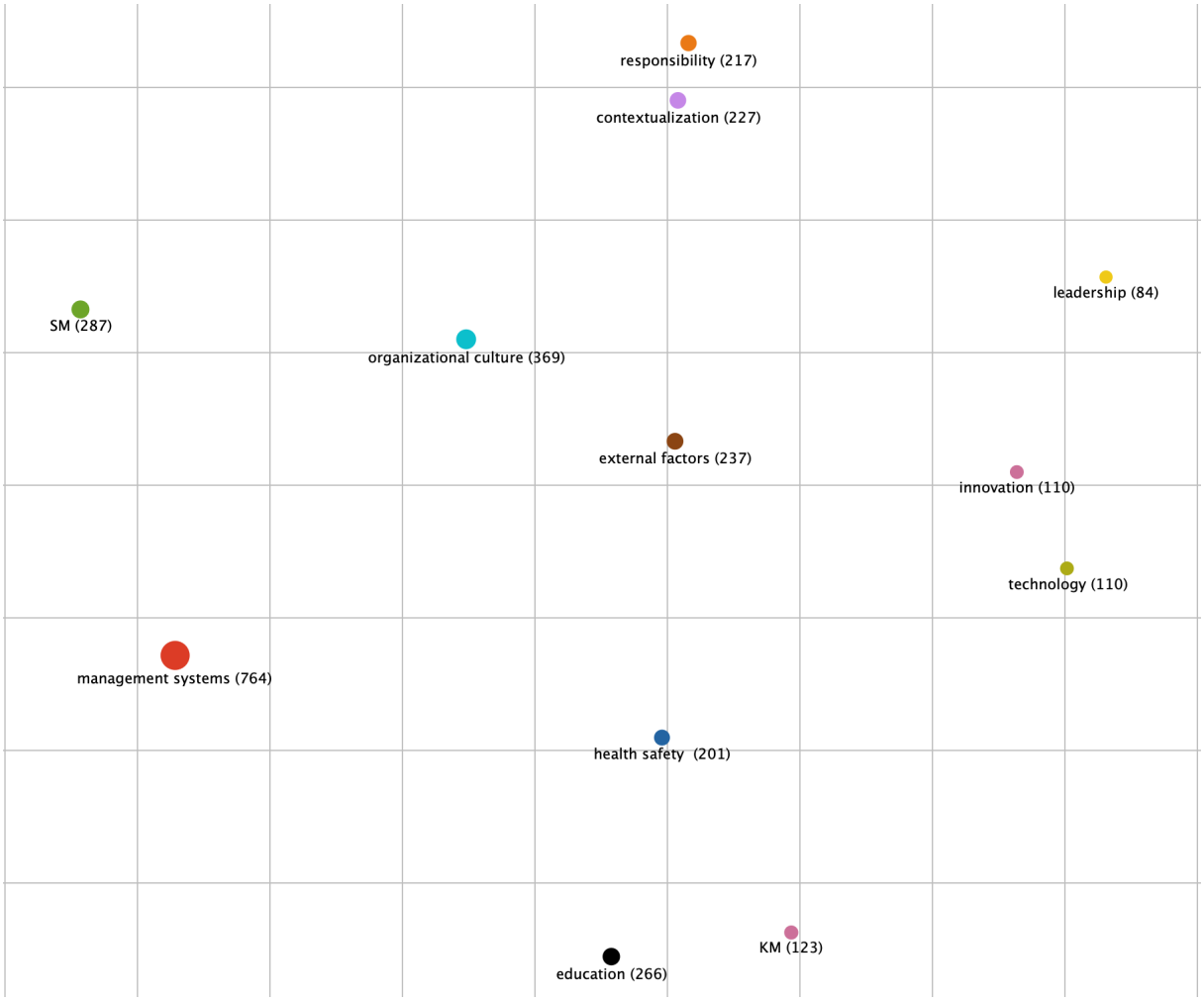


Figure 5.8. Code map for the 5 units of analysis - similarity between codes based on co-occurrence of code in a segment

The Code map is a 2-dimension representation of all the codes, and therefore when interpreting the code map, the visual representation may represent a stronger closeness than that given by the distance matrix. The Code map in

Figure 5.8 highlights the similarity of codes "responsibility" and "contextualization" as well as codes "innovation" and "technology".

The similarity between codes "responsibility" and "contextualization" represents an interesting finding. The literature review concluded that empirical research shows confusion relative to responsibility as perceived through the prism of the management system, of the legislative understanding, of the maturity of the managerial strata; organizational practices seem to comfort this finding point out to a discourse proximity between responsibility and context.

Code maps per document, with and without code relation representation are given in the Appendix section, chapter 8.2.7.

5.3.4 Similarity analysis for documents

The MAXQDA Similarity analysis for Documents function, establishes document similarity/dissimilarity in terms of code frequencies.

For the present research, several analyses were done to establish document distance based on code frequency as positioned through a distance matrix. The distance matrix was computed based on squared Euclidean distances. Consequently, each document is represented as a vector in multidimensional space, and the distance between two documents is calculated as the sum of squared differences of each vector's coordinates. This calculation method allows a better inclusion and representation of higher deviations.

The output of the analysis is a distance matrix, in which selected documents are listed in both rows and columns. The values in the distance matrix range from 0, i.e., no similarity between the two documents to 1, i.e., the two documents are identical. In the MAXQDA representation, similarity is also represented by the colouring of the distances in shades of green, the darker the shade, the more similar the documents.

The first analysis conveyed the similarity of the documents in terms or codes "health safety" and "innovation".

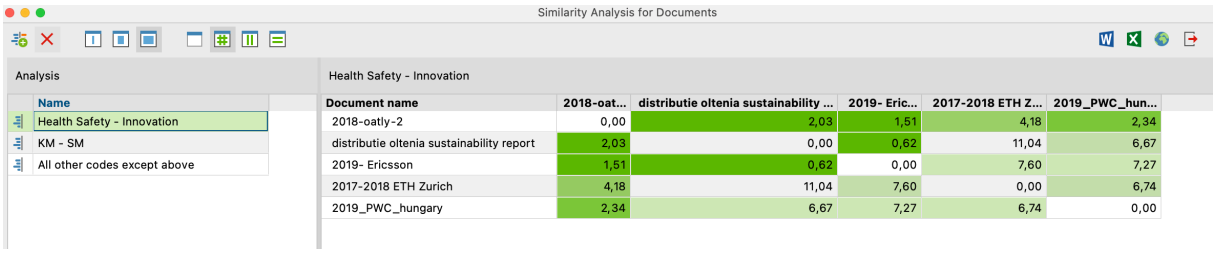


Figure 5.9. Document similarity according to codes "health safety" and "innovation"

The second analysis conveyed the similarity of the documents in terms or codes "KM" and "SM".

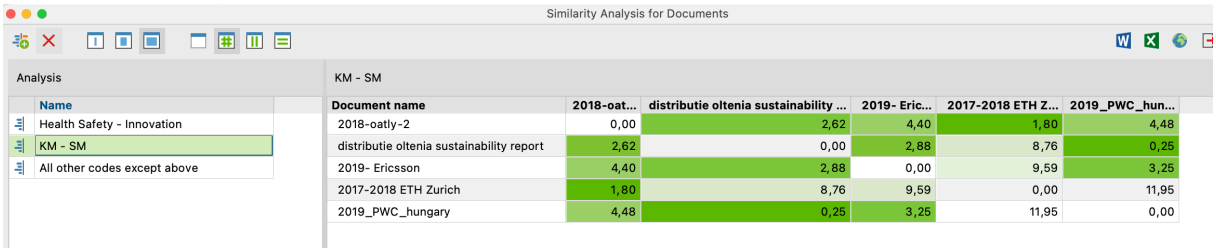
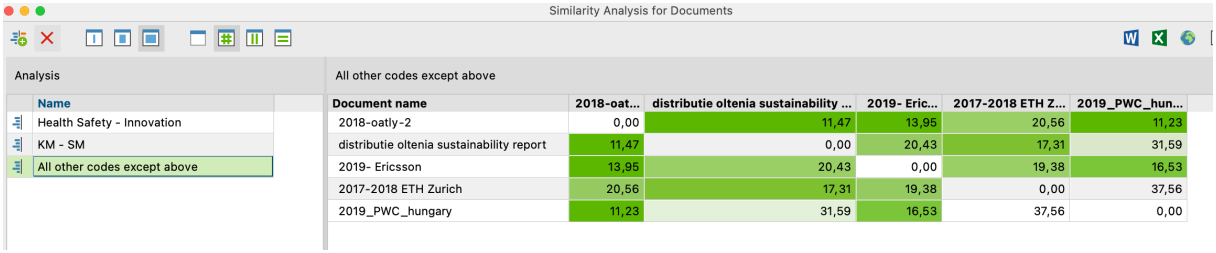


Figure 5.10. Document similarity according to codes "KM" and "SM"

The third analysis conveyed the similarity of the documents in terms of all other codes.



Document name	2018-oat...	distributie oltenia sustainability ...	2019- Eric...	2017-2018 ETH Z...	2019_PWC_hun...
2018-oatly-2	0,00	11,47	13,95	20,56	11,23
distributie oltenia sustainability report	11,47	0,00	20,43	17,31	31,59
2019- Ericsson	13,95	20,43	0,00	19,38	16,53
2017-2018 ETH Zurich	20,56	17,31	19,38	0,00	37,56
2019_PWC_hungary	11,23	31,59	16,53	37,56	0,00

Figure 5.11. Document similarity according to codes "Management Systems", "Organizational culture", "Education", "External Factors", "Contextualization", "Responsibility", "Technology" and "Leadership"

Based on the similarity of the documents, the MAXQDA Document Map function allows the visual representation of the analysis units according to similarity.

As all codes were assigned to all documents, the document map, as previous analysis was done according to code frequency. On the document map, the more similar two documents are in terms of code frequency, the closer they are drawn to each other; the more dissimilar they are, the further away they are placed. Similarity of documents is visually represented by attributing the same colour to the documents.

A difference in terms of frequencies is determined by the inequality of occurrence of a given code in two documents.

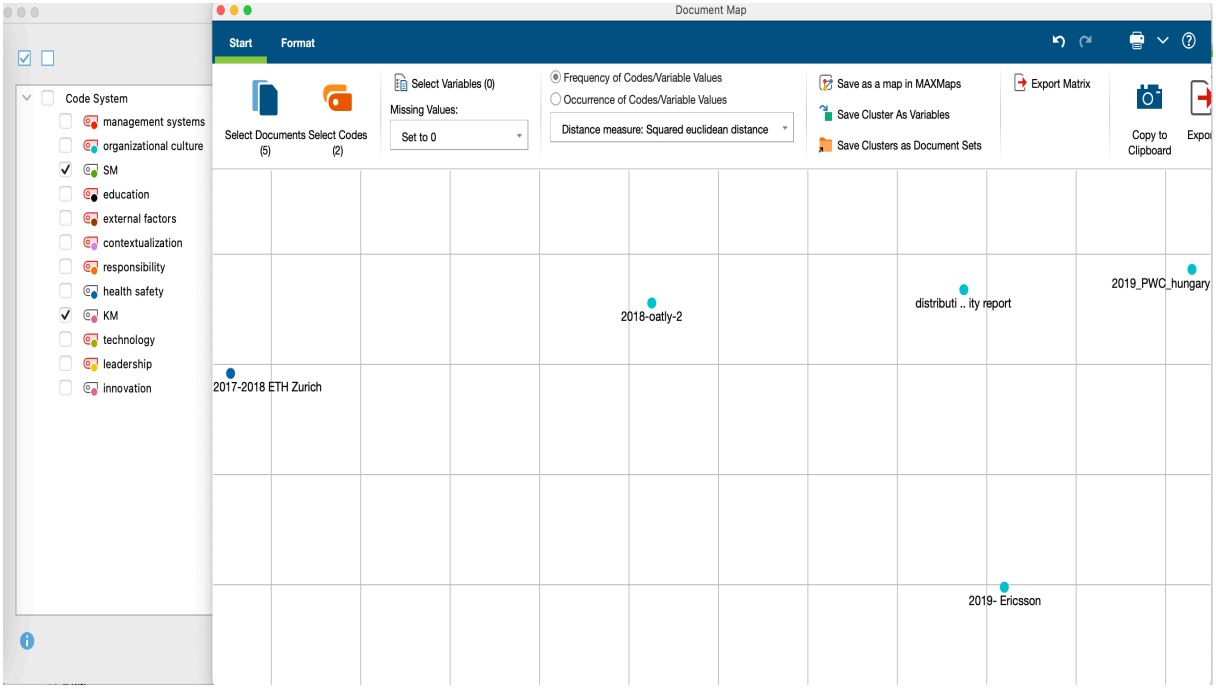


Figure 5.12. Document Map according to codes "KM" and "SM"

Using the same parameters as for the document similarity, documents were mapped according to three configurations, as shown in Figure 5.12, Figure 5.13 and Figure 5.14.

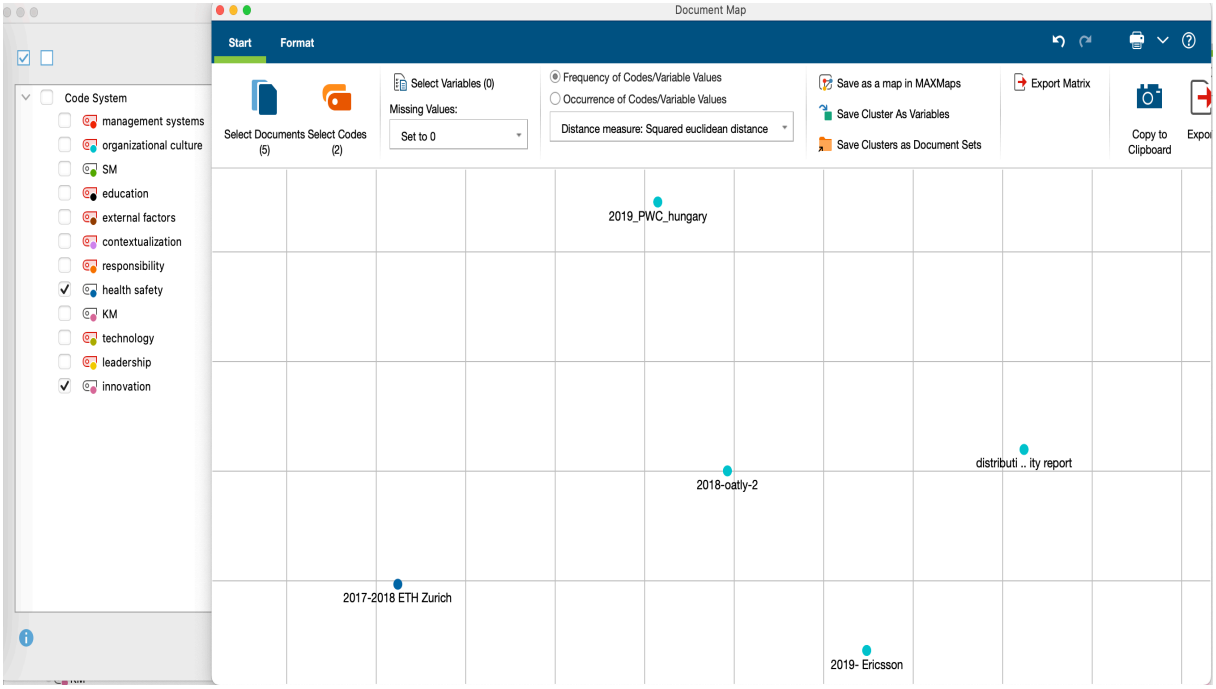


Figure 5.13. Document Map according to codes "Health Safety" and "Innovation"

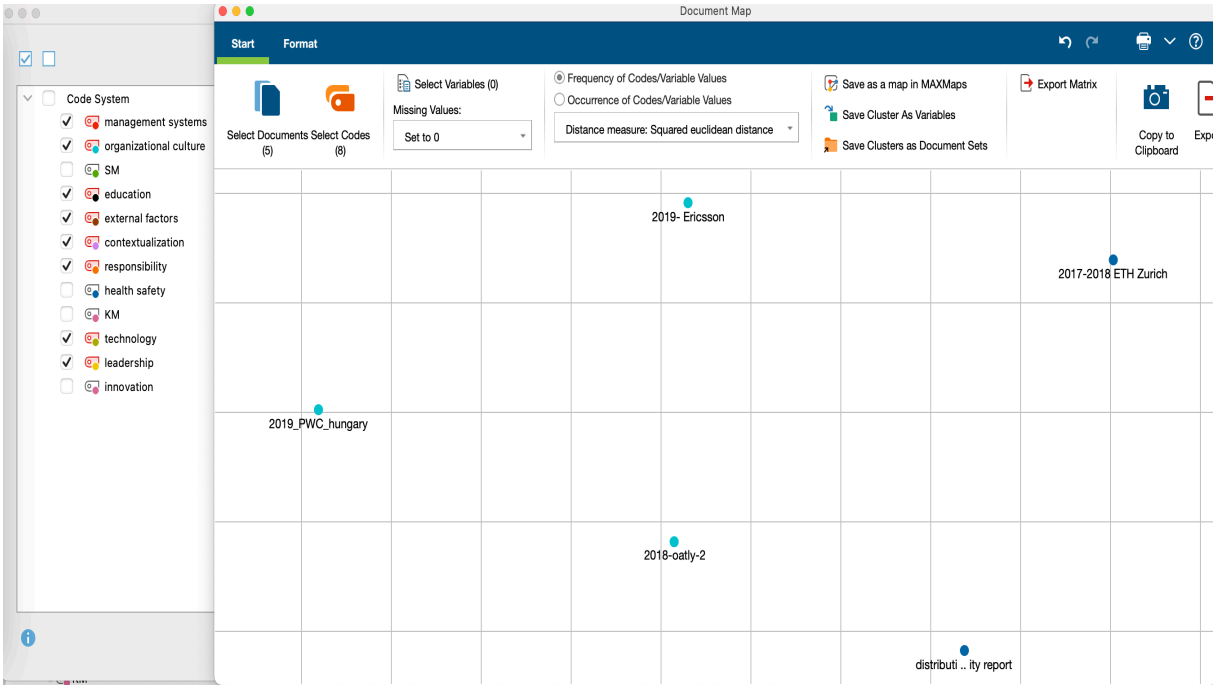


Figure 5.14. Document Map according to codes "Management Systems", "Organizational culture", "Education", "External Factors", "Contextualization", "Responsibility", "Technology" and "Leadership"

5.4 Inferential statistics

Previous chapters of the PhD. Thesis consist in the description of the data set; the following chapters are dedicated to testing hypothesis.

The first step is identifying the most appropriate statistical analysis to be undertaken based on code-variables obtained by converting codes and associated frequencies in each unit of analysis into variables. Variables are numerical and the dependence or independence is to be established.

The purpose of a statistical test is to assess the compatibility between a dataset and a model which is constructed from a synthesis of assumptions named the "null hypotheses" - H0. This "null hypothesis" most often reflects the absence of a relationship or of a difference (Wasserstein and Lazar, 2016). This hypothesis is then tested and can be rejected as false or accepted as true. Unfortunately, the results of any statistical analysis are not 100% proof; there is always a risk associated to the analysis. Two types of risk can be identified:

1. The first-degree risk characterizes through a probability named α the possibility to reject H0 as false, while it is true;
2. The second-degree risk characterizes through a probability named β the possibility to accept H0 as true, while it is false.

As these probabilities are never null, a reasonable threshold is established that characterizes the probability to reject H0 as false, while it is true. This probability is named the observed significance level for the test hypotheses – *P*. In recent years and given the importance that has been given to the *P value* in relation to the study of important data set, voices have risen to inform of the misinterpretations and misuse of the *P value* (Wasserstein and Lazar, 2016; Nahm, 2017).

The P-value only shows the probability of accepting the 'null hypothesis' and does not render conclusion about the veracity of the H1 hypotheses (Gilles et al., 2008; Nahm, 2017).

It is often postulated that a value of $p<0.05$ implies that the statistical test is significant and that, considering a reasonable risk to be mistaken, H0 can be rejected as being false, while H1 can be accepted (Gilles et al., 2008). Wasserstein and Lazar (2016) refer to the American Statistical Association and remind that that the P-value is "a statement about the data in relation to a specified hypothetical explanation" (Wasserstein and Lazar, 2016, p.131).

5.4.1 Cronbach's alpha

Cronbach's alpha is an objective, statistical measure for reliability, i.e. the ability to measure repeatedly the same result, modulated by errors arising only from measurement errors (Cortina, 1993; Tavakol and Dennick, 2011). Cronbach's alpha was developed in 1951 to measure the internal consistency of a test or scale, for which variance is due to subjects or to interaction between subjects and items. In the case of evaluation of error induction in relation to the passing of time, Cronbach's alpha is not most appropriate, but rather testing and retesting techniques (Taber, 2017).

As internal consistency refers to "the extent to which the items in a test measure the same concept or construct" (Tavakol and Dennick, 2011, p.53), it must be established before undertaking other statistical analysis. The main advantage of the use of Cronbach's alpha is the relative ease of use, as it can be

computed based on a single test administration, rather than on testing and retesting (Tavakol and Dennick, 2011) and is not influenced by the response scale (Cortina, 1993).

The formulae 5.1 can be applied to calculate Cronbach's alpha (Peterson, 1994):

$$\alpha = \left(\frac{k}{k-1}\right)\left(1 - \sum_{i=1}^{k} \frac{\sigma_i^2}{\sigma_s^2}\right) \quad \text{or} \quad \alpha = \frac{k\bar{r}}{1+\bar{r}(k-1)} \tag{5.1}$$

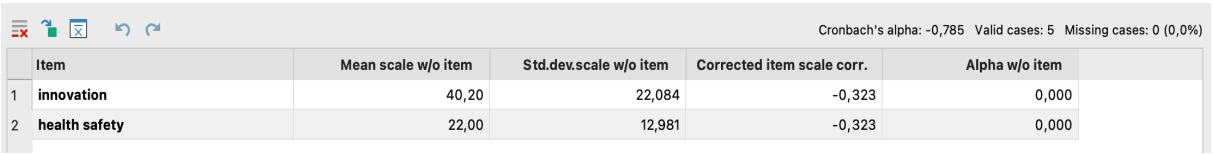
Where:

$$\sigma_i^2 = variance\ of\ the\ item\ i$$
$$\sigma_s^2 = variance\ of\ the\ scale$$
$$\bar{r} = \ the\ average\ interitem\ correlation$$

Cronbach's alpha is a number between 0 and 1 and can be used to show the perception that participants have in relation to the research variables, i.e., are they independent one form the other or interrelated (Cortina, 1993; Gilles et al., 2008). The extent to which the variables can be combined to show one-dimensionality is not proven by Cronbach's alpha alone, as reminded by Cortina (1993).

The acceptable value for Cronbach's alpha varies according to researchers but is widely situated between 0.70 and 0.95 (Cortina, 1993), with some authors placing the minimum at 0.8 (Gilles et al., 2008). Nonetheless, and contrary to many conclusions in literature, the value of Cronbach's alpha must be computed in relation to the number of variables (Cortina, 1993), and more specifically, by analysing also the average interitem correlation to put into perspective the influence that the number of variables may have on the same value of alpha.

The theoretical assumption states that there exists a series of mediating factors contributing to Occupational Health and Safety Sustainability-Oriented Innovation. Firstly, the independent evolutions of these two variables were tested by calculating Cronbach's alpha. A very surprising result was found: the value of alpha was negative.



Cronbach's alpha: -0,785 Valid cases: 5 Missing cases: 0 (0,0%)

	Item	Mean scale w/o item	Std.dev.scale w/o item	Corrected item scale corr.	Alpha w/o item
1	innovation	40,20	22,084	-0,323	0,000
2	health safety	22,00	12,981	-0,323	0,000

Figure 5.15. Cronbach's Alpha (code-variables "innovation" and "health safety")

The most often encountered reasons for a negative value of the Cronbach's alpha are (as supported by (Nichols, 1999)):

1. Data or item coding errors (often encountered in questionnaires, where questions are lexically constructed in an opposite direction, i.e., at the negative form, whereas the rest of the questionnaire is at the positive form);
2. Small sample size or small number of items, i.e., a sampling error has produced a negative average covariance in each sample of cases.

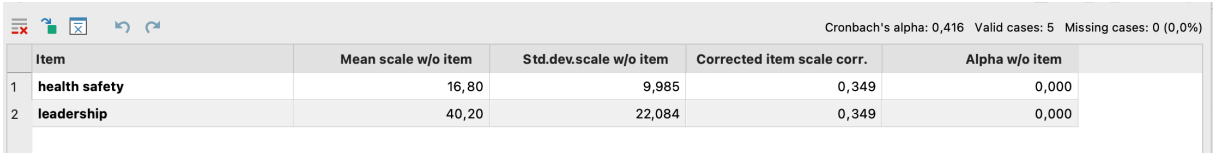
The following verifications were done in response to the above:

1. ***Data or item coding errors***

The data set was not constructed through a questionnaire, so there is no "a priory" error induced by the coding of the data in an opposite manner with regards to the theme of innovation as opposed to other themes.

2. ***Sample size or small number of items***

Firstly, the frequency for code-variable "innovation" is not the lowest, as it ranks higher than code-variable "leadership". Consequently, Cronbach alpha was computed for codes "health and safety" and "leadership" to see if the same phenomenon of negative alpha is observed. In this case, and although the code frequency is even lower for the same sample size, Cronbach's alpha was positive.

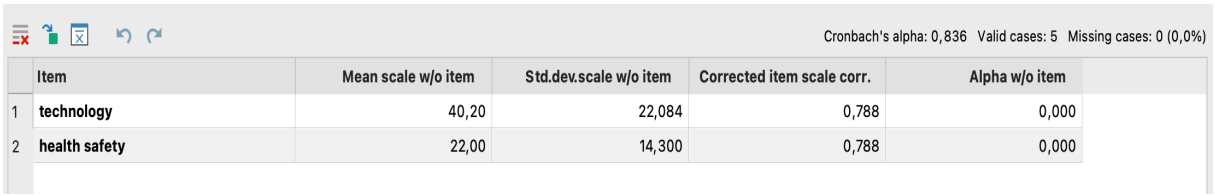


Cronbach's alpha: 0,416 Valid cases: 5 Missing cases: 0 (0,0%)

	Item	Mean scale w/o item	Std.dev.scale w/o item	Corrected item scale corr.	Alpha w/o item
1	health safety	16,80	9,985	0,349	0,000
2	leadership	40,20	22,084	0,349	0,000

Figure 5.16. Cronbach's Alpha (code-variables "leadership" and "health safety")

A second analysis was conducted for codes "health and safety" and "technology", which has equal frequency in the data set as the code "innovation". The computed Cronbach alpha is of 0.836, showing, what is more an interrelation between OHS and technology.



Cronbach's alpha: 0,836 Valid cases: 5 Missing cases: 0 (0,0%)

	Item	Mean scale w/o item	Std.dev.scale w/o item	Corrected item scale corr.	Alpha w/o item
1	technology	40,20	22,084	0,788	0,000
2	health safety	22,00	14,300	0,788	0,000

Figure 5.17. Cronbach's Alpha (code-variables "technology" and "health safety")

Given the above, the negative value for Cronbach's alpha for codes "health safety" and "innovation" cannot be linked either to sample size or to the number of occurrences in the data set. Furthermore, the coded segments were reviewed to observe specific formulation patterns, but no such patterns were found.

Followingly, a random lexical search was undertook using words of the lexical field of innovation, such as "new", "innov*", "develop*" with the purpose of identifying segments of text that required a modification of the code attribution. The findings of the lexical search did not point out to any incoherence in the initial coding process as described in previous chapters.

As neither of the most frequent explanations was fitting to the present research, a more in-depth bibliographical research on Cronbach's alpha was undertook. This highlighted the works of Martineau (1982) and Vaske, Beamen and Sponarski (2017) who both pointed out that in specific configurations, a negative value of Cronbach's alpha can be observed, when the answers of the respondents to a questionnaire are diametrically opposed or inconsistent.

Considering this, the Code Matrix Browser was reviewed. The visual representation with only codes "health safety" and "innovation" shows that code frequencies were diametrically opposed within the data set. Indeed "health safety" ranked very high for both Distributie Oltenia and Ericsson, average for Oatly and low for ETH Zurich and PWC Hungary; on the other hand, "innovation" ranked high

for ETH Zurich, average for Ericsson and low for Oatly, Distributie Oltenia and PWC Hungary.

In considering that the respondents of the data set, i.e. the organizations have answered in diametrically opposed manners to "health safety" and "innovation" themes, the negative total variance of the corresponding code-variables may have been induced by the respondents themselves, in configurations similar to those studied by Martineau (1982) and Vaske, Beamen and Sponarski (2017).

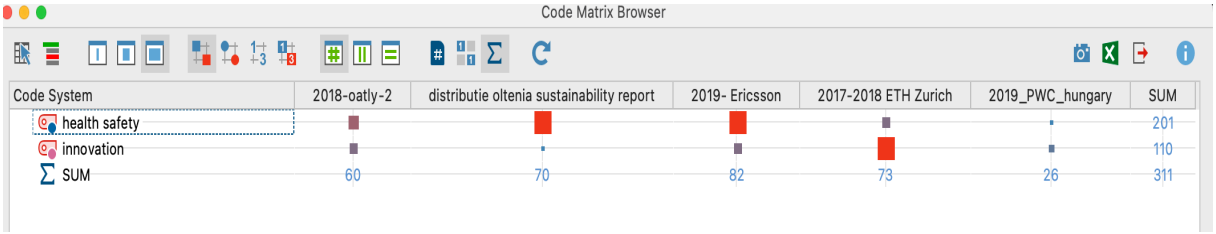
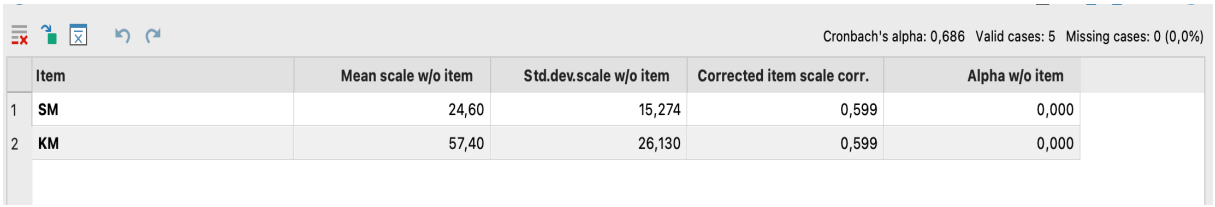


Figure 5.18. Code Matrix Browser (code-variables "innovation" and "health safety")

Followingly Cronbach's alpha was calculated for code-variables KM and SM. The value of Cronbach's alpha is 0.686, which points out that the two variables are independent from one another. This finding is coherent with the theoretical conclusions and the theoretical assumptions.

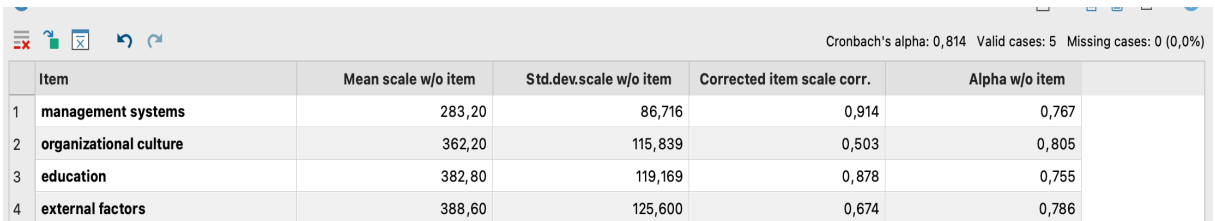


	Item	Mean scale w/o item	Std.dev.scale w/o item	Corrected item scale corr.	Alpha w/o item
1	SM	24,60	15,274	0,599	0,000
2	KM	57,40	26,130	0,599	0,000

Figure 5.19. Cronbach's Alpha (code-variables "SM" and "KM")

The next steps consisted in evaluating Cronbach's alpha for the other codes in relation to SM, KM, OHS and SOI to identify existing interrelations which would support the existence of contributing mediating factors.

KM is interrelated with all the codes with an initial Cronbach alpha of 0.769. By excluding the variable "responsibility", the value of Cronbach's alpha rises to 0.814.



	Item	Mean scale w/o item	Std.dev.scale w/o item	Corrected item scale corr.	Alpha w/o item
1	management systems	283,20	86,716	0,914	0,767
2	organizational culture	362,20	115,839	0,503	0,805
3	education	382,80	119,169	0,878	0,755
4	external factors	388,60	125,600	0,674	0,786
5	contextualization	390,60	127,151	0,993	0,783
6	technology	414,00	134,252	0,155	0,829
7	leadership	419,20	131,233	0,573	0,806
8	KM	411,40	126,609	0,662	0,789

Figure 5.20. Cronbach's Alpha (code-variables "management systems", "organizational culture", "education", "external factors", "technology", "leadership" and "KM")

The value of Cronbach's alpha is 0.757, for SM and all the other code-variables. This value is close to the acceptability threshold and by removing the code-variable "responsibility", Cronbach's alpha rises to 0.820.

Cronbach's alpha: 0,820 Valid cases: 5 Missing cases: 0 (0,0%)

	Item	Mean scale w/o item	Std.dev.scale w/o item	Corrected item scale corr.	Alpha w/o item
1	management systems	316,00	94,327	0,900	0,770
2	organizational culture	395,00	122,368	0,524	0,808
3	education	415,60	125,564	0,915	0,762
4	external factors	421,40	132,572	0,679	0,795
5	contextualization	423,40	134,180	0,992	0,793
6	technology	446,80	141,533	0,139	0,837
7	leadership	452,00	139,243	0,471	0,819
8	SM	411,40	126,609	0,618	0,789

Figure 5.21. Cronbach's Alpha (code-variables "management systems", "organizational culture", "education", "external factors", "contextualization", "technology", "leadership" and "SM")

This finding requires further consideration. Indeed, both KM and SM are dependent of the same variables: management systems, organizational culture, education, external factors, contextualization, technology and leadership, and to a lesser extent responsibility, but taken separately they are perceived by organizations in the data set as being independent. This can be potentially explained by the existence, within each mediating factor of lower-level factors contributing either to KM or SM. This can constitute a future avenue of research in identifying the lower-level components of each mediating factor and investigating its specific contributions to SM or KM.

The next step consisted in establishing interrelations between OHS, KM and SM, and SOI, KM and SM. Contrary to the theoretical model, and to expectations based on previous results, it appeared that "health safety" is a variable independent from both KM and SM.

Cronbach's alpha: 0,125 Valid cases: 5 Missing cases: 0 (0,0%)

	Item	Mean scale w/o item	Std.dev.scale w/o item	Corrected item scale corr.	Alpha w/o item
1	health safety	82,00	37,343	-0,213	0,686
2	KM	97,60	27,318	0,662	-1,137
3	SM	64,80	28,190	0,037	0,185

Figure 5.22. Cronbach's Alpha (code-variables "KM", "SM" and "health safety")

On the other hand, a rather strong interrelation exists for KM, SM and SOI, as Cronbach's alpha is 0.822.

Cronbach's alpha: 0,822 Valid cases: 5 Missing cases: 0 (0,0%)

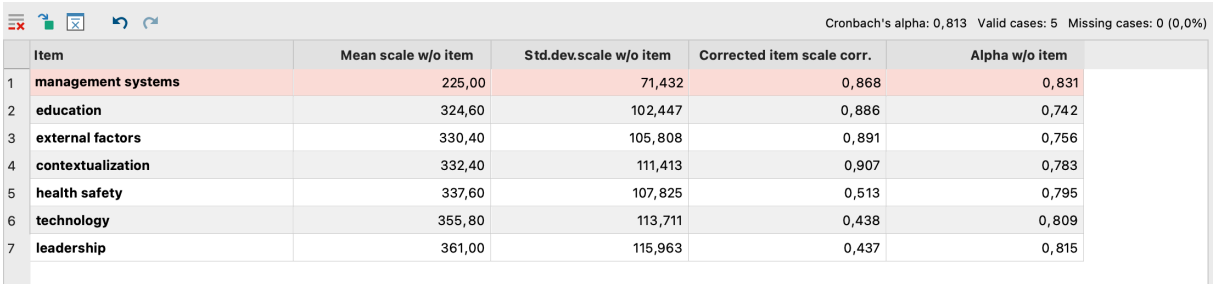
	Item	Mean scale w/o item	Std.dev.scale w/o item	Corrected item scale corr.	Alpha w/o item
1	KM	79,40	36,672	0,734	0,734
2	SM	46,60	27,300	0,681	0,922
3	innovation	82,00	37,343	0,863	0,686

Figure 5.23. Cronbach's Alpha (code-variables "KM", "SM" and "innovation")

These results are coherent with the idea highlighted by most research articles dealing with OHS, in that organizations perceive OHS as stand-alone.

To the same extent, SOI is generally perceived as an effort emerging from research and development, from understanding and anticipating needs and market trends, and thus is closely related to the management of knowledge within and without the organization, as to that of the stakeholders.

So, if neither KM, nor SM relate to OHS, does that mean than neither of the theoretical identified mediating factors does not relate to OHS? The answer is negative, as Cronbach's alpha is 0.759 in relation to all variables and 0.794 after the exclusion of "responsibility", and 0.813 after further removal of "organizational culture".

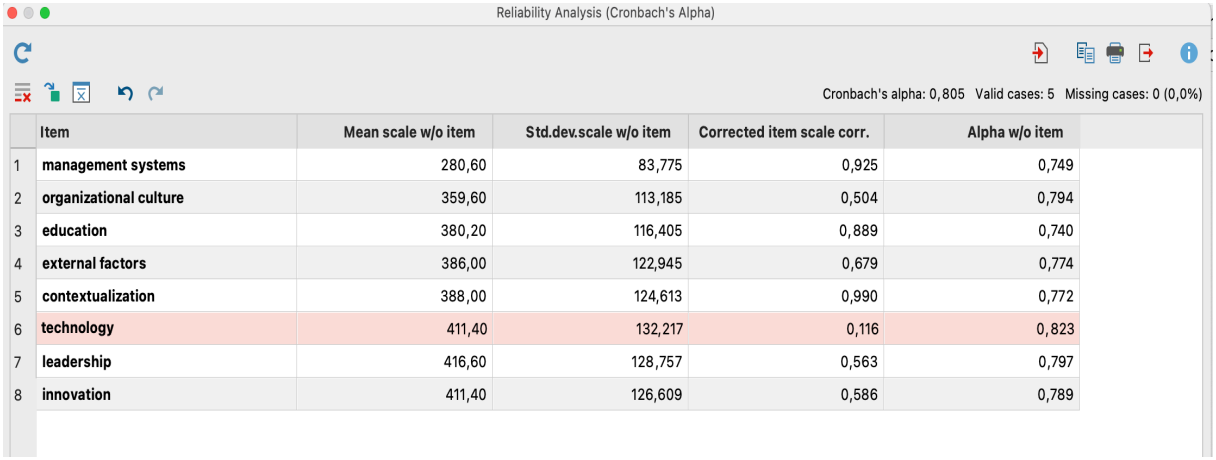


Cronbach's alpha: 0,813 Valid cases: 5 Missing cases: 0 (0,0%)

	Item	Mean scale w/o item	Std.dev.scale w/o item	Corrected item scale corr.	Alpha w/o item
1	management systems	225,00	71,432	0,868	0,831
2	education	324,60	102,447	0,886	0,742
3	external factors	330,40	105,808	0,891	0,756
4	contextualization	332,40	111,413	0,907	0,783
5	health safety	337,60	107,825	0,513	0,795
6	technology	355,80	113,711	0,438	0,809
7	leadership	361,00	115,963	0,437	0,815

Figure 5.24. Cronbach's Alpha (code-variables "management systems", "education", "external factors", "contextualization", "technology", "leadership" and "health safety")

Similarly, "innovation" is interrelated to all variables with a Cronbach alpha of 0.756, and of 0.805 after the exclusion of "responsibility".



Reliability Analysis (Cronbach's Alpha)

Cronbach's alpha: 0,805 Valid cases: 5 Missing cases: 0 (0,0%)

	Item	Mean scale w/o item	Std.dev.scale w/o item	Corrected item scale corr.	Alpha w/o item
1	management systems	280,60	83,775	0,925	0,749
2	organizational culture	359,60	113,185	0,504	0,794
3	education	380,20	116,405	0,889	0,740
4	external factors	386,00	122,945	0,679	0,774
5	contextualization	388,00	124,613	0,990	0,772
6	technology	411,40	132,217	0,116	0,823
7	leadership	416,60	128,757	0,563	0,797
8	innovation	411,40	126,609	0,586	0,789

Figure 5.25. Cronbach's Alpha (code-variables "management systems", "organizational culture", "education", "external factors", "contextualization", "technology", "leadership" and "innovation")

It can be concluded from all the previous analyses that "responsibility" is perceived as rather independent from all the considered dependent variables: SM, KM, OHS and SOI. In considering that sustainability reports are a top-management prerogative, this finding is coherent with those of previous researchers pointing out a widespread confusion regarding responsibility, in particular with regards to OHS.

5.4.2 Correlation of the mediating factors

As reminded by Schober et al. (2018), correlation implies that by modifying the magnitude of one variable, a modification of another variable is induced. Therefore, correlation measures the association between the two variables, in terms of strength and direction.

If the relationship between the two variables is linear, then the correlation coefficient will be named Pearson's correlation coefficient. Linear correlation implies that the change in magnitude of one variable induces a proportional (same or opposite direction) change in the other variable. Pearson's coefficient is a value between -1 and +1, without any unit (Sedgwick, 2012).

The use of Pearson's correlation coefficient requires that the data respect the following assumptions: be continuous, be normally distributed and be linearly related. However, if these assumptions cannot be met, it is more appropriate to test variable correlation by using Spearman's correlation coefficient (Schober et al., 2018, Statstutor, 2020). Spearman's correlation coefficient - R is computed by ranking the data from lowest to highest and then calculating the Pearson correlation coefficient (Statstutor, 2020).

An important advantage of the Spearman coefficient is its robustness against outliers, which highly influence the Pearson coefficient (Schober, et al., 2018).

Spearman correlation shall consider a more general relationship between the two variables, under the form of monotonic functions. A monotonic function is characterized by its entirely non-increasing or non-decreasing behaviour.

As the Pearson correlation coefficient, the Spearman correlation coefficient is also a measure of strength between paired data and is measured on an interval going from -1 to +1; closeness to the extremities of the interval shows stronger monotonic relationship (Stastutor, 2020).

A value of 0 for either Pearson or Spearman correlation coefficients does not imply that there is no relationship between the variables, but merely that the relationship is neither linear, nor monotonic.

Firstly, the normal distribution of the variables was verified by creating box and whisker charts for each variable. This type of chart represents data into quartiles around the median. The whiskers are vertical lines which indicate the variability outside the quartiles. Outliers are represented as points unrelated to the whiskers. In the case of a normal distribution, the median line should be as close as possible to the middle of the box, while the whiskers should be of approximately equal length.

The box and whiskers chart (Figure 5.26) shows that only the code-variable "contextualization" presents a median which is quite close to the centre of the box and whiskers of approximately equal length.

Code-variable "innovation" presents a lower whisker which is shorter than the upper one, indicating positive skewness; about a gaussian curve, the distribution of the data would be shifted towards the left of the median, and thus the distribution tail of the curve is spreading out right of the median.

With regards to "health safety" and "technology" the opposite phenomenon can be observed: the lower whisker is longer than the upper one, indicating negative skewness; with reference to a gaussian curve, the distribution of the data would tend to be shifted towards the right of the median, and thus the distribution tail is spreading out left of the median.

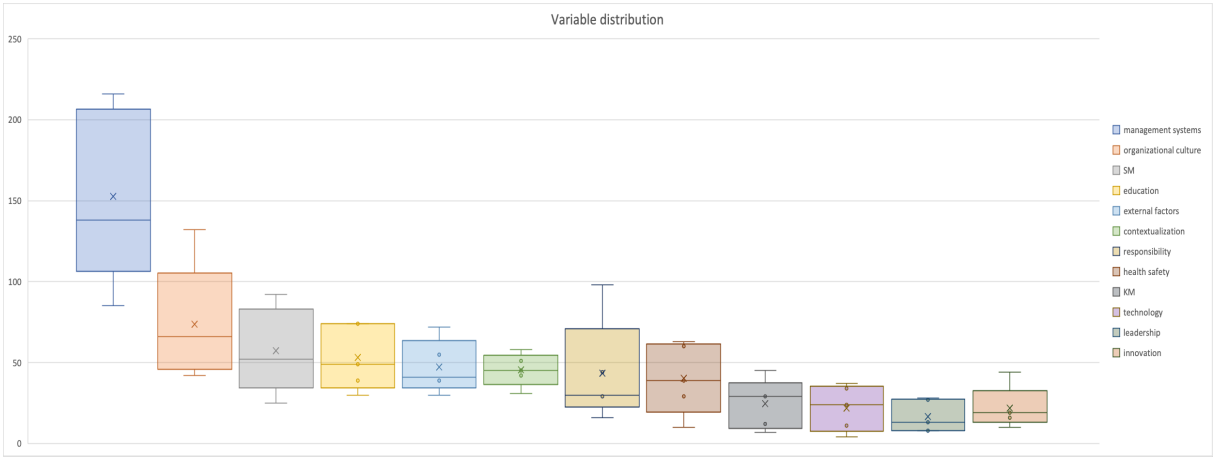


Figure 5.26. Box and whiskers chart for Code-variables

The box and whiskers representation of the variables is insufficient to conclude to a normal distribution of the code-variables. As pointed out by *The Concise Encyclopedia of Statistics* (Springer, 2008), Pearson was a pioneer regarding the testing of differences with the normal distribution, which are characterized by the measure of asymmetry and the measure of Kurtosis, as common measures of shape.

According to the Engineering Statistics Handbook proposed by The National Institute of Standards and Technology (U.S. Department of Commerce), skewness measures the lack of symmetry of the distribution of a variable and Kurtosis measures the weight of the tail of the distribution of a variable in comparison to a normal distribution (i.e., the outliers). The measure of skewness will show if the bulk of the data is positioned left or right of the mean for each variable, while Kurtosis describes the tails of the distribution curve (Westfall, 2014).

Considering that there is no à priori knowledge of the distribution form of each variable, nonparametric tests will be used to calculate the skewness of the distribution of the data. As reminded by Chin and Lee (2008), nonparametric test are only 95% as efficient as parametric tests, but are necessary when the distribution is not known, for small sample sizes (n<30) and when dealing with out-of-range values.

Furthermore, nonparametric tests are efficient in determining whether the distribution is symmetrical (skew=0) or left or right leaning. Consequently, the calculation of the skew of each variable through non-parametric tests will help establish, whether the distribution curve will have a normal tendency, thus determining whether Pearson correlation tests can be undertaken.

Given the existence of the raw data, skewness will be computed through the adjusted Fisher-Pearson coefficient of skewness, which presents the following advantages: considering sample size (NIST, 2021), being a rather common measure in several statistical software (Doane and Seward, 2011; NIST, 2021) and presenting small errors linked to skewed populations (Joanes and Gill, 1998).

The adjusted Fisher-Pearson skewness coefficient is calculated as follows (Doane and Seward, 2011; NIST, 2021):

$$G_1 = \frac{n}{(n-1)(n-2)} \sum_{i=1}^{n} \left(\frac{x_i - \bar{x}}{s}\right)^3 \quad (5.2)$$

Where:

$$n = number\ of\ data\ points$$
$$\bar{x} = mean$$
$$s = standard\ deviation\ of\ the\ sample$$

The interpretation of the adjusted Fisher-Pearson skewness coefficient allows to conclude:

- The direction of the skewness as given by the sign: a negative value equals a negatively skewed distribution, while a positive value equals a positively skewed distribution;
- The comparison with the normal distribution, in that the larger the value, the more important the difference with a normal distribution;
- Adjustment of the magnitude of the skewness coefficient to the sample size;
- The adjustment coefficient will tend towards 1 in case of large samples.

Although there is no clear-cut interpretation of the value of the skewness coefficient, the following interpretation is most accepted based on Bulmer (1979):

$$if\ -1 > G_1\ or\ G_1 > 1\ then\ the\ distribution\ is\ higly\ skewed \quad (5.3)$$

$$if\ -1 \leq G_1 \leq -0.5\ or\ 0.5 \leq G_1 \leq 1\ then\ the\ distribution\ is\ moderately\ skewed \quad (5.4)$$

$$if\ -0.5 < G_1 < 0.5\ then\ the\ distribution\ is\ approximately\ symmetric \quad (5.5)$$

Kurtosis can be calculated as an average of the fourth moment of the mean, i.e., the fourth powers of the deviations from the mean (Bulmer, 1979).

$$\kappa = \frac{\frac{\sum_{i=1}^{n}(x_i-\bar{x})^4}{n}}{s^4} \quad (5.6)$$

Where:

$$n = number\ of\ data\ points$$
$$\bar{x} = mean$$
$$s = standard\ deviation\ of\ the\ sample$$

With this formula, the value of the Kurtosis for a normal distribution is 3. The interpretation of Kurtosis according to Westfall (2014) and NIST (2021) relates to the tails of the distribution curve. The tails can be symmetric or asymmetric, which is highlighted by the skewness of the distribution curve, but also can be characterized in terms of their respective weights as either heavy (the tail presents many values) or light (the tail presents few values); a light tailed distribution, shall tend to 0 faster than an exponential one, whereas the heavy tailed distribution, shall tend to 0 slower than the exponential one.

The interpretation of Kurtosis according to DeCarlo (1997) is as follows:

$$a\ normal\ ditribution\ has\ a\ \kappa = 3 \quad (5.7)$$

$$if\ \kappa < 3\ then\ the\ distribution\ has\ lighter\ tails\ than\ a\ normal\ distribution \quad (5.8)$$

$$if\ \kappa > 3\ then\ the\ distribution\ has\ heavier\ tails\ than\ a\ normal\ distribution \quad (5.9)$$

MAXQDA does not have functions for the calculation of the skewness or the Kurtosis of a data set. Consequently, the data set was exported from MAXQDA and imported into EXCEL. The mean, standard deviation and the adjusted Fisher-Pearson coefficient were then calculated for each code variable. Additionally, the Kurtosis was calculated.

Table 5.5. Skewness and Kurtosis of Code-variables

Document name	management systems	organizational culture	SM	education	external factors	contextualization	responsibility	health safety	KM	technology	leadership	innovation
2018-oatly-2	128	79	74	49	39	45	16	39	30	34	8	21
distributie oltenia sustainability report	197	42	52	74	72	51	30	60	12	37	13	10
2019- Ericsson	138	66	25	39	41	42	98	63	29	24	27	19
2017-2018 ETH Zurich	216	132	92	74	55	58	44	29	45	11	28	44
2019_PWC_hungary	85	50	44	30	30	31	29	10	7	4	8	16
Mean	153	74	57	53	47	45	43	40	25	22	17	22
Standard deviation	53,336	35,542	26,130	20,142	16,410	10,114	32,090	22,084	15,274	14,300	9,985	12,981
Skewness	0,024	1,403	0,220	0,131	0,868	-0,342	1,725	-0,361	0,150	-0,292	0,439	1,653
Kurtosis	2,599	7,359	3,594	1,766	1,327	3,251	1,797	1,122	3,632	1,193	2,046	8,406

Table 5.5 points out that the only code-variable that presents a skewness coefficient close to 0 and a Kurtosis value close to 3 is the code-variable "management systems". This implies that the code-variable "management systems" presents a rather symmetric distribution with balanced tails, approaching that of a normal distribution. This finding seems to be coherent with the generally and widely expressed intention of dedicating effort to implementing effective management systems that contribute to the growth and stability of the organization, but which also respond to present-day preoccupations related to the three dimensions of sustainability.

Three code-variables present negative skewness coefficients: "contextualization", "health-safety" and "technology" (-0.342; -0.361 and -0.292 respectively); this indicates that the distribution curve is skewed left, i.e., that the average value is left of the mode and of the median, but also the existence of many outliers situated in the negative direction. This is indicative of numerous organizations having below average concerns and initiatives declared in their sustainability reports and few organizations proposing above average declared concerns and initiatives. From a behavioural point of view, this could be explained by the existence of champion "organizations" regarding each code-variable or by the fact that, as pointed out also in the literature review, big organizations, as part of their communication strategy towards third parties, will dedicate more energy to communicating around their adaptative behaviour and their initiatives to include and respond to wider sustainability concerns.

What is more regarding code-variables "health safety" and "technology" the value of the skewness coefficient confirms the preliminary assumption of negative skewness based on the box and whiskers chart (the bulk of the data is situated towards the high end of the scale, with the lower whisker longer than the upper one). The values of Kurtosis are of 1.122 for "health-safety" and 1.193 for "technology", which confirm the departing from a normal distribution.

With regards to code-variable "contextualization", the initial assumption based on the box and whiskers chart was that the variable may approach a normal distribution. The numerical values of the skewness and Kurtosis infirm this initial hypothesis: the skewness coefficient has a rather low negative value of –0.342 and a Kurtosis above 3, indicating a heavy tail. This could be explained by the fact that most companies do not include in their sustainability reports initiatives and

efforts which directly point to the understanding of their operational context. This could be explained by any of the following:

- Organizations dedicate little conscious effort to understanding the context in which they operate; this hypothesis is coherent, the bibliographical concluding that most companies do not dedicate specific resources to keeping up with legislative or industrial change (for instance, in the field of OHS);
- The bulk of the industrial tissue being made up of small and medium sized organizations, these do not have the financial means to dedicate specific resources to following or trending their operational and/or legislative context.

Code-variable "education" presents a rather low skewness coefficient (0.131, which is < 0.5), indicating a rather symmetrical distribution; Kurtosis on the other hand presents a moderate value of 1.766, departing from a normal distribution.

These values are not immediately interpretable per se. In reference to notions of electronics, a sine wave signal is characterized by a Kurtosis of 1.5 (Siemens, 2019; Florencias-Oliveros et al., 2018) and a skewness of 0 (Florencias-Oliveros et al., 2018). A sinusoidal pattern for the code-variable "education" could be interpreted as a periodic oscillation of the interest shown by organizations to the theme of education, perhaps as a cyclical pattern. The cyclical patterns can relate to a series of disruptive elements pertaining to external or contextual factors such as new technologies or management methods, new client needs, new legislative frameworks, or new competitors. Therefore, the existence of a relationship between code-variable "education" on the one hand and each of the following code-variables: "innovation", "contextualization", "external factors" should be verified statistically.

Code-variable "responsibility" has a moderately high skewness coefficient (1.725) and a moderate Kurtosis (1.797). The skewness of the distribution curve for the code-variable "responsibility" is not surprising; indeed, as shown in the literature review, the perception organizations have of responsibility is varying. It can be inferred those relative initiatives and efforts that organizations declare in their sustainability reports will be dispersed accordingly, causing the appearance of a moderate number of outliers in the distribution curve.

Oppositely, code-variable "leadership" presents a low skewness coefficient of 0.439, but a Kurtosis of 2.046. Low skewness will tend to show a tendency towards symmetry of the distribution curve. As internally, leadership is perceived as an important driver towards success, while externally it is brought to the forefront for competitive advantage, the result of moderately low skewness is unsurprising. By also considering the value of the Kurtosis, it can be concluded that, regarding leadership, the distribution is rather compact but slightly departing from the normal distribution. The conclusion is coherent with the alure of the box and whiskers chart.

Code-variables "SM" and "KM" each present a Kurtosis slightly higher than the value of the Kurtosis of a normal distribution curve: 3.594 for SM and 3.632 for KM. The skewness coefficients are of 0.220 for SM and 0.150 for KM, which are both situated within the range of what is generally accepted for a symmetric distribution.

Code-variables "organizational culture" and "innovation" present respectively high skewness (1.403 and 1.653 respectively) and high Kurtosis (7.359 and 8.406 respectively), meaning that the distribution for each code-

variable is strongly asymmetrical and presents numerous outliers. This finding is coherent with the diversity of practices regarding these code-variables; the skewness may be explained by the communication strategy of the organization; if some, might consider communicating on organizational culture and innovation sensible, as part of the competitive advantage, other organizations may perceive wide-target communication beneficial as enhancing their competitive advantage while stressing their preoccupation to respond to wider societal and environmental concerns.

Finally, the code-variable "external factors" is moderately skewed (coefficient of 0.868) and rather light-tailed (Kurtosis = 1.327). The asymmetric consideration of external factors in sustainability reports may be explained by permeability of the management system to external factors.

In conclusion, only the code-variable "management systems" can be assimilated to a normal distribution. All other variables have been found as not respecting the normality assumption.

The next step of the research consists in an analysis of association between the code-variables by taking into consideration that the normality assumption is only respected by one of the variables.

Spearman correlation coefficient examines if there is an association between the ranks of the values of two variables, to determine the existence of a monotonic relationship, without considering a specific format (exponential, linear, etc.). Although it is derived from the Pearson correlation, it is adapted to skewed distributions and/or the presence of outliers in the data set. The value of the Spearman coefficient varies between -1 and 1, with the sign indicating the direction of the association; the absence of correlation is given by a value of 0 for the Spearman coefficient.

The value of Spearman's coefficient needs to be related to a statistical significance, which is the confidence that a result is not due to chance, but to another factor (Gallo, 2016). Indeed, statistical studies are run on a sample of the entire population, as it is not possible to consider every constituent of the population. Unfortunately, the sampled group is not necessarily representative of the entire population because of the size of the sampled group or because of the variation in the population. With regards to sample size, statistical significance is biased as the smaller the sample, the higher the chances to have sampling errors in the establishment of the sample group. To the same extent, the higher the variation in the population, the higher are the chances of selecting individuals that depart from the average and are consequently not representative of the population.

The significance of the Spearman's correlation coefficient is obtained by applying the following steps (Ramsey, 1989; Gallo, 2016; RGS):

1. Define the null hypothesis (generally stating that there is no significant correlation between the two variables)– H0;
2. Define the alternative hypothesis – H1;
3. Calculation of statistical results:
   a. Arrange the paired data (X, Y);
   b. Rank for each variable, the data from smallest to highest; for equal ranks, the average rank should be calculated;
   c. Calculate the difference between the two ranks for each pair;
   d. Square the difference of ranks to remove negative data;
   e. Calculate the value of Spearman's correlation coefficient or R-coefficient with formula (5.10):

$$R = 1 - \frac{6\sum d^2}{(n^3 - n)}, \text{ with } -1 \leq R \leq 1 \quad (5.10)$$

f. verify if the result is meaningful or due to hazard, by comparing the obtained value with the critical values of the Spearman Ranked correlation coefficient table;

4. Interpretation of the results: test the R-coefficient for significance by using a table of critical values of R and conclude to the confidence that the results are not due to chance, thus allowing the rejection of H0.

As shown in previous paragraphs, except for "management systems", the distribution of which is possible to assimilate to a normal distribution, all other code-variables present skewed distributions.

In a comparative study investigating correlation coefficient for nonnormal distributions, Bishara and Hittner (2015) remind that literature often recommends Spearman correlation for nonnormal data as it maintains a low rate for Type I error (incorrect dismissal of the true null hypothesis), although it is viewed as slightly conservative in that it has a negative bias, especially for extreme nonnormal variable.

Consequently, a two-tailed Spearman test was run on all the variables. Considering that the present research aims at testing the validity of the theoretical assumptions and that there is no preliminary indication regarding the direction of the relationship between the variables based on organizational practices, it is considered more appropriate to consider effects in any direction. Therefore, a 2-tailed analysis was considered most appropriate to the given research.

The hypothesis was formulated as follows:

- H0: There is no monotonic association between the two variables;
- H1: There is a monotonic association between the two variables.

Spearman's correlation coefficient was then calculated by using MAXQDA Stats module.

Table 5.6. Spearman correlation coefficient among code-variables

	management systems	organizational culture	SM	education	external factors	contextualization	responsibility	health safety	KM	technology	leadership	innovation
management systems		0,300 (p=0,6826) N=5	0,500 (p=0,4498) N=5	0,872 (p=0,0833) N=5	0,900 (p=0,0833) N=5	0,900 (p=0,0833) N=5	0,600 (p=0,3496) N=5	0,300 (p=0,6826) N=5	0,600 (p=0,3496) N=5	0,300 (p=0,6826) N=5	0,872 (p=0,0833) N=5	0,300 (p=0,6826) N=5
organizational culture	0,300 (p=0,6826) N=5		0,600 (p=0,3496) N=5	0,205 (p=0,6826) N=5	-0,100 (p=0,9494) N=5	0,400 (p=0,5162) N=5	0,100 (p=0,9494) N=5	-0,200 (p=0,7822) N=5	0,900 (p=0,0833) N=5	-0,300 (p=0,6826) N=5	0,410 (p=0,4498) N=5	1,000 (p=0,0166) N=5
SM	0,500 (p=0,4498) N=5	0,600 (p=0,3496) N=5		0,718 (p=0,1328) N=5	0,300 (p=0,6826) N=5	0,800 (p=0,1328) N=5	-0,300 (p=0,6826) N=5	-0,400 (p=0,5162) N=5	0,700 (p=0,2328) N=5	0,100 (p=0,9494) N=5	0,205 (p=0,6826) N=5	0,600 (p=0,3496) N=5
education	0,872 (p=0,0833) N=5	0,205 (p=0,6826) N=5	0,718 (p=0,1328) N=5		0,872 (p=0,0833) N=5	0,975 (p=0,0166) N=5	0,154 (p=0,7822) N=5	0,205 (p=0,6826) N=5	0,564 (p=0,3496) N=5	0,564 (p=0,3496) N=5	0,526 (p=0,3496) N=5	0,205 (p=0,6826) N=5
external factors	0,900 (p=0,0833) N=5	-0,100 (p=0,9494) N=5	0,300 (p=0,6826) N=5	0,872 (p=0,0833) N=5		0,800 (p=0,1328) N=5	0,500 (p=0,4498) N=5	0,500 (p=0,4498) N=5	0,300 (p=0,6826) N=5	0,600 (p=0,3496) N=5	0,667 (p=0,2328) N=5	-0,100 (p=0,9494) N=5
contextualization	0,900 (p=0,0833) N=5	0,400 (p=0,5162) N=5	0,800 (p=0,1328) N=5	0,975 (p=0,0166) N=5	0,800 (p=0,1328) N=5		0,200 (p=0,7822) N=5	0,100 (p=0,9494) N=5	0,700 (p=0,2328) N=5	0,400 (p=0,5162) N=5	0,616 (p=0,2328) N=5	0,400 (p=0,5162) N=5
responsibility	0,600 (p=0,3496) N=5	0,100 (p=0,9494) N=5	-0,300 (p=0,6826) N=5	0,154 (p=0,7822) N=5	0,500 (p=0,4498) N=5	0,200 (p=0,7822) N=5		0,500 (p=0,4498) N=5	0,200 (p=0,7822) N=5	-0,100 (p=0,9494) N=5	0,872 (p=0,0833) N=5	0,100 (p=0,9494) N=5
health safety	0,300 (p=0,6826) N=5	-0,200 (p=0,7822) N=5	-0,400 (p=0,5162) N=5	0,205 (p=0,6826) N=5	0,500 (p=0,4498) N=5	0,100 (p=0,9494) N=5	0,500 (p=0,4498) N=5		0,100 (p=0,9494) N=5	0,700 (p=0,2328) N=5	0,308 (p=0,5162) N=5	-0,200 (p=0,7822) N=5
KM	0,600 (p=0,3496) N=5	0,900 (p=0,0833) N=5	0,700 (p=0,2328) N=5	0,564 (p=0,3496) N=5	0,300 (p=0,6826) N=5	0,700 (p=0,2328) N=5	0,200 (p=0,7822) N=5	0,100 (p=0,9494) N=5		0,100 (p=0,9494) N=5	0,564 (p=0,3496) N=5	0,900 (p=0,0833) N=5
technology	0,300 (p=0,6826) N=5	-0,300 (p=0,6826) N=5	0,100 (p=0,9494) N=5	0,564 (p=0,3496) N=5	0,600 (p=0,3496) N=5	0,400 (p=0,5162) N=5	-0,100 (p=0,9494) N=5	0,700 (p=0,2328) N=5	0,100 (p=0,9494) N=5		-0,051 (p=0,9494) N=5	-0,300 (p=0,6826) N=5
leadership	0,872 (p=0,0833) N=5	0,410 (p=0,4498) N=5	0,205 (p=0,6826) N=5	0,526 (p=0,3496) N=5	0,667 (p=0,2328) N=5	0,616 (p=0,2328) N=5	0,872 (p=0,0833) N=5	0,308 (p=0,5162) N=5	0,564 (p=0,3496) N=5	-0,051 (p=0,9494) N=5		0,410 (p=0,4498) N=5
innovation	0,300 (p=0,6826) N=5	1,000 (p=0,0166) N=5	0,600 (p=0,3496) N=5	0,205 (p=0,6826) N=5	-0,100 (p=0,9494) N=5	0,400 (p=0,5162) N=5	0,100 (p=0,9494) N=5	-0,200 (p=0,7822) N=5	0,900 (p=0,0833) N=5	-0,300 (p=0,6826) N=5	0,410 (p=0,4498) N=5	

The p-values obtained measure how probable it is that any observed association is due to chance and allow the rejection of the null hypothesis.

A probability of 5% or less, is considered statistically significant and is the generally accepted threshold for rejecting the null hypothesis. This implies that there is a 95% probability for the null hypothesis not to be true, i.e. that the data be statistically significant and show a true association.

Given the above, it appears from Table 5.6 that the null hypothesis can be rejected for the code-variable pairs: "innovation" and "organizational culture", as well as "education" and "contextualization". H1 is therefore accepted for these two

pairs, concluding that a monotonic relationship exists between code-variables "innovation" and "organizational culture" (R=1; p=0.0166) and "education" and "contextualization" (R=0.975; p=0.0166).

5.5 Discussions and conclusions

In the case of the present research, the objective is to establish a comparison regarding the theoretical model and real practices by characterizing code relationships. These relationships are straightforward as in the case of the attribution of two codes to the same analysis unit or segment or more hidden, such as those of mediating codes (i.e., one code helps establish a connection between other codes).

In this chapter the author proposed a mixed-methods approach to the interpretation of the data set. Following the coding of sustainability reports, a qualitative and quantitative (codes were converted into variable based on frequency of occurrence) analysis were undertaken.

This chapter therefore established whether organizations have practices that advance OHS and SOI and identified the "sharp-edge" mediating factors.

The semantic analysis pointed out that reporting practices include two categories of vocabulary:

- Business driven, expressed through the words business, company, product or service;
- Sustainability driven, expressed through the words: sustainability, GRI (Global Reporting Initiative), climate;
- Ambivalent (possibly belonging to either of the two categories above); expressed through the words: report, management, energy, employee.

With regards to expressions, despite the common declared purpose of the reports, which is to communicate around sustainability practices, there are few common expressions across the analysis units and no common vocabulary in the data set. Firstly, it must be pointed out that the most common 3-words expressions are all relative to sustainability with regards to external frameworks: sustainable development goals relative to the United Nations discourse and Global Reporting Initiative/Index relative to the GRI discourse. The sustainability reports being issued by the European headquarters of the 5 considered organizations, the repetition of the expression "greenhouse gas emissions" may be explained through the influence of the European Union policy and focus on the subject matter.

Surprisingly, the basic forms of the words "health" (Distributie Oltenia and Ericsson), "safety" (Distributie Oltenia and Ericsson) and "innovate" (none of the top 50) are scarce in the top 50 most frequent word lists, although all reports discuss initiatives to advance and improve health and safety within and without the organization, but also the role of innovation and the novel character of their approaches.

The semantic analysis pointed out that underlying statements can be inferred outside of the declared practices. Consequently, a more in-depth analysis of the meanings was necessary to understand the outreach of the organizational practices inventoried in the sustainability reports. This was achieved through a content analysis of the sustainability reports.

The Content Analysis highlighted the results based on the coding process. The Document portrait pointed out the relative proportion of each code, with 4 out of 5 organizations (Oatly, Distributie Oltenia, ETH Zürich and PWC Hungary) having

had the highest proportion of coded parts with code "SM", while 1 company out of 5 (Ericsson) had the highest proportion of coded text with code variable "KM", "SM ranking second. As discussed several times, sustainability reports are above all communication tools and as such are strongly directed to how the organization responds to stakeholder expectations while fulfilling its own objectives. Interestingly, the Codeline analysis allowed to conclude that throughout the reports the code "management systems" is recurring on most pages of each sustainability reports, whereas all other codes are more fragmented and dispersed.

The Descriptive Statistics section comforted the results of the qualitative analysis by quantifying the high proportion of code "management system" throughout the 5 sustainability reports. The Code Matrix Browser representation of the documents presenting highest frequency of each code highlights that those reports having more numerous pages will present higher proportions of most codes. For instance, the ETH Zürich sustainability report is longest in number of pages and ranks as having the highest number of occurrences for codes "management systems", "organizational culture", "SM", "education", "KM", "leadership" and "innovation"; it ranks 2nd for code "external factors", and outside of the top 3 for codes "health safety", "leadership" and "responsibility". The Code Maps depict a variety of views relative to each code; the clustering of codes into 4 clusters positions code "leadership" as a cluster of its own for all 5 organizations. This could be induced by the fact that leadership is often perceived as a skill involving the synthesis of some or all mediating factors, but with a part of personal vision of the leader.

In the Inferential Statistics part, Cronbach's alpha was calculated to establish interrelatedness of the variables. Secondly, variables were tested for compatibility with normal distribution; based on the values of skewness coefficients and Kurtosis, it was not possible to verify the assumption of normality for the code-variables (except for code-variable "management systems"). Therefore, associations were tested through Spearman correlation analysis.

A summary of the main conclusions regarding organizations' perceptions is proposed hereafter:

- Organizations perceive Knowledge Management and Stakeholder Management as independent from one another, yet dependent on the same mediating factors: management systems, organizational culture, education, external factors, contextualization, technology and leadership. This can be potentially explained by the existence, within each mediating factor or lower-level factors contributing either to KM or SM. The decomposition into lower-level mediating factors can constitute a future avenue of research;
- Organizations do not perceive responsibility as interrelated to either Knowledge Management or Stakeholder Management;
- Considering the above conclusions, it is surprising to see that organizations perceive the trio Knowledge Management, Stakeholder Management and Sustainability-Oriented Innovation as being interrelated. This can be explained by independent contributions of Knowledge Management and Stakeholder Management to Sustainability-Oriented Innovation;
- Organizations perceive Occupational Health and Safety as independent from both Knowledge Management and Stakeholder Management;
- Organizations perceive Occupational health and safety as interrelated to the following mediating factors: technology, management systems,

education, external factors, contextualization and leadership. This finding also contributes to reinforce the hypothesis of the existence of lower-level dimensions within each mediating factor and which can contribute specifically to one of the studied phenomena;

- Organizations perceive Sustainability-Oriented Innovation as interrelated to the following mediating factors: management systems, organizational culture, education, external factors, contextualization, technology and leadership;
- The analysis pointed out that organizations answer in diametrically opposed manners regarding OHS and SOI, pointing to the fact that organizations focus on one or other of the two subjects rather than tackling both at once;
- The mediating factor management systems is the only one to present a normal distribution; the other code-variables present non-normal distributions;
- A monotonic relation exists only between code-variables "innovation" and "organizational culture" and "education" and "contextualization";
- Responsibility is perceived as stand-alone in the constellation of organizational preoccupations and in coherence with the literature review Given the normative, legislative, and social bindings of organizational ecosystems, and despite corroborating the state-of-the-art on the subject, this conclusion is counterintuitive.

Concluding to the above findings, the theory based, and the practice based MIM model was created in Figure 5.27. It can be concluded that "education", "external factors", "contextualization", "technology", "leadership" and "management systems" are both theory and practice based mediating factors between OHS and SOI. "Knowledge Management", "Stakeholder Management" and "Organizational Culture" are, from a theoretical standpoint mediating factors between OHS and SOI, but this is not confirmed by organizational practice. Indeed, according to organizational perception, these factors only contribute to SOI, and as such the author names them contributing factors. Finally, "responsibility", as highlighted by the bibliographical study is perceived by organizations as stand alone, without any contribution to either OHS or SOI from a practical perspective.

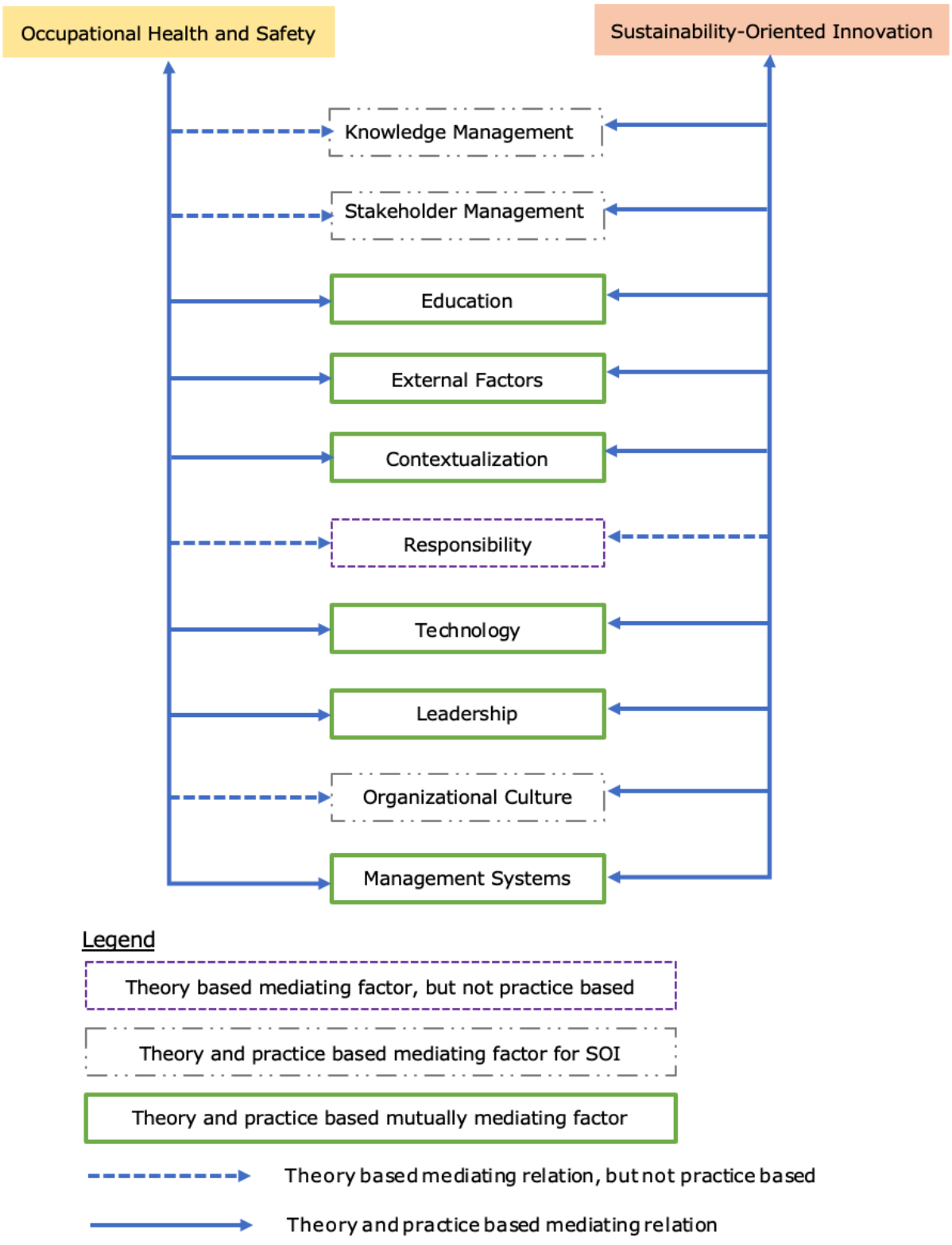


Figure 5.27. Mutual Influence Model - Theory and Practice based (author's contribution)

6 CONCLUSIONS AND CONTRIBUTIONS

The final chapter of the PhD thesis is dedicated to the presentation of the research conclusions. Critical considerations of the present research and its limitations are also discussed.

6.1 General conclusions

Throughout the thesis, the author has researched the existence and characterization of the relationship between Occupational Health and Safety and Sustainability-Oriented Innovation, with specific focus on the identification and characterization of mediating factors. The purpose is to identify leverages that industry and academia can focus upon to the mutual advantage of OHS and SOI.

The study was theory-driven but was built as a comparison between the findings of the bibliographical study to those defined by organizational practices as self-described in the sustainability reports of 5 organizations.

To this end, the first step consisted in a bibliographical study of each phenomenon with the purpose of summarizing current state of knowledge in each field. This bibliographical study highlighted that up-to-date research regarding OHS and SOI is characterized by a large variety of research streams and subsequent definitions and concepts. Recurring concepts surfaced: Knowledge Management and Stakeholder Management are perceived as influencing both OHS and SOI from a theoretical standpoint, as both are at least tangent to the wider concept of Sustainability.

This implied that that the investigation of the existence of an interrelation between OHS and SOI could be hypothesized. The absence of a unified structural canvas research constitutes a major challenge to the study of interrelations between SOI and OHS.

In order to overcome this barrier, the individual complexities of Occupational Health and Safety and Sustainability-Oriented Innovation were bypassed through the identification of mediating factors based on sequential theoretical research convergent to the research theme. These theoretical finding led to the proposal of a Mutual Influence Model, describing the connections between OHS and SOI. The identified convergent research issues helped formulate the research hypothesis.

Both scientific and grey literature recognize that, in practice, organizations are already addressing social and environmental concerns and that these are documented in organizational sustainability reports. Consequently, the applied research consisted in analysing organizational practices with regards to OHS and SOI as self-reported in sustainability reports. Sustainability reports are mainly textual, but also visual and numerical testimonies of organizational attitudes, beliefs, and practices, obtained through voluntary self-declaration. Indeed, despite strong interest towards sustainability, there is no obligation for organizations to declare their sustainability practices, let alone by publishing a sustainability report. Being voluntary publications, sustainability reports are mainly meant for third-party communication. They depict, among others, innovative approaches implemented by the organizations in support of the three sustainability

dimensions, as well as organizational practices in safeguarding employee health and safety.

Sustainability reports were analysed from the prism of theoretical mediating factors. The objective was to establish the practice-based interrelationships between mediating factors in organizational practices and contribute to the understanding of interrelationships with OHS and SOI. This analysis was based on mixed methods as most appropriate for the identification of convergence and divergence axis between practice-based findings and theoretical assumptions. The mixed methods included qualitative and quantitative components: semantic and content analysis, descriptive and inferential statistics. The legitimation was addressed in terms of process, through the systematic justification of the use of a given method, and of results, through critical interpretation and in-depth contextualization.

In the construction of the research process, the author purposefully decided that the applied research does not come in validation of the theoretical research but shall be built as a comparison. As constructed, the research hypothesis defends the existence of multiple realities: a theoretical or academic reality and a practice-based one. The research hypothesis proposes that these two realities are not mutually exclusive nor are they perfectly overlapping, but rather complementary. Both realities are multi-faceted as they combine several views and both contribute to an in-depth understanding of OHS and SOI phenomena, as to a causal understanding of the interrelationship between the two phenomena.

Finally, the Mutual Influence Model was adapted to consider theoretical and practice-based findings which pointed out that all the theoretically identified mediating factors are not confirmed through organizational practice. The current research endeavour concluded that the theoretically identified mediating factors "education", "external factors", "contextualization", "technology", "leadership" and "management systems" are also practice based mediating factors between OHS and SOI. With regards to "Knowledge Management", "Stakeholder Management" and "Organizational Culture" organizational practice does not align with the theoretical conclusion of them being mediating factors between OHS and SOI, but only contributors to SOI. Finally, "responsibility", as highlighted by the bibliographical study, is perceived by organizations as a free electron.

In this regard, the Mutual Influence Model is a useful map for academia and industry alike as it identifies potential avenues of research/practice development that could jointly further OHS and SOI.

6.2 Original contributions

Current research, as proven by the literature review, has shown its limitations, and mixed methods research is a new avenue for the contextualized understanding of the relationship between Occupational Health and Safety and Sustainability-Oriented Innovation.

The author's contributions are multiple: bibliographical study regarding current state of knowledge on up-to-date independently studied management streams: Occupational Health and Safety and Sustainability-Oriented Innovation. The literature review is multi-faceted and proposes an original delimitation according to historical, structural, process, stakeholder, and management system viewpoints. The critical analysis of research obstacles and the identification of elements of convergence represent another theoretical contribution.

Followingly and based on the author's published research on themes convergent to the research themes, the interweaving of OHS and SOI was studied at a theoretical level, which led to the identification of theoretical key elements and their regrouping into theoretically mediating factors. Finally, the author synthesized the conclusions by proposing a Mutual Influence Model (MIM).

With regards to the applied research, the author proposed a novel research design: theory-driven and based on a mixed methods research approach. Theoretical considerations of qualitative and quantitative analysis are described, as those relative to the implementation process, results, and interpretation. Inferences are made at every step of the research based on data collection and extensive description of the research process. Detailed research results are listed in an Appendix section.

The author awarded specific care to transferability through extensive and detailed description of the organizations as participants to the study, the selection of the data set and of the research method. Also, legitimation is ensured by the links between the qualitative and quantitative analysis.

Finally, the interpretation of results, i.e., theory and practice-based mediating factors are identified and modelled in a synthetic Mutual Influence Model.

From an applied research perspective, the critical and extensive discussions and conclusions of the theoretical results led to the identification of potential future avenues of research, among which the decomposition of mediating factors into lower-level mediating factors to investigate specific contributions to OHS and SOI.

The original contributions are listed in the following paragraphs per thesis chapter.

Chapter 2. The chapter surveys the current state of the knowledge on two topics: Occupational Health and Safety and Sustainability-Oriented Innovation. Consequently, the author's research contributions are theoretical; the juxtaposition of the two management streams constitutes a first original contribution.

The comprehensive literature review is the author's following contribution. The multi-faceted presentation that was proposed by the author is also original as discusses historical, structural, process, stakeholder, and management system viewpoints.

Another research contribution is the distillation of research streams and research obstacles for the two domains and the identification of elements of convergence in literature.

Chapter 3. The author contributed to the chapter as follows: firstly, the chapter is based on the author's published research on themes convergent to the research themes to pass from the juxtaposition of the research theme to their interweaving at the theoretical level. This approach as well as its conclusions constitute an original contribution.

Another contribution is given by the identification of theoretical key elements and their regrouping into theoretically mediating factors.

A third contribution is the modelling of the Mutual Influence Model (MIM) which synthesizes the theoretical research.

Chapter 4. The author's main contribution to the chapter is the in-depth presentation of the applied research approach. The chapter overviews theoretical and historical considerations regarding mixed methods: the underlying paradigm, the articulation of quantitative-qualitative methods and the subsequent issues relative to the legitimation of the research process and results.

The mixed method strategy is characterized in terms of timing, weight, data mixing and strategy-driver; justifications are proposed at each step, to ensure legitimation of the process.

Followingly, the author reviewed three Computer Assisted Qualitative Data Analysis Software for the identification of the best-fit analytical tool. Each software was briefly presented in terms of construction, functionalities, or user friendliness. Finally, a hardware and feature based comparison chart was proposed. The selection of the MAXQDA software was duly justified.

Chapter 5. The author's main contributions to the chapter are practical contributions. The first is conceiving and building the experimental set-up for the mixed methods analysis. The qualitative and quantitative analysis are presented from a theoretical perspective, but also with regards to implementation process, results, and interpretation. Legitimation is ensured by the links between the qualitative and quantitative analysis; to this end an extensive appendix section is dedicated to ensuring the link between data and results. Contextualization of findings is done at each step of the research.

The qualitative analysis is extensive and propose two approaches: semantic and content analysis for the entire data set. Taken independently, this applied research is a novel approach through the complementary qualitative analysis that were proposed.

From a quantitative perspective, the author's contributions include the characterization of organizational perception relative to each variable as a distribution curve through the wider population.

Finally, a more global contribution is the interpretation of results which allow to establish interactions and associations among the mediating factors which leads to the author modelling the sharp-edge Mutual Influence Model in parallel to the practice based one.

6.3 Considerations on Research Limitations and Future Research Avenues

First, the limitation of the present work relates to the applied research. The selected companies although multisectoral, are European based, meaning that the data set may not be fully representative of the global one. Future research should include a wider geographical panel of organizations. Furthermore, given the amount of time necessary for the coding process despite the use of CAQDAS, the data set was limited to five organizations due to time constraints relative to the PhD. research. A numerical extension of the data set would also contribute to reinforce the legitimation of the research results.

Secondly, and unlike the multiple reviewer process implemented for the identification of mediating factors, the sustainability report coding process was done by one reviewer in an iterative manner. The inclusion of another reviewer would be interesting to reinforce the legitimation of the coding process and coding results.

The qualitative analysis was theory-driven. A complementary research could consider a grounded-theory approach for the coding process, and a comparison of the thus obtained mediating factors could be undertaken.

Similarly, an extension of the quantitative study could include further investigation of statistical relationships based on non-monotonic relationships.

Another future research domain can aim at the establishment of trends, by comparing the coding results of sustainability reports issued over a 5- or 10-year period by the same organization. Such a temporal approach may confirm evolutions in practice within the same organizations and contribute to the development of sustainability maturity models.

Finally, from a theoretical perspective, each mediating factor can be studied in-depth and the way in which it contributes to OHS and SOI can be characterized. Furthermore, the theoretical framework can be extended to include contributing factors (i.e., those theoretically mediating factors which are not practice-based mediating factors).

All in all, the present doctoral thesis has proposed a new impulse related to two fields (OHS and SOI) the understanding of which is problematic for both academia and industry. The research approach that consisted in bypassing the individual understanding of each field to consider that of the interactions/interrelationships/interconnections among them has shed new light into future avenues of research for the comprehension of each field but also on a novel approach of advancing the sustainable development efforts.

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8 APPENDIX

8.1 Appendix: Categorization of key elements

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Ivascu, L., Mateescu, A., and Draghici, A. (2019). A proposed inventory of sustainable development indicators for the manufacturing process assessment.	Sustainable management models	Methods	Methods	management systems	management systems
Dufour, C., Ivascu, L., Mateescu, A., and Draghici, A. (2019). A proposed inventory of sustainable development indicators for the manufacturing process assessment.	resource management (reduce waste and resource efficiency)	method	method	management systems	management systems
Dufour, C., Ivascu, L., Mateescu, A., and Draghici, A. (2019). A proposed inventory of sustainable development indicators for the manufacturing process assessment.	cleaner production and technologies	Technology	Technology	technology	technology

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Ivascu, L., Mateescu, A., and Draghici, A. (2019). A proposed inventory of sustainable development indicators for the manufacturing process assessment.	recycling and reuse	objective	objective	management systems	management systems
Dufour, C., Ivascu, L., Mateescu, A., and Draghici, A. (2019). A proposed inventory of sustainable development indicators for the manufacturing process assessment.	improving social conditions	Values	Values	organizational culture	management systems
Dufour, C., Ivascu, L., Mateescu, A., and Draghici, A. (2019). A proposed inventory of sustainable development indicators for the manufacturing process assessment.	better working conditions	objective	Responsibility	management systems	management systems
Dufour, C., Ivascu, L., Mateescu, A., and Draghici, A. (2019). A proposed inventory of sustainable development indicators for the manufacturing process assessment.	manufacturing process assessment	method	method	management systems	management systems
Dufour, C., Ivascu, L., Mateescu, A., and Draghici, A. (2019). A proposed inventory of sustainable development indicators for the manufacturing process assessment.	sustainable development and competitiveness	objective	objective	management systems	management systems

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Ivascu, L., Mateescu, A., and Draghici, A. (2019). A proposed inventory of sustainable development indicators for the manufacturing process assessment.	process mapping	method	method	management systems	management systems
Dufour, C., Ivascu, L., Mateescu, A., and Draghici, A. (2019). A proposed inventory of sustainable development indicators for the manufacturing process assessment.	responsiveness	relationship	relationship	organizational culture	organizational culture
Dufour, C., Ivascu, L., Mateescu, A., and Draghici, A. (2019). A proposed inventory of sustainable development indicators for the manufacturing process assessment.	competitiveness	relationship	relationship	organizational culture	organizational culture
Dufour, C., Ivascu, L., Mateescu, A., and Draghici, A. (2019). A proposed inventory of sustainable development indicators for the manufacturing process assessment.	indicators such as production costs, time to market or stock costs	method	method	management systems	management systems
Dufour, C., Ivascu, L., Mateescu, A., and Draghici, A. (2019). A proposed inventory of sustainable development indicators for the manufacturing process assessment.	customer interest	relationship	relationship	contextualization	contextualization

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Ivascu, L., Mateescu, A., and Draghici, A. (2019). A proposed inventory of sustainable development indicators for the manufacturing process assessment.	sustainable manufacturing	method	method	management systems	management systems
Dufour, C., Ivascu, L., Mateescu, A., and Draghici, A. (2019). A proposed inventory of sustainable development indicators for the manufacturing process assessment.	aggregated indicator	method	method	management systems	management systems
Dufour, C., Ivascu, L., Mateescu, A., and Draghici, A. (2019). A proposed inventory of sustainable development indicators for the manufacturing process assessment.	(sustainable) value added	objective	objective	organizational culture	organizational culture
Dufour, C., Ivascu, L., Mateescu, A., and Draghici, A. (2019). A proposed inventory of sustainable development indicators for the manufacturing process assessment.	sustainable manufacturing	objective	objective	management systems	management systems
Dufour, C., Ivascu, L., Mateescu, A., and Draghici, A. (2019). A proposed inventory of sustainable development indicators for the manufacturing process assessment.	sustainable development indicators	method	method	management systems	management systems

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Ivascu, L., Mateescu, A., and Draghici, A. (2019). A proposed inventory of sustainable development indicators for the manufacturing process assessment.	sustainable development measurement system and indicators	method	method	management systems	management systems
Dufour, C., Ivascu, L., Mateescu, A., and Draghici, A. (2019). A proposed inventory of sustainable development indicators for the manufacturing process assessment.	aggregated vs non -aggregated metrics	method	method	management systems	management systems
Dufour, C., Ivascu, L., Mateescu, A., and Draghici, A. (2019). A proposed inventory of sustainable development indicators for the manufacturing process assessment.	data analysis	method	method	management systems	management systems
Dufour, C., Ivascu, L., Mateescu, A., and Draghici, A. (2019). A proposed inventory of sustainable development indicators for the manufacturing process assessment.	decision-making	Effects	leadership	leadership	leadership
Dufour, C., Ivascu, L., Mateescu, A., and Draghici, A. (2019). A proposed inventory of sustainable development indicators for the manufacturing process assessment.	indicator choice	Effects	leadership	management systems	management systems

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Ivascu, L., Mateescu, A., and Draghici, A. (2019). A proposed inventory of sustainable development indicators for the manufacturing process assessment.	indicator interconnection	management systems	relationship	management systems	management systems
Dufour, C., Ivascu, L., Mateescu, A., and Draghici, A. (2019). A proposed inventory of sustainable development indicators for the manufacturing process assessment.	flow of information	objective	objective	management systems	management systems
Dufour, C., Ivascu, L., Mateescu, A., and Draghici, A. (2019). A proposed inventory of sustainable development indicators for the manufacturing process assessment.	cost, image, quality, lead-time	method	method	management systems	management systems
Dufour, C., Ivascu, L., Mateescu, A., and Draghici, A. (2019). A proposed inventory of sustainable development indicators for the manufacturing process assessment.	risk indicators	method	method	management systems	management systems
Dufour, C., Ivascu, L., Mateescu, A., and Draghici, A. (2019). A proposed inventory of sustainable development indicators for the manufacturing process assessment.	social indicator	method	method	management systems	management systems

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Ivascu, L., Mateescu, A., and Draghici, A. (2019). A proposed inventory of sustainable development indicators for the manufacturing process assessment.	economic indicator	method	method	management systems	management systems
Dufour, C., Ivascu, L., Mateescu, A., and Draghici, A. (2019). A proposed inventory of sustainable development indicators for the manufacturing process assessment.	environmental indicator	method	method	management systems	management systems
Dufour, C., Ivascu, L., Mateescu, A., and Draghici, A. (2019). A proposed inventory of sustainable development indicators for the manufacturing process assessment.	6R method (reduce, reuse, recycle, recover, redesign and remanufacture)	method	method	management systems	management systems
Dufour, C., Ivascu, L., Mateescu, A., and Draghici, A. (2019). A proposed inventory of sustainable development indicators for the manufacturing process assessment.	Steering	leadership	leadership	leadership	leadership
Dufour, C., Ivascu, L., Mateescu, A., and Draghici, A. (2019). A proposed inventory of sustainable development indicators for the manufacturing process assessment.	Benchmarking	method	method	management systems	management systems

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Ivascu, L., Mateescu, A., and Draghici, A. (2019). A proposed inventory of sustainable development indicators for the manufacturing process assessment.	Sustainable-Value Added: the value added of the final product which is the result of a manufacturing process, and which considers the environmental, social and economic impacts of the manufacturing process	method	method	management systems	management systems
Dufour, C., Ivascu, L., Mateescu, A., and Draghici, A. (2019). A proposed inventory of sustainable development indicators for the manufacturing process assessment.	Stakeholder and shareholder involvement	relationship	relationship	contextualization	contextualization
Dufour, C., Ivascu, L., Mateescu, A., and Draghici, A. (2019). A proposed inventory of sustainable development indicators for the manufacturing process assessment.	External communication	communicatio n	communication	contextualization	contextualization

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Rennung, F., Paschek, D., **Dufour,C.M.,** Draghici A. (2018a) Managing Complexity in Large-Scale Business Projects. A Theoretical Model.	Knowledge base	infrastructure	infrastructure	management systems	management systems
Rennung, F., Paschek, D., **Dufour,C.M.,** Draghici A. (2018a) Managing Complexity in Large-Scale Business Projects. A Theoretical Model.	Interdisciplinarity	objective	objective	organizational culture	organizational culture
Rennung, F., Paschek, D., **Dufour,C.M.,** Draghici A. (2018a) Managing Complexity in Large-Scale Business Projects. A Theoretical Model.	Strategic alliances	relationship	relationship	organizational culture	organizational culture
Rennung, F., Paschek, D., **Dufour,C.M.,** Draghici A. (2018a) Managing Complexity in Large-Scale Business Projects. A Theoretical Model.	Outsourcing to third parties	relationship	relationship	contextualization	contextualization
Rennung, F., Paschek, D., **Dufour,C.M.,** Draghici A. (2018a) Managing Complexity in Large-Scale Business Projects. A Theoretical Model.	Complexity management	management systems	management systems	contextualization	management systems

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Rennung, F., Paschek, D., **Dufour,C.M.,** Draghici A. (2018a) Managing Complexity in Large-Scale Business Projects. A Theoretical Model.	Globalization	relationship	relationship	external factors	external factors
Rennung, F., Paschek, D., **Dufour,C.M.,** Draghici A. (2018a) Managing Complexity in Large-Scale Business Projects. A Theoretical Model.	New technologies	technology	technology	technology	technology
Rennung, F., Paschek, D., **Dufour,C.M.,** Draghici A. (2018a) Managing Complexity in Large-Scale Business Projects. A Theoretical Model.	Resource scarcity, demographic change, climate change and energy transition are only some selected megatrends that affect the company as external factors and the companies need to position their strategies	infrastructure	infrastructure	external factors	external factors

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Rennung, F., Paschek, D., **Dufour,C.M.,** Draghici A. (2018a) Managing Complexity in Large-Scale Business Projects. A Theoretical Model.	new markets, competitors, and individual customer	external factors	EXTERNAL FACTORS	contextualization	contextualization
Rennung, F., Paschek, D., **Dufour,C.M.,** Draghici A. (2018a) Managing Complexity in Large-Scale Business Projects. A Theoretical Model.	ever-changing needs of internal and external customers, for example because of new information and telecommunications technologies	communication	communication	contextualization	contextualization
Rennung, F., Paschek, D., **Dufour,C.M.,** Draghici A. (2018a) Managing Complexity in Large-Scale Business Projects. A Theoretical Model.	customer interface	infrastructure	infrastructure	management systems	management systems
Rennung, F., Paschek, D., **Dufour,C.M.,** Draghici A. (2018a) Managing Complexity in Large-Scale Business Projects. A Theoretical Model.	internal process	management systems	management systems	management systems	management systems

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Rennung, F., Paschek, D., **Dufour,C.M.,** Draghici A. (2018a) Managing Complexity in Large-Scale Business Projects. A Theoretical Model.	cross-disciplinary knowledge	objective	objective	contextualization	contextualization
Rennung, F., Paschek, D., **Dufour,C.M.,** Draghici A. (2018a) Managing Complexity in Large-Scale Business Projects. A Theoretical Model.	future-oriented character	objective	objective	organizational culture	organizational culture
Rennung, F., Paschek, D., **Dufour,C.M.,** Draghici A. (2018a) Managing Complexity in Large-Scale Business Projects. A Theoretical Model.	stakeholders	relationship	relationship	contextualization	contextualization
Rennung, F., Paschek, D., **Dufour,C.M.,** Draghici A. (2018a) Managing Complexity in Large-Scale Business Projects. A Theoretical Model.	customer integration/relationship management	relationship	relationship	contextualization	contextualization
Rennung, F., Paschek, D., **Dufour,C.M.,** Draghici A. (2018a) Managing Complexity in Large-Scale Business Projects. A Theoretical Model.	network management	management systems	management systems	management systems	management systems

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Rennung, F., Paschek, D., **Dufour,C.M.,** Draghici A. (2018a) Managing Complexity in Large-Scale Business Projects. A Theoretical Model.	market demand	external factors	EXTERNAL FACTORS	external factors	external factors
Rennung, F., Paschek, D., **Dufour,C.M.,** Draghici A. (2018a) Managing Complexity in Large-Scale Business Projects. A Theoretical Model.	economic and environmental factors	external factors	EXTERNAL FACTORS	external factors	external factors
Rennung, F., Paschek, D., **Dufour,C.M.,** Draghici A. (2018a) Managing Complexity in Large-Scale Business Projects. A Theoretical Model.	diversity of customer requirements	external factors	EXTERNAL FACTORS	external factors	external factors
Rennung, F., Paschek, D., **Dufour,C.M.,** Draghici A. (2018a) Managing Complexity in Large-Scale Business Projects. A Theoretical Model.	suppliers	relationship	relationship	contextualization	contextualization
Rennung, F., Paschek, D., **Dufour,C.M.,** Draghici A. (2018a) Managing Complexity in Large-Scale Business Projects. A Theoretical Model.	products	technology	technology	management systems	management systems

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Rennung, F., Paschek, D., **Dufour,C.M.,** Draghici A. (2018a) Managing Complexity in Large-Scale Business Projects. A Theoretical Model.	hierarchal levels	relationship	relationship	management systems	management systems
Rennung, F., Paschek, D., **Dufour,C.M.,** Draghici A. (2018a) Managing Complexity in Large-Scale Business Projects. A Theoretical Model.	degree of centralization	relationship	relationship	management systems	management systems
Rennung, F., Paschek, D., Dufour,C.M., Draghici A. (2018a) Managing Complexity in Large-Scale Business Projects. A Theoretical Model.	communication systems	communication	communication	contextualization	management systems
Rennung, F., Paschek, D., **Dufour,C.M.,** Draghici A. (2018a) Managing Complexity in Large-Scale Business Projects. A Theoretical Model.	balanced scorecard	method	method	management systems	management systems
Rennung, F., Paschek, D., **Dufour,C.M.,** Draghici A. (2018b) Managing Complexity in Large-Scale Business Projects. Experimental Validation of the Proposed Model	Resource efficiency	objective	objective	management systems	management systems

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Rennung, F., Paschek, D., **Dufour,C.M.,** Draghici A. (2018b) Managing Complexity in Large-Scale Business Projects. Experimental Validation of the Proposed Model	Time-to-market	measurement	measurement	management systems	management systems
Rennung, F., Paschek, D., **Dufour,C.M.,** Draghici A. (2018b) Managing Complexity in Large-Scale Business Projects. Experimental Validation of the Proposed Model	Innovation and innovation capacity	objective	objective	organizational culture	organizational culture
Rennung, F., Paschek, D., **Dufour,C.M.,** Draghici A. (2018b) Managing Complexity in Large-Scale Business Projects. Experimental Validation of the Proposed Model	Flexibility	objective	objective	management systems	management systems
Rennung, F., Paschek, D., **Dufour,C.M.,** Draghici A. (2018b) Managing Complexity in Large-Scale Business Projects. Experimental Validation of the Proposed Model	Complexity management	management systems	management systems	management systems	management systems
Rennung, F., Paschek, D., **Dufour,C.M.,** Draghici A. (2018b) Managing Complexity in Large-Scale Business Projects. Experimental Validation of the Proposed Model	Data security	technology	technology	technology	technology

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Rennung, F., Paschek, D., **Dufour,C.M.,** Draghici A. (2018b) Managing Complexity in Large-Scale Business Projects. Experimental Validation of the Proposed Model	Know-how	education	education	education	education
Rennung, F., Paschek, D., **Dufour,C.M.,** Draghici A. (2018b) Managing Complexity in Large-Scale Business Projects. Experimental Validation of the Proposed Model	Process evolution	method	method	technology	management systems
Rennung, F., Paschek, D., **Dufour,C.M.,** Draghici A. (2018b) Managing Complexity in Large-Scale Business Projects. Experimental Validation of the Proposed Model	Product/service indivualization	technology	technology	organizational culture	organizational culture
Rennung, F., Paschek, D., **Dufour,C.M.,** Draghici A. (2018b) Managing Complexity in Large-Scale Business Projects. Experimental Validation of the Proposed Model	Complex value chain	management systems	management systems	management systems	management systems
Rennung, F., Paschek, D., **Dufour,C.M.,** Draghici A. (2018b) Managing Complexity in Large-Scale Business Projects. Experimental Validation of the Proposed Model	Market volatility	external factors	EXTERNAL FACTORS	external factors	external factors

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Rennung, F., Paschek, D., **Dufour,C.M.,** Draghici A. (2018b) Managing Complexity in Large-Scale Business Projects. Experimental Validation of the Proposed Model	Demand volatility	external factors	EXTERNAL FACTORS	external factors	external factors
Rennung, F., Paschek, D., **Dufour,C.M.,** Draghici A. (2018b) Managing Complexity in Large-Scale Business Projects. Experimental Validation of the Proposed Model	Client-oriented Product life cycle	method	method	management systems	management systems
Rennung, F., Paschek, D., **Dufour,C.M.,** Draghici A. (2018b) Managing Complexity in Large-Scale Business Projects. Experimental Validation of the Proposed Model	Limited focus	responsibility	responsibility	responsibility	responsibility
Rennung, F., Paschek, D., **Dufour,C.M.,** Draghici A. (2018b) Managing Complexity in Large-Scale Business Projects. Experimental Validation of the Proposed Model	Fragmented organization	management systems	management systems	management systems	management systems
Rennung, F., Paschek, D., **Dufour,C.M.,** Draghici A. (2018b) Managing Complexity in Large-Scale Business Projects. Experimental Validation of the Proposed Model	Dynamic environment	external factors	EXTERNAL FACTORS	external factors	external factors

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Rennung, F., Paschek, D., **Dufour,C.M.,** Draghici A. (2018b) Managing Complexity in Large-Scale Business Projects. Experimental Validation of the Proposed Model	Appropriate measures	measurement	measurement	management systems	management systems
Dufour, C., Pana, A.M., Dumitrel, G.A, Draghici, A. (2021), Occupational health and safety in higher education: case-study for the implementation of the knowledge-creating spiral	Formal higher education	education	education	education	education
Dufour, C., Pana, A.M., Dumitrel, G.A, Draghici, A. (2021), Occupational health and safety in higher education: case-study for the implementation of the knowledge-creating spiral	Prevention and protection plan	management systems	legislation	management systems	management systems
Dufour, C., Pana, A.M., Dumitrel, G.A, Draghici, A. (2021), Occupational health and safety in higher education: case-study for the implementation of the knowledge-creating spiral	Knowledge generation/creation	objective	objective	organizational culture	management systems

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Pana, A.M., Dumitrel, G.A, Draghici, A. (2021), Occupational health and safety in higher education: case-study for the implementation of the knowledge-creating spiral	traditional and specific professional knowledge, while developing their abilities, skills and appropriate attitudes.	objective	objective	organizational culture	education
Dufour, C., Pana, A.M., Dumitrel, G.A, Draghici, A. (2021), Occupational health and safety in higher education: case-study for the implementation of the knowledge-creating spiral	Task accomplishment	objective	objective	management systems	management systems
Dufour, C., Pana, A.M., Dumitrel, G.A, Draghici, A. (2021), Occupational health and safety in higher education: case-study for the implementation of the knowledge-creating spiral	holistic professionals	education	education	education	organizational culture
Dufour, C., Pana, A.M., Dumitrel, G.A, Draghici, A. (2021), Occupational health and safety in higher education: case-study for the implementation of the knowledge-creating spiral	organizational safety culture	objective	objective	management systems	management systems

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Pana, A.M., Dumitrel, G.A, Draghici, A. (2021), Occupational health and safety in higher education: case-study for the implementation of the knowledge-creating spiral	organizational objectives	objective	objective	management systems	management systems
Dufour, C., Pana, A.M., Dumitrel, G.A, Draghici, A. (2021), Occupational health and safety in higher education: case-study for the implementation of the knowledge-creating spiral	laboratory courses	education	education	education	education
Dufour, C., Pana, A.M., Dumitrel, G.A, Draghici, A. (2021), Occupational health and safety in higher education: case-study for the implementation of the knowledge-creating spiral	theoretical knowledge and skill development	objective	objective	education	education
Dufour, C., Pana, A.M., Dumitrel, G.A, Draghici, A. (2021), Occupational health and safety in higher education: case-study for the implementation of the knowledge-creating spiral	safety rules: laws regulations	legislation	legislation	external factors	external factors

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Pana, A.M., Dumitrel, G.A, Draghici, A. (2021), Occupational health and safety in higher education: case-study for the implementation of the knowledge-creating spiral	sustainable jobs and practices	value	value	organizational culture	organizational culture
Dufour, C., Pana, A.M., Dumitrel, G.A, Draghici, A. (2021), Occupational health and safety in higher education: case-study for the implementation of the knowledge-creating spiral	role of education	education	education	education	education
Dufour, C., Pana, A.M., Dumitrel, G.A, Draghici, A. (2021), Occupational health and safety in higher education: case-study for the implementation of the knowledge-creating spiral	knowledge channel	infrastructure	infrastructure	management systems	management systems
Dufour, C., Pana, A.M., Dumitrel, G.A, Draghici, A. (2021), Occupational health and safety in higher education: case-study for the implementation of the knowledge-creating spiral	risk management	management systems	method	management systems	management systems

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Pana, A.M., Dumitrel, G.A, Draghici, A. (2021), Occupational health and safety in higher education: case-study for the implementation of the knowledge-creating spiral	employer representative	management systems	leadership	leadership	leadership
Dufour, C., Pana, A.M., Dumitrel, G.A, Draghici, A. (2021), Occupational health and safety in higher education: case-study for the implementation of the knowledge-creating spiral	teaching tool	education	education	education	education
Dufour, C., Pana, A.M., Dumitrel, G.A, Draghici, A. (2021), Occupational health and safety in higher education: case-study for the implementation of the knowledge-creating spiral	legal requirement	legislation	legislation	external factors	external factors
Dufour, C., Pana, A.M., Dumitrel, G.A, Draghici, A. (2021), Occupational health and safety in higher education: case-study for the implementation of the knowledge-creating spiral	prevention and protection plan	legislation	legislation	external factors	external factors

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Pana, A.M., Dumitrel, G.A, Draghici, A. (2021), Occupational health and safety in higher education: case-study for the implementation of the knowledge-creating spiral	awareness	objective	objective	organizational culture	organizational culture
Dufour, C., Pana, A.M., Dumitrel, G.A, Draghici, A. (2021), Occupational health and safety in higher education: case-study for the implementation of the knowledge-creating spiral	knowledge dissemination	objective	objective	organizational culture	management systems
Dufour, C., Pana, A.M., Dumitrel, G.A, Draghici, A. (2021), Occupational health and safety in higher education: case-study for the implementation of the knowledge-creating spiral	tacit/explicit knowledge	asset	asset	management systems	management systems
Dufour, C., Pana, A.M., Dumitrel, G.A, Draghici, A. (2021), Occupational health and safety in higher education: case-study for the implementation of the knowledge-creating spiral	socialization	method	method	management systems	management systems

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Pana, A.M., Dumitrel, G.A, Draghici, A. (2021), Occupational health and safety in higher education: case-study for the implementation of the knowledge-creating spiral	articulation	method	method	management systems	management systems
Dufour, C., Pana, A.M., Dumitrel, G.A, Draghici, A. (2021), Occupational health and safety in higher education: case-study for the implementation of the knowledge-creating spiral	combination	method	method	management systems	management systems
Dufour, C., Pana, A.M., Dumitrel, G.A, Draghici, A. (2021), Occupational health and safety in higher education: case-study for the implementation of the knowledge-creating spiral	internalization	method	method	management systems	management systems
Dufour, C., Pana, A.M., Dumitrel, G.A, Draghici, A. (2021), Occupational health and safety in higher education: case-study for the implementation of the knowledge-creating spiral	risk assessment methodology	method	method	management systems	management systems

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Pana, A.M., Dumitrel, G.A, Draghici, A. (2021), Occupational health and safety in higher education: case-study for the implementation of the knowledge-creating spiral	knowledge (transfer) channel	infrastructure	infrastructure	management systems	management systems
Dufour, C., Pana, A.M., Dumitrel, G.A, Draghici, A. (2021), Occupational health and safety in higher education: case-study for the implementation of the knowledge-creating spiral	attitudes and skills	education	education	education	education
Dufour, C., Pana, A.M., Dumitrel, G.A, Draghici, A. (2021), Occupational health and safety in higher education: case-study for the implementation of the knowledge-creating spiral	teacher as trainer	education	education	education	education
Dufour, C., Pana, A.M., Dumitrel, G.A, Draghici, A. (2021), Occupational health and safety in higher education: case-study for the implementation of the knowledge-creating spiral	skill acquisition	education	education	education	education

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Pana, A.M., Dumitrel, G.A, Draghici, A. (2021), Occupational health and safety in higher education: case-study for the implementation of the knowledge-creating spiral	knowledge aims (theoretical knowledge, reasoning, problem-solving, work attitude and technical skills)	education	education	education	education
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Organizational mission	organizational culture	organizational culture	organizational culture	organizational culture
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Organizational goals	organizational culture	organizational culture	organizational culture	organizational culture
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Organizational practices	management systems	management systems	management systems	management systems
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Sustainable developpement dimensions: social, economical, environmental	objective	responsibility	organizational culture	organizational culture

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	OHS embedded in sustainability	objective	objective	organizational culture	organizational culture
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Innovation /innovative measures	objective	objective	organizational culture	organizational culture
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Leadership	leadership	leadership	leadership	leadership
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Beyond compliance	objective	objective	organizational culture	organizational culture
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Stakeholder links	relationship	relationship	contextualization	contextualization
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Partnerships	relationship	relationship	contextualization	contextualization

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Safety culture at work	safety culture	safety culture	organizational culture	organizational culture
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Measurements	measurement	measurement	management systems	management systems
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Reporting	measurement	measurement	management systems	management systems
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Standards	management systems	management systems	management systems	management systems
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Certification	management systems	management systems	management systems	management systems
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Research	education	education	education	education

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Investment	method	method	management systems	management systems
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Bruntland commission report: "Protecting the safety and health of employees was a requirement set out in the Brundtland Commission report. The report was published in 1987. Organizations have to deal with the management of risks and dangers at work to protect the health and safety of their employees."	infrastructure	infrastructure	organizational culture	organizational culture

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Risk management	risk assessment	risk assessment	management systems	management systems
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Employee engagement	objective	objective	organizational culture	organizational culture
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Innovation opportunities	external factors	organizational culture	external factors	external factors
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Business performance	measurement	measurement	management systems	management systems
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Education	education	education	education	education
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	In-depth expertise	education	education	education	education

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	assessment and monitoring of safety and environmental performance	method	method	management systems	management systems
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	OSH promotes and maintains the highest physical, mental and social level for the well-being of workers in all organizational occupations.	value	value	organizational culture	organizational culture
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Child labor	responsibility	responsibility + legislation	responsibility	responsibility
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Practices	good practices	good practices	organizational culture	organizational culture
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Fatal/non-fatal accidents	objective	objective	management systems	management systems

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		Author	Independent Reviewer	Author	Independent Reviewer
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Education	education	education	education	education
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Training	education	education	education	education
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Globalization trends	external factors	EXTERNAL FACTORS	external factors	external factors
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Stakeholder value	measurement	measurement	organizational culture	organizational culture
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Aggregation of practices, disciplines, education and reporting	management systems	management systems	management systems	management systems
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Social needs	values	values	organizational culture	organizational culture

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Competition for natural resources	method	method	external factors	external factors
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Climate change	external factors	EXTERNAL FACTORS	external factors	external factors
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Pollution	management systems	management systems	management systems	management systems
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Nutrition	objective	objective	organizational culture	organizational culture
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	recycling, re-use, renewable energy production, and corporate social responsibility	method	method	management systems	management systems
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	UN's Sustainable Development Goals	objective	objective	management systems	organizational culture

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		Author	Independent Reviewer	Author	Independent Reviewer
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Safety of society	value	value	external factors	organizational culture
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Value to communities	value	value	organizational culture	organizational culture
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	sustainable economy and the environment	objective	objective	organizational culture	organizational culture
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	we talk about people, we talk about safety, health, development	value	value	organizational culture	organizational culture
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	economy: expected result	measurement	measurement	management systems	management systems
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	organizational culture	organizational culture	organizational culture	organizational culture	organizational culture

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	occupational accidents, diseases and costs	objective	objective	management systems	management systems
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	innovation of safety and health at work	objective	objective	education	education
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	stakeholder expectations	relationship	relationship	external factors	external factors
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	3Ps: people, planet, profit	value	value	organizational culture	organizational culture
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	OHS practices	good practices	good practices	management systems	management systems
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Safe jobs and healthy employees are the premises for sustainable jobs	value	value	organizational culture	organizational culture

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Improving working condition	objective	objective	management systems	management systems
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Workplace innovation and technology – technology is one of the most effective ways to improve working conditions and achieve competitive results.	technology	technology	organizational culture	organizational culture

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		Author	Independent Reviewer	Author	Independent Reviewer
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Education – Employee education contributes to the understanding and learning of organizational best practices. Continuous employee training can help reduce work- related accidents. Training courses for employees are directly linked to the creation of sustainable jobs.	education	education	education	education

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		Author	Independent Reviewer	Author	Independent Reviewer
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Organizational culture - culture is dynamic, it varies from society to society and requires an analysis of social culture when it comes to improving the working environment. Social culture contributes to the development of organizational culture through its actions for people.	organizational culture	organizational culture	organizational culture	organizational culture
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Improving strategic decisions – stakeholders should take the best strategic decisions for the organization, based on employee health and safety.	management systems	leadership	leadership	leadership

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		Author	Independent Reviewer	Author	Independent Reviewer
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	Workplace control – control of workplaces through appropriate techniques and methodologies contributes to reducing occupational risks and increasing job security	method	method	management systems	management systems
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	workplace education, workplace innovation, safety and health, environmental control	infrastructure	organizational culture	organizational culture	organizational culture
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C**. (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	new organizational management style	management systems	management systems	management systems	management systems
Ivascu, L., Artene, A., Turi, A., Balan, M., and **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits.	long-term effects of culture, technology and politics	organizational culture	organizational culture	external factors	external factors

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Gaureanu, A., Ivascu, L., **Doufur, C.** (2019). Highlights of OSH training quality: continuous training of trainers.	Preventive training /corrective training	education	education	education	education
Gaureanu, A., Ivascu, L., **Doufur, C.** (2019). Highlights of OSH training quality: continuous training of trainers.	Employer obligation	responsibility	responsibility	responsibility	responsibility
Gaureanu, A., Ivascu, L., **Doufur, C.** (2019). Highlights of OSH training quality: continuous training of trainers.	Quality of training	education	education	education	education
Gaureanu, A., Ivascu, L., **Doufur, C.** (2019). Highlights of OSH training quality: continuous training of trainers.	Instructor competence	education	education	education	education
Gaureanu, A., Ivascu, L., **Doufur, C.** (2019). Highlights of OSH training quality: continuous training of trainers.	work accidents	objective	objective	management systems	management systems
Gaureanu, A., Ivascu, L., **Doufur, C.** (2019). Highlights of OSH training quality: continuous training of trainers.	accident costs	objective	objective	management systems	management systems

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Gaureanu, A., Ivascu, L., **Doufur, C.** (2019). Highlights of OSH training quality: continuous training of trainers.	OHS culture	safety culture	safety culture	organizational culture	organizational culture
Gaureanu, A., Ivascu, L., **Doufur, C.** (2019). Highlights of OSH training quality: continuous training of trainers.	Knowledge management principles	method	method	management systems	management systems
Gaureanu, A., Ivascu, L., **Doufur, C.** (2019). Highlights of OSH training quality: continuous training of trainers.	Safety culture	objective	organizational culture	organizational culture	organizational culture
Gaureanu, A., Ivascu, L., **Doufur, C.** (2019). Highlights of OSH training quality: continuous training of trainers.	Education	education	education	education	education
Gaureanu, A., Ivascu, L., **Doufur, C.** (2019). Highlights of OSH training quality: continuous training of trainers.	Knowledge transfers	objective	objective	management systems	management systems

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Gaureanu, A., Ivascu, L., **Doufur, C.** (2019). Highlights of OSH training quality: continuous training of trainers.	Generational approach	management systems	management systems	external factors	external factors
Gaureanu, A., Ivascu, L., **Doufur, C.** (2019). Highlights of OSH training quality: continuous training of trainers.	Training Beneficiary capabilities	education	education	education	education
Gaureanu, A., Ivascu, L., **Doufur, C.** (2019). Highlights of OSH training quality: continuous training of trainers.	Prevention and Protection Plan (PPP)	legislation	legislation	external factors	external factors
Gaureanu, A., Ivascu, L., **Doufur, C.** (2019). Highlights of OSH training quality: continuous training of trainers.	Risk assessment	risk assessment	risk assessment	management systems	management systems
Gaureanu, A., Ivascu, L., **Doufur, C.** (2019). Highlights of OSH training quality: continuous training of trainers.	internal entity with a participatory role in OSH decisions (OHS committee, work delegate)	responsibility	responsibility	management systems	management systems

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		Author	Independent Reviewer	Author	Independent Reviewer
Gaureanu, A., Ivascu, L., **Doufur, C.** (2019). Highlights of OSH training quality: continuous training of trainers.	compliance activity	responsibility	responsibility	management systems	management systems
Gaureanu, A., Ivascu, L., **Doufur, C.** (2019). Highlights of OSH training quality: continuous training of trainers.	continuous education	education	education	education	education
Gaureanu, A., Ivascu, L., **Doufur, C.** (2019). Highlights of OSH training quality: continuous training of trainers.	stimulation of creativity	values	values	organizational culture	organizational culture
Gaureanu, A., Ivascu, L., **Doufur, C.** (2019). Highlights of OSH training quality: continuous training of trainers.	legislation	legislation	legislation	external factors	external factors
Gaureanu, A., Ivascu, L., **Doufur, C.** (2019). Highlights of OSH training quality: continuous training of trainers.	Quality standards	management systems	management systems	management systems	management systems
Gaureanu, A., Ivascu, L., **Doufur, C.** (2019). Highlights of OSH training quality: continuous training of trainers.	Managerial competence	education	education	education	education

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Gaureanu, A., Ivascu, L., **Doufur, C.** (2019). Highlights of OSH training quality: continuous training of trainers.	Educational system as a contributor	education	education	education	education
Gaureanu, A., Ivascu, L., **Doufur, C.** (2019). Highlights of OSH training quality: continuous training of trainers.	Legal requirements	legislation	legislation	external factors	external factors
Gaureanu, A., Ivascu, L., **Doufur, C.** (2019). Highlights of OSH training quality: continuous training of trainers.	Study programs	education	education	education	education
Gaureanu, A., Ivascu, L., **Doufur, C.** (2019). Highlights of OSH training quality: continuous training of trainers.	Safety attitude	objective	organizational culture	organizational culture	organizational culture
Dufour, C., Pana, A. M., Dumitrel, G.A. (2019). Occupational Health and Safety Education: the Prevention and Protection Plan In University Chemical Laboratories	University education	education	education	education	education

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Pana, A. M., Dumitrel, G.A. (2019). Occupational Health and Safety Education: the Prevention and Protection Plan In University Chemical Laboratories	core-knowledge	asset	asset	organizational culture	organizational culture
Dufour, C., Pana, A. M., Dumitrel, G.A. (2019). Occupational Health and Safety Education: the Prevention and Protection Plan In University Chemical Laboratories	knowledge for safe operations	asset	asset	education	education
Dufour, C., Pana, A. M., Dumitrel, G.A. (2019). Occupational Health and Safety Education: the Prevention and Protection Plan In University Chemical Laboratories	risk assessment	risk assessment	risk assessment	management systems	management systems
Dufour, C., Pana, A. M., Dumitrel, G.A. (2019). Occupational Health and Safety Education: the Prevention and Protection Plan In University Chemical Laboratories	pedagogical methods	method	method	education	education
Dufour, C., Pana, A. M., Dumitrel, G.A. (2019). Occupational Health and Safety Education: the Prevention and Protection Plan In University Chemical Laboratories	adequate behavior	organizational culture	organizational culture	education	education

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		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Pana, A. M., Dumitrel, G.A. (2019). Occupational Health and Safety Education: the Prevention and Protection Plan In University Chemical Laboratories	sustainable work environment	objective	objective	management systems	management systems
Dufour, C., Pana, A. M., Dumitrel, G.A. (2019). Occupational Health and Safety Education: the Prevention and Protection Plan In University Chemical Laboratories	knowledge management	management systems	management systems	management systems	management systems
Dufour, C., Pana, A. M., Dumitrel, G.A. (2019). Occupational Health and Safety Education: the Prevention and Protection Plan In University Chemical Laboratories	knowledge transfer channel	infrastructure	communication	management systems	management systems
Dufour, C., Pana, A. M., Dumitrel, G.A. (2019). Occupational Health and Safety Education: the Prevention and Protection Plan In University Chemical Laboratories	protection and prevention plan	legislation	method //DOUBLON	external factors	management systems
Dufour, C., Pana, A. M., Dumitrel, G.A. (2019). Occupational Health and Safety Education: the Prevention and Protection Plan In University Chemical Laboratories	legislation	legislation	legislation	external factors	external factors

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		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Pana, A. M., Dumitrel, G.A. (2019). Occupational Health and Safety Education: the Prevention and Protection Plan In University Chemical Laboratories	traditional and industry-specific OHS risks	risk assessment	risk assessment	management systems	management systems
Dufour, C., Pana, A. M., Dumitrel, G.A. (2019). Occupational Health and Safety Education: the Prevention and Protection Plan In University Chemical Laboratories	risk identification	risk assessment	risk assessment	management systems	management systems
Dufour, C., Pana, A. M., Dumitrel, G.A. (2019). Occupational Health and Safety Education: the Prevention and Protection Plan In University Chemical Laboratories	risk mitigation	risk assessment	risk assessment	management systems	management systems
Dufour, C., Pana, A. M., Dumitrel, G.A. (2019). Occupational Health and Safety Education: the Prevention and Protection Plan In University Chemical Laboratories	theoretical learning	education	education	education	education
Dufour, C., Pana, A. M., Dumitrel, G.A. (2019). Occupational Health and Safety Education: the Prevention and Protection Plan In University Chemical Laboratories	skill development	education	education	education	education

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Pana, A. M., Dumitrel, G.A. (2019). Occupational Health and Safety Education: the Prevention and Protection Plan In University Chemical Laboratories	worker duties and responsibilities	relationship	relationship	Responsibility	Responsibility
Dufour, C., Pana, A. M., Dumitrel, G.A. (2019). Occupational Health and Safety Education: the Prevention and Protection Plan In University Chemical Laboratories	Teachers as instructors and safety representatives	relationship	relationship	education	education
Dufour, C., Pana, A. M., Dumitrel, G.A. (2019). Occupational Health and Safety Education: the Prevention and Protection Plan In University Chemical Laboratories	hazard identification, risk assessment and preventive measures	risk assessment	risk assessment	management systems	management systems
Dufour, C., Pana, A. M., Dumitrel, G.A. (2019). Occupational Health and Safety Education: the Prevention and Protection Plan In University Chemical Laboratories	education has been a driver for developing knowledge, skills and desired attitudes	values	values	organizational culture	education
Dufour, C., Pana, A. M., Dumitrel, G.A. (2019). Occupational Health and Safety Education: the Prevention and Protection Plan In University Chemical Laboratories	knowledge generation	objective	objective	management systems	management systems

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Pana, A. M., Dumitrel, G.A. (2019). Occupational Health and Safety Education: the Prevention and Protection Plan In University Chemical Laboratories	OHS behavioral objective	objective	objective	management systems	management systems
Dufour, C., Pana, A. M., Dumitrel, G.A. (2019). Occupational Health and Safety Education: the Prevention and Protection Plan In University Chemical Laboratories	behavioral rules	organizational culture	organizational culture	organizational culture	organizational culture
Dufour, C., Pana, A. M., Dumitrel, G.A. (2019). Occupational Health and Safety Education: the Prevention and Protection Plan In University Chemical Laboratories	working conditions	infrastructure	infrastructure	management systems	management systems
Dufour, C., Pana, A. M., Dumitrel, G.A. (2019). Occupational Health and Safety Education: the Prevention and Protection Plan In University Chemical Laboratories	student and personnel awareness	education	education	education	education
Dufour, C., Pana, A. M., Dumitrel, G.A. (2019). Occupational Health and Safety Education: the Prevention and Protection Plan In University Chemical Laboratories	the knowledge creating spiral	method	method	management systems	management systems

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Pana, A. M., Dumitrel, G.A. (2019). Occupational Health and Safety Education: the Prevention and Protection Plan In University Chemical Laboratories	face-to-face intervention	method	method	management systems	management systems
Dufour, C., Pana, A. M., Dumitrel, G.A. (2019). Occupational Health and Safety Education: the Prevention and Protection Plan In University Chemical Laboratories	University - industry knowledge transfer channel	infrastructure	infrastructure	management systems	management systems
Dufour, C., Pana, A. M., Dumitrel, G.A. (2019). Occupational Health and Safety Education: the Prevention and Protection Plan In University Chemical Laboratories	formal higher education	education	education	education	education

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C. M., and Draghici, A. (2018). Gas distribution companies: How can knowledge management promote occupational health and safety?.	KM Generational turnover: Generational turnover is a pending KM issue, visible at certain moments in time and being solved by one-shot interventions but requiring more strategic reflections on KM. This implies that the tacit knowledge remains within the company for many years (decades) and that retirement can cause a knowledge gap.	effects	effects	external factors	external factors

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C. M., and Draghici, A. (2018). Gas distribution companies: How can knowledge management promote occupational health and safety?.	KM Technological turnover: common KM issue as a technological bump causes an input of knowledge with a short-term vision on KM which comprises training, assessment of knowledge and know-how acquisition.	effects	effects	technology	technology

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C. M., and Draghici, A. (2018). Gas distribution companies: How can knowledge management promote occupational health and safety?.	Knowledge obsolescence spiral: new technologies arise and the use of older technologies is limited, knowledge being lost through lack of practice and lack of transmission. The obsolescence of technologies and the inherent decline in number of technical interventions cause an obsolescence spiral of OHS knowledge	effects	effects	management systems	management systems

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		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C. M., and Draghici, A. (2018). Gas distribution companies: How can knowledge management promote occupational health and safety?.	context and the organization culture through extensive assessment and mapping of the knowledge ecosystem.	method	method	management systems	management systems
Dufour, C. M., and Draghici, A. (2018). Gas distribution companies: How can knowledge management promote occupational health and safety?.	Knowledge-gaps	effects	effects	education	education
Dufour, C. M., and Draghici, A. (2018). Gas distribution companies: How can knowledge management promote occupational health and safety?.	Tacit knowledge	asset	asset	education	education
Dufour, C. M., and Draghici, A. (2018). Gas distribution companies: How can knowledge management promote occupational health and safety?.	assimilating OHS-knowledge by embedding it into technical knowledge.	method	method	education	education

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C. M., and Draghici, A. (2018). Gas distribution companies: How can knowledge management promote occupational health and safety?.	Experts/champios: highly-skilled operators, recognition by both hierarchy and peers.	relationship	leadership	leadership	leadership
Dufour, C. M., and Draghici, A. (2018). Gas distribution companies: How can knowledge management promote occupational health and safety?.	Knowledge-disseminators	organizational culture	method	management systems	management systems
Dufour, C. M., and Draghici, A. (2018). Gas distribution companies: How can knowledge management promote occupational health and safety?.	Organizational redundancy: method to achieve reliability and knowledge dissemination between the managerial line (ML) and the expertise line (EL) on two levels: structural and cultural	method	method	management systems	management systems

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C. M., and Draghici, A. (2018). Gas distribution companies: How can knowledge management promote occupational health and safety?.	Competence transfer	management systems	management systems	management systems	management systems
Dufour, C. M., and Draghici, A. (2018). Gas distribution companies: How can knowledge management promote occupational health and safety?.	Responsibility transfer	responsibility	management systems	responsibility	responsibility
Dufour, C. M., and Draghici, A. (2018). Gas distribution companies: How can knowledge management promote occupational health and safety?.	Measurement tools	measurement	measurement	management systems	management systems
Dufour, C. M., and Draghici, A. (2018). Gas distribution companies: How can knowledge management promote occupational health and safety?.	Share-fairs	education	education	education	education
Dufour, C. M., and Draghici, A. (2018). Gas distribution companies: How can knowledge management promote occupational health and safety?.	Literacy	education	education	education	education

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C. M., and Draghici, A. (2018). Gas distribution companies: How can knowledge management promote occupational health and safety?.	Narrative Management	education	education	education	education
Paschek, D., Mocan, A., **Dufour, C.** M., and Draghici, A. (2017, December). Organizational knowledge management with Big Data. The foundation of using Artificial Intelligence.	Knowledge management	method	method	management systems	management systems
Paschek, D., Mocan, A., **Dufour, C.** M., and Draghici, A. (2017, December). Organizational knowledge management with Big Data. The foundation of using Artificial Intelligence.	Data	infrastructure	asset	management systems	management systems
Paschek, D., Mocan, A., **Dufour, C.** M., and Draghici, A. (2017, December). Organizational knowledge management with Big Data. The foundation of using Artificial Intelligence.	Information	infrastructure	asset	management systems	management systems

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Paschek, D., Mocan, A., **Dufour, C.** M., and Draghici, A. (2017, December). Organizational knowledge management with Big Data. The foundation of using Artificial Intelligence.	Decision	responsibility	responsibility	leadership	leadership
Paschek, D., Mocan, A., **Dufour, C.** M., and Draghici, A. (2017, December). Organizational knowledge management with Big Data. The foundation of using Artificial Intelligence.	Organizational learning	education	education	management systems	education
Paschek, D., Mocan, A., **Dufour, C.** M., and Draghici, A. (2017, December). Organizational knowledge management with Big Data. The foundation of using Artificial Intelligence.	Human resource management	management systems	management systems	management systems	management systems
Paschek, D., Mocan, A., **Dufour, C.** M., and Draghici, A. (2017, December). Organizational knowledge management with Big Data. The foundation of using Artificial Intelligence.	KPI	measurement	measurement	management systems	management systems

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Paschek, D., Mocan, A., **Dufour, C.** M., and Draghici, A. (2017, December). Organizational knowledge management with Big Data. The foundation of using Artificial Intelligence.	Product improvement	organizational culture	objective	management systems	management systems
Paschek, D., Mocan, A., **Dufour, C.** M., and Draghici, A. (2017, December). Organizational knowledge management with Big Data. The foundation of using Artificial Intelligence.	Big data	infrastructure	infrastructure	management systems	management systems
Paschek, D., Mocan, A., **Dufour, C.** M., and Draghici, A. (2017, December). Organizational knowledge management with Big Data. The foundation of using Artificial Intelligence.	Knowledge transfer	method	method	management systems	management systems
Paschek, D., Mocan, A., **Dufour, C.** M., and Draghici, A. (2017, December). Organizational knowledge management with Big Data. The foundation of using Artificial Intelligence.	HR processes	management systems	management systems	management systems	management systems

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Paschek, D., Mocan, A., **Dufour, C.** M., and Draghici, A. (2017, December). Organizational knowledge management with Big Data. The foundation of using Artificial Intelligence.	Employee integration and education	education	education	education	management systems
Paschek, D., Mocan, A., **Dufour, C.** M., and Draghici, A. (2017, December). Organizational knowledge management with Big Data. The foundation of using Artificial Intelligence.	Employee knowledge	asset	asset	education	education
Paschek, D., Mocan, A., **Dufour, C.** M., and Draghici, A. (2017, December). Organizational knowledge management with Big Data. The foundation of using Artificial Intelligence.	Staff retirement	management systems	management systems	external factors	external factors
Paschek, D., Mocan, A., **Dufour, C.** M., and Draghici, A. (2017, December). Organizational knowledge management with Big Data. The foundation of using Artificial Intelligence.	Competencies	education	education	education	education

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Paschek, D., Mocan, A., **Dufour, C.** M., and Draghici, A. (2017, December). Organizational knowledge management with Big Data. The foundation of using Artificial Intelligence.	Asset	asset	asset	management systems	management systems
Paschek, D., Mocan, A., **Dufour, C.** M., and Draghici, A. (2017, December). Organizational knowledge management with Big Data. The foundation of using Artificial Intelligence.	Obsolete knowledge	asset	management systems	management systems	management systems
Paschek, D., Mocan, A., **Dufour, C.** M., and Draghici, A. (2017, December). Organizational knowledge management with Big Data. The foundation of using Artificial Intelligence.	skill and competencies development	education	education	education	education
Paschek, D., Mocan, A., **Dufour, C.** M., and Draghici, A. (2017, December). Organizational knowledge management with Big Data. The foundation of using Artificial Intelligence.	Decision-making base	responsibility	responsibility	contextualization	management systems

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		Author	Independent Reviewer	Author	Independent Reviewer
Paschek, D., Mocan, A., **Dufour, C.** M., and Draghici, A. (2017, December). Organizational knowledge management with Big Data. The foundation of using Artificial Intelligence.	Collection system (data, information, knowledge)	infrastructure	infrastructure	contextualization	management systems
Paschek, D., Mocan, A., **Dufour, C.** M., and Draghici, A. (2017, December). Organizational knowledge management with Big Data. The foundation of using Artificial Intelligence.	KM System implementation	infrastructure	infrastructure	contextualization	management systems
Paschek, D., Mocan, A., **Dufour, C.** M., and Draghici, A. (2017, December). Organizational knowledge management with Big Data. The foundation of using Artificial Intelligence.	Entrepreneurial knowledge acquisition	objective	objective	management systems	management systems
Paschek, D., Mocan, A., **Dufour, C.** M., and Draghici, A. (2017, December). Organizational knowledge management with Big Data. The foundation of using Artificial Intelligence.	Lessons learned	education	education	education	education

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		Author	Independent Reviewer	Author	Independent Reviewer
Paschek, D., Mocan, A., **Dufour, C.** M., and Draghici, A. (2017, December). Organizational knowledge management with Big Data. The foundation of using Artificial Intelligence.	Knowledge development	objective	objective	management systems	management systems
Paschek, D., Mocan, A., **Dufour, C.** M., and Draghici, A. (2017, December). Organizational knowledge management with Big Data. The foundation of using Artificial Intelligence.	Knowledge is a perception	value	value	organizational culture	organizational culture
Paschek, D., Mocan, A., **Dufour, C.** M., and Draghici, A. (2017, December). Organizational knowledge management with Big Data. The foundation of using Artificial Intelligence.	Knowledge has a life span	effects	effects	organizational culture	organizational culture
Paschek, D., Mocan, A., **Dufour, C.** M., and Draghici, A. (2017, December). Organizational knowledge management with Big Data. The foundation of using Artificial Intelligence.	Knowledge can be lost	effects	effects	organizational culture	organizational culture

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Paschek, D., Mocan, A., **Dufour, C.** M., and Draghici, A. (2017, December). Organizational knowledge management with Big Data. The foundation of using Artificial Intelligence.	Knowledge is not indefinitely true	effects	effects	organizational culture	organizational culture
Paschek, D., Mocan, A., **Dufour, C.** M., and Draghici, A. (2017, December). Organizational knowledge management with Big Data. The foundation of using Artificial Intelligence.	Support HR	management systems	management systems	management systems	management systems
Gaureanu, A., Mocan, A., Weinschrott, H., and **Dufour, C.** (2017). A Proposed Model for Evaluate Organizational Safety Culture.	Safety culture	objective	organizational culture	organizational culture	organizational culture
Gaureanu, A., Mocan, A., Weinschrott, H., and **Dufour, C.** (2017). A Proposed Model for Evaluate Organizational Safety Culture.	Training/instruction	education	education	education	education

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Gaureanu, A., Mocan, A., Weinschrott, H., and **Dufour, C.** (2017). A Proposed Model for Evaluate Organizational Safety Culture.	Organizational behavior	organizational culture	organizational culture	organizational culture	management systems
Gaureanu, A., Mocan, A., Weinschrott, H., and **Dufour, C.** (2017). A Proposed Model for Evaluate Organizational Safety Culture.	Safety leadership	relationship	leadership	leadership	leadership
Gaureanu, A., Mocan, A., Weinschrott, H., and **Dufour, C.** (2017). A Proposed Model for Evaluate Organizational Safety Culture.	proactive safety initiatives into practices	management systems	method	management systems	management systems
Gaureanu, A., Mocan, A., Weinschrott, H., and **Dufour, C.** (2017). A Proposed Model for Evaluate Organizational Safety Culture.	preventive measures for occupational health and safety	method	method	management systems	management systems
Gaureanu, A., Mocan, A., Weinschrott, H., and **Dufour, C.** (2017). A Proposed Model for Evaluate Organizational Safety Culture.	continuous improvement approach	management systems	organizational culture	management systems	management systems

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Gaureanu, A., Mocan, A., Weinschrott, H., and **Dufour, C.** (2017). A Proposed Model for Evaluate Organizational Safety Culture.	"workers and their managers cooperatively gather and analyze information and knowledge to identify systemic causes of observed risk behaviors and the associated conditions of their development, and then elaborate and implement corrective measures to nurture safety culture"	relationship	relationship	contextualization	contextualization
Gaureanu, A., Mocan, A., Weinschrott, H., and **Dufour, C.** (2017). A Proposed Model for Evaluate Organizational Safety Culture.	safety culture assessment	safety culture	safety culture	management systems	management systems

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Gaureanu, A., Mocan, A., Weinschrott, H., and **Dufour, C.** (2017). A Proposed Model for Evaluate Organizational Safety Culture.	psychological influence	relationship	relationship	organizational culture	organizational culture
Gaureanu, A., Mocan, A., Weinschrott, H., and **Dufour, C.** (2017). A Proposed Model for Evaluate Organizational Safety Culture.	legal compliance	legislation	legislation	external factors	external factors
Gaureanu, A., Mocan, A., Weinschrott, H., and **Dufour, C.** (2017). A Proposed Model for Evaluate Organizational Safety Culture.	safety culture weaknesses identification	safety culture	safety culture	management systems	management systems
Gaureanu, A., Mocan, A., Weinschrott, H., and **Dufour, C.** (2017). A Proposed Model for Evaluate Organizational Safety Culture.	quantitative methodology	method	method	management systems	management systems
Gaureanu, A., Mocan, A., Weinschrott, H., and **Dufour, C.** (2017). A Proposed Model for Evaluate Organizational Safety Culture.	worker awareness	education	education	education	organizational culture

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		Author	Independent Reviewer	Author	Independent Reviewer
Gaureanu, A., Mocan, A., Weinschrott, H., and **Dufour, C.** (2017). A Proposed Model for Evaluate Organizational Safety Culture.	shared values	value	value	organizational culture	organizational culture
Gaureanu, A., Mocan, A., Weinschrott, H., and **Dufour, C.** (2017). A Proposed Model for Evaluate Organizational Safety Culture.	formal safety issues	risk assessment	risk assessment	management systems	management systems
Gaureanu, A., Mocan, A., Weinschrott, H., and **Dufour, C.** (2017). A Proposed Model for Evaluate Organizational Safety Culture.	learning from errors, incidents, and accidents;	education	organizational culture	organizational culture	organizational culture
Gaureanu, A., Mocan, A., Weinschrott, H., and **Dufour, C.** (2017). A Proposed Model for Evaluate Organizational Safety Culture.	resistant to change	worker participation	worker participation	organizational culture	organizational culture

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Gaureanu, A., Mocan, A., Weinschrott, H., and **Dufour, C.** (2017). A Proposed Model for Evaluate Organizational Safety Culture.	preventive measures from three perspectives: (a) technological development including up-date and implementation of protection intrinsic technical means; (b) occupational safety and health (OSH) management system definition and continuous improvement; (c) development and nurture the OSH culture.	method	method	management systems	management systems
Gaureanu, A., Mocan, A., Weinschrott, H., and **Dufour, C.** (2017). A Proposed Model for Evaluate Organizational Safety Culture.	workplace wellbeing	objective	objective	organizational culture	management systems

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		Author	Independent Reviewer	Author	Independent Reviewer
Gaureanu, A., Mocan, A., Weinschrott, H., and **Dufour, C.** (2017). A Proposed Model for Evaluate Organizational Safety Culture.	effectiveness of prevention	safety culture	effects	management systems	management systems
Gaureanu, A., Mocan, A., Weinschrott, H., and **Dufour, C.** (2017). A Proposed Model for Evaluate Organizational Safety Culture.	legal framework	legislation	legislation	external factors	external factors
Gaureanu, A., Mocan, A., Weinschrott, H., and **Dufour, C.** (2017). A Proposed Model for Evaluate Organizational Safety Culture.	decision projection	responsibility	responsibility	responsibility	responsibility
Gaureanu, A., Mocan, A., Weinschrott, H., and **Dufour, C.** (2017). A Proposed Model for Evaluate Organizational Safety Culture.	behavioral management	management systems	management systems	management systems	management systems
Gaureanu, A., Mocan, A., Weinschrott, H., and **Dufour, C.** (2017). A Proposed Model for Evaluate Organizational Safety Culture.	evaluation methods	method	method	management systems	management systems

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		Author	Independent Reviewer	Author	Independent Reviewer
Gaureanu, A., Mocan, A., Weinschrott, H., and **Dufour, C.** (2017). A Proposed Model for Evaluate Organizational Safety Culture.	legal obligations	legislation	legislation	external factors	external factors
Gaureanu, A., Mocan, A., Weinschrott, H., and **Dufour, C.** (2017). A Proposed Model for Evaluate Organizational Safety Culture.	legal responsibilities	infrastructure	responsibility	responsibility	external factors
Gaureanu, A., Mocan, A., Weinschrott, H., and **Dufour, C.** (2017). A Proposed Model for Evaluate Organizational Safety Culture.	responsible specialist in OHS	asset	organizational culture	management systems	responsibility
Gaureanu, A., Mocan, A., Weinschrott, H., and **Dufour, C.** (2017). A Proposed Model for Evaluate Organizational Safety Culture.	adaptation to change in circumstances	worker participation	worker participation	organizational culture	organizational culture
Gaureanu, A., Mocan, A., Weinschrott, H., and **Dufour, C.** (2017). A Proposed Model for Evaluate Organizational Safety Culture.	integration of prevention methods at all hierarchical levels	method	method	management systems	management systems

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		Author	Independent Reviewer	Author	Independent Reviewer
Gaureanu, A., Mocan, A., Weinschrott, H., and **Dufour, C.** (2017). A Proposed Model for Evaluate Organizational Safety Culture.	top management	worker participation	worker participation	management systems	management systems
Gaureanu, A., Mocan, A., Weinschrott, H., and **Dufour, C.** (2017). A Proposed Model for Evaluate Organizational Safety Culture.	risk control	risk assessment	risk assessment	management systems	management systems
Gaureanu, A., Mocan, A., Weinschrott, H., and **Dufour, C.** (2017). A Proposed Model for Evaluate Organizational Safety Culture.	policies	management systems	organizational culture	management systems	management systems
Gaureanu, A., Mocan, A., Weinschrott, H., and **Dufour, C.** (2017). A Proposed Model for Evaluate Organizational Safety Culture.	checks	measurement	measurement	management systems	management systems
Gaureanu, A., Mocan, A., Weinschrott, H., and **Dufour, C.** (2017). A Proposed Model for Evaluate Organizational Safety Culture.	worker feedback	worker participation	worker participation	organizational culture	organizational culture

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		Author	Independent Reviewer	Author	Independent Reviewer
Gaureanu, A., Mocan, A., Weinschrott, H., and **Dufour, C.** (2017). A Proposed Model for Evaluate Organizational Safety Culture.	OHS quantification	measurement	measurement	management systems	management systems
Gaureanu, A., Mocan, A., Weinschrott, H., and **Dufour, C.** (2017). A Proposed Model for Evaluate Organizational Safety Culture.	OHS measurement	measurement	measurement	management systems	management systems
Gaureanu, A., Mocan, A., Weinschrott, H., and **Dufour, C.** (2017). A Proposed Model for Evaluate Organizational Safety Culture.	Context adaptation	worker participation	worker participation	education	education
Gaureanu, A., Mocan, A., Weinschrott, H., and **Dufour, C.** (2017). A Proposed Model for Evaluate Organizational Safety Culture.	Collecting and structuring knowledge	objective	objective	management systems	management systems
Gaureanu, A., Draghici, A., **Dufour, C.** and Weinschrott, H. (2018, October). The Organizational Safety Culture Assessment.	Knowledge base	asset	asset	management systems	management systems

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Gaureanu, A., Draghici, A., **Dufour, C.,** and Weinschrott, H. (2018, October). The Organizational Safety Culture Assessment.	Psychological influence	relationship	relationship	external factors	organizational culture
Gaureanu, A., Draghici, A., **Dufour, C.,** and Weinschrott, H. (2018, October). The Organizational Safety Culture Assessment.	Legal compliance	legislation	legislation	external factors	external factors
Gaureanu, A., Draghici, A., **Dufour, C.,** and Weinschrott, H. (2018, October). The Organizational Safety Culture Assessment.	Safety culture assessment	safety culture	safety culture	management systems	management systems
Gaureanu, A., Draghici, A., **Dufour, C.,** and Weinschrott, H. (2018, October). The Organizational Safety Culture Assessment.	safety culture weaknesses identification	risk assessment	risk assessment	organizational culture	organizational culture

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		Author	Independent Reviewer	Author	Independent Reviewer
Gaureanu, A., Draghici, A., **Dufour, C.,** and Weinschrott, H. (2018, October). The Organizational Safety Culture Assessment.	"knowledge acquisition and structuring about the organizational safety culture can support the elaboration and implementation of appropriate preventive-corrective measures in the organization"	objective	objective	organizational culture	organizational culture
Gaureanu, A., Draghici, A., **Dufour, C.,** and Weinschrott, H. (2018, October). The Organizational Safety Culture Assessment.	Safety culture	safety culture	safety culture	organizational culture	organizational culture
Gaureanu, A., Draghici, A., **Dufour, C.,** and Weinschrott, H. (2018, October). The Organizational Safety Culture Assessment.	Safety management system	management systems	management systems	management systems	management systems
Gaureanu, A., Draghici, A., **Dufour, C.,** and Weinschrott, H. (2018, October). The Organizational Safety Culture Assessment.	Knowledge collecting	objective	objective	management systems	management systems

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		Author	Independent Reviewer	Author	Independent Reviewer
Gaureanu, A., Draghici, A., **Dufour, C.,** and Weinschrott, H. (2018, October). The Organizational Safety Culture Assessment.	Risk evaluation	risk assessment	risk assessment	management systems	management systems
Gaureanu, A., Draghici, A., **Dufour, C.,** and Weinschrott, H. (2018, October). The Organizational Safety Culture Assessment.	Information and training for workers	education	education	education	education
Gaureanu, A., Draghici, A., **Dufour, C.,** and Weinschrott, H. (2018, October). The Organizational Safety Culture Assessment.	Responsibilities	relationship	responsibility	responsibility	responsibility
Gaureanu, A., Draghici, A., **Dufour, C.,** and Weinschrott, H. (2018, October). The Organizational Safety Culture Assessment.	Top management	worker participation	worker participation	management systems	management systems
Gaureanu, A., Draghici, A., **Dufour, C.,** and Weinschrott, H. (2018, October). The Organizational Safety Culture Assessment.	knowledge, psychological influence and legal compliance	objective	objective	external factors	external factors

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., and Draghici, A. (2020). Stakeholder Management in Risk Management–Considerations on the ISO 31000 Standard. Management.	Internal and external stakeholders: stakeholders affect or are affected by the organization's behavior	relationship	relationship	contextualization	contextualization
Dufour, C., and Draghici, A. (2020). Stakeholder Management in Risk Management–Considerations on the ISO 31000 Standard. Management.	Risk management: Approaches for engaging with risk are regrouped; strategy definition and decision making, considers internal and external factors and includes interactions with stakeholders	risk assessment	risk assessment	management systems	management systems
Dufour, C., and Draghici, A. (2020). Stakeholder Management in Risk Management–Considerations on the ISO 31000 Standard. Management.	Contextual understanding of uncertainties	asset	asset	contextualization	contextualization
Dufour, C., and Draghici, A. (2020). Stakeholder Management in Risk Management–Considerations on the ISO 31000 Standard. Management.	develop robust and adapted mechanism	management systems	management systems	management systems	contextualization

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., and Draghici, A. (2020). Stakeholder Management in Risk Management–Considerations on the ISO 31000 Standard. Management.	ISO 31000	standards	standards	management systems	management systems
Dufour, C., and Draghici, A. (2020). Stakeholder Management in Risk Management–Considerations on the ISO 31000 Standard. Management.	Stakeholder identification	relationship	relationship	contextualization	contextualization
Dufour, C., and Draghici, A. (2020). Stakeholder Management in Risk Management–Considerations on the ISO 31000 Standard. Management.	Stakeholder involvement	relationship	relationship	contextualization	contextualization
Dufour, C., and Draghici, A. (2020). Stakeholder Management in Risk Management–Considerations on the ISO 31000 Standard. Management.	Stakeholder alliances	relationship	relationship	contextualization	contextualization
Dufour, C., and Draghici, A. (2020). Stakeholder Management in Risk Management–Considerations on the ISO 31000 Standard. Management.	Organizational objectives	objective	objective	management systems	management systems
Dufour, C., and Draghici, A. (2020). Stakeholder Management in Risk Management–Considerations on the ISO 31000 Standard. Management.	Organizational governance, leadership, management	leadership	leadership	management systems	management systems

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., and Draghici, A. (2020). Stakeholder Management in Risk Management–Considerations on the ISO 31000 Standard. Management.	human behavior and cultural factors	organizational culture	organizational culture	education	education
Dufour, C., and Draghici, A. (2020). Stakeholder Management in Risk Management–Considerations on the ISO 31000 Standard. Management.	consistent and dependable decision-making	responsibility	responsibility	management systems	management systems
Dufour, C., and Draghici, A. (2020). Stakeholder Management in Risk Management–Considerations on the ISO 31000 Standard. Management.	event-focusing vs. effect-focusing	management systems	organizational culture	organizational culture	organizational culture
Dufour, C., and Draghici, A. (2020). Stakeholder Management in Risk Management–Considerations on the ISO 31000 Standard. Management.	risk as an opportunity, a potential catalyst for flexibility or adaptability or market strengthening	risk assessment	risk assessment	organizational culture	organizational culture
Dufour, C., and Draghici, A. (2020). Stakeholder Management in Risk Management–Considerations on the ISO 31000 Standard. Management.	organizational objectives	objective	objective	organizational culture	organizational culture

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., and Draghici, A. (2020). Stakeholder Management in Risk Management–Considerations on the ISO 31000 Standard. Management.	stakeholder theory: Jones and Wicks (1999) have reminded that scholarly work has concluded that stakeholder theory is concerned with the nature of the organization's relationships in terms of both processes and outcomes for the firm and its stakeholders and focuses on managerial decision making.	relationship	relationship	contextualization	contextualization

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		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., and Draghici, A. (2020). Stakeholder Management in Risk Management–Considerations on the ISO 31000 Standard. Management.	stakeholders are groups with which the organization has relationships and which impact and are impacted by the organization's decisions which is coherent with the approach of the ISO 31000.	relationship	relationship	contextualization	contextualization
Dufour, C., and Draghici, A. (2020). Stakeholder Management in Risk Management–Considerations on the ISO 31000 Standard. Management.	Stakeholder as risk-bearer (Mitchell et al. (1997)	relationship	relationship	contextualization	contextualization
Dufour, C., and Draghici, A. (2020). Stakeholder Management in Risk Management–Considerations on the ISO 31000 Standard. Management.	stakeholder classification according to three criteria: urgency, legitimacy and power.	relationship	relationship	contextualization	contextualization

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., and Draghici, A. (2020). Stakeholder Management in Risk Management–Considerations on the ISO 31000 Standard. Management.	stakeholder salience - the degree to which managers give priority to competing stakeholder claims	relationship	relationship	contextualization	contextualization
Dufour, C., and Draghici, A. (2020). Stakeholder Management in Risk Management–Considerations on the ISO 31000 Standard. Management.	managerial response to stakeholders	responsibility	responsibility	responsibility	responsibility
Dufour, C., and Draghici, A. (2020). Stakeholder Management in Risk Management–Considerations on the ISO 31000 Standard. Management.	managers' perception	worker participation	worker participation + leadership	organizational culture	organizational culture
Dufour, C., and Draghici, A. (2020). Stakeholder Management in Risk Management–Considerations on the ISO 31000 Standard. Management.	personal and professional knowledge	asset	asset	education	education
Dufour, C., and Draghici, A. (2020). Stakeholder Management in Risk Management–Considerations on the ISO 31000 Standard. Management.	subjectivity of the decision-making process	responsibility	responsibility	management systems	management systems

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		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., and Draghici, A. (2020). Stakeholder Management in Risk Management–Considerations on the ISO 31000 Standard. Management.	risk management principles	risk assessment	risk assessment	management systems	management systems
Dufour, C., and Draghici, A. (2020). Stakeholder Management in Risk Management–Considerations on the ISO 31000 Standard. Management.	constrained operating environment	external factors	EXTERNAL FACTORS	external factors	external factors
Dufour, C., and Draghici, A. (2020). Stakeholder Management in Risk Management–Considerations on the ISO 31000 Standard. Management.	stakeholder attributes	relationship	relationship	contextualization	contextualization
Dufour, C., and Draghici, A. (2020). Stakeholder Management in Risk Management–Considerations on the ISO 31000 Standard. Management.	professional knowledge, experience, training, environmental or OHS preoccupations	asset	asset	education	education
Dufour, C., and Draghici, A. (2020). Stakeholder Management in Risk Management–Considerations on the ISO 31000 Standard. Management.	stakeholder claims	relationship	relationship	contextualization	contextualization

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., and Draghici, A. (2020). Stakeholder Management in Risk Management–Considerations on the ISO 31000 Standard. Management.	voluntary response to stakeholder claims	leadership	leadership	management systems	management systems
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	Intellectual capital: as widely, although but not unanimously accepted, has two components: human and structural capital [8, 7, 17], each being a combination of knowledge in its pure topical form (savoir), relational (savoir-vivre) and existential (savoir-être).	asset	asset	organizational culture	organizational culture
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	Knowledge management	method	method	management systems	management systems

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		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	KM implementation errors	education	education	management systems	management systems
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	human, innovation and process capital	asset	asset	organizational culture	organizational culture
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	knowledge as a constitutive function [13] and intangible asset	asset	asset	organizational culture	organizational culture
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	IC components are developed through learning (individual, group and organizational), propelling knowledge to the status of developer of IC and setting KM as a vector for IC	method	method	management systems	management systems

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		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	IC measurement	measurement	measurement	management systems	management systems
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	value of IC for stakeholders and communication purposes	relationship	relationship	contextualization	contextualization
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	tangible and intangible assets	asset	asset	management systems	management systems
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	competitive advantage	asset	asset	contextualization	contextualization
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	strategic level	management systems	leadership	leadership	leadership

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		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	competence	education	education	education	education
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	customer value	asset	asset	contextualization	contextualization
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	knowledge flow	objective	objective	management systems	management systems
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	knowledge as asset	asset	asset	organizational culture	organizational culture
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	internal resources	asset	asset	management systems	management systems

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		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	human dimension	management systems	value or responsibility	organizational culture	organizational culture
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	IC measurement (metrics and unique financial measure)	measurement	measurement	management systems	management systems
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	IC reporting model (dynamic factors, measures, management approaches)	measurement	measurement	management systems	management systems
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	knowledge assets measuring	method	method	management systems	management systems
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	working guide	management systems	management systems	management systems	management systems

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	market value vs book value	measurement	measurement	contextualization	contextualization
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	Human capital is constituted from personal and professional knowledge, skills, and abilities, as well as internalized company culture, which fuse into an organizational business problem solver	asset	asset	organizational culture	organizational culture

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		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	innovation is also linked to human capital and the organization's capacity to innovate is not just a proof of value creation but represents a measure of the efficient employment of human capital	infrastructure	infrastructure	organizational culture	organizational culture
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	Structural capital is made up of customer capital and organizational capital, which is in turn made up of process and innovation capitals	infrastructure	infrastructure	contextualization	contextualization
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	Customer capital is the value of relationships between the organization and the customer	infrastructure	infrastructure	contextualization	contextualization

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	Organizational capital relates to the organizational credo: organizational mission/vision, core values, strategies, internal processes [17]; it is an ever-evolving component of structural capital as it is a learning process which enables the selection and withholding of the most effective organizational measures.	infrastructure	infrastructure	contextualization	contextualization

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	Process capital is concerned with the factors (techniques, procedures, and programs) necessary for the delivery of goods and services. It includes therefore, all information channels that impact the efficiency of communication and the speed of learning within the company.	infrastructure	infrastructure	management systems	management systems

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	Innovation capital deals with intellectual properties and intangible assets which drive the organization forward. Although debate exists regarding the forms through which innovation capital manifests and its attachment to organizational capital, the consensus regarding knowledge as a competitive advantage, has conferred innovation capital an undeniably important role in IC	infrastructure	infrastructure	organizational culture	organizational culture

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		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	improvement process of the object of knowledge and the methodology of acquisition	objective	objective	management systems	management systems
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	accuracy of knowledge	asset	asset	contextualization	contextualization
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	timeliness of knowledge	asset	asset	contextualization	contextualization
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	knowledge resources	infrastructure	infrastructure	management systems	management systems
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	best practice identification and diffusion	good practices	good practices	management systems	management systems

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		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	acceleration of learning patterns	education	education	education	education
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	collaborative activities	worker participation	worker participation	organizational culture	organizational culture
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	knowledge sharing	method	method	management systems	management systems
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	knowledge stocks and flows as of individual or organizational learning and have difficulties in distilling core competencies	method	method	management systems	management systems

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	shared context	organizational culture	organizational culture	contextualization	contextualization
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	knowledge flow	infrastructure	infrastructure	management systems	management systems
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	interpretation as part of the creative process	method	method	management systems	management systems
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	company culture, values and goals	organizational culture	organizational culture	organizational culture	organizational culture

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		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	innovation: internalized knowledge and the integration of a different vision of the organizational context (product, service, process) which leads to a new achievement; Without the human element to create the new vision/knowledge or create a new combination, there is no innovational achievement. As such, knowledge can only be a flow connecting the inside and the outside of the individual.	asset	asset	organizational culture	organizational culture
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	Competitive advantage	asset	asset	contextualization	contextualization

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		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	Individual skills	asset	asset	education	education
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	Technological solutions	technology	technology	technology	technology

Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	Innovation capital: HR policies contribute to new modes of reasoning which enhance the emergence of new knowledge [15]. By merely combining what was known in the past, the organization is neither evolving, nor adapting to the changing context. This new knowledge, which is an innovational achievement can make the difference between understanding the potential shifts in the market or staying blocked in the old conception; The purpose of knowledge is to give organizations a competitive advantage through	asset	asset	management systems	management systems

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
	innovational achievements that translate to new products/services or new processes. As such, it is a tool in navigating towards the future, but is unfortunately used to explain the past or at best understand the present.				
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	Knowledge management ad scenario-making tool	method	method	management systems	management systems
Dufour, C., Draghici, A., and Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators.	the meeting of the minds spurs innovational achievement and enhances IC	value	value	organizational culture	organizational culture

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., and Draghici, A. (2018). A Quantitative Study on Sustainability Reporting Over the Past 20 Years in the Water Utilities Sector.	Transparency	values	values	organizational culture	organizational culture
Dufour, C., and Draghici, A. (2018). A Quantitative Study on Sustainability Reporting Over the Past 20 Years in the Water Utilities Sector.	Reporting	communication	communication	management systems	management systems
Dufour, C., and Draghici, A. (2018). A Quantitative Study on Sustainability Reporting Over the Past 20 Years in the Water Utilities Sector.	Transparency	values	values	organizational culture	organizational culture
Dufour, C., and Draghici, A. (2018). A Quantitative Study on Sustainability Reporting Over the Past 20 Years in the Water Utilities Sector.	Communication tool	method	method	management systems	management systems
Dufour, C., and Draghici, A. (2018). A Quantitative Study on Sustainability Reporting Over the Past 20 Years in the Water Utilities Sector.	Assessment tool	method	method	management systems	management systems

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., and Draghici, A. (2018). A Quantitative Study on Sustainability Reporting Over the Past 20 Years in the Water Utilities Sector.	social and environmental impacts of organizations that cannot be accurately rendered by the traditional reporting tools	measurement	measurement	contextualization	contextualization
Dufour, C., and Draghici, A. (2018). A Quantitative Study on Sustainability Reporting Over the Past 20 Years in the Water Utilities Sector.	Global Reporting Initiative	management systems	management systems	management systems	management systems
Dufour, C., and Draghici, A. (2018). A Quantitative Study on Sustainability Reporting Over the Past 20 Years in the Water Utilities Sector.	Legitimacy	relationship	relationship	contextualization	contextualization
Dufour, C., and Draghici, A. (2018). A Quantitative Study on Sustainability Reporting Over the Past 20 Years in the Water Utilities Sector.	Social pressure	external factors	EXTERNAL FACTORS	contextualization	contextualization

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., and Draghici, A. (2018). A Quantitative Study on Sustainability Reporting Over the Past 20 Years in the Water Utilities Sector.	Stakeholders	relationship	relationship	contextualization	contextualization
Dufour, C., and Draghici, A. (2018). A Quantitative Study on Sustainability Reporting Over the Past 20 Years in the Water Utilities Sector.	Pressure groups: employees and investors	relationship	relationship	contextualization	contextualization
Dufour, C., and Draghici, A. (2018). A Quantitative Study on Sustainability Reporting Over the Past 20 Years in the Water Utilities Sector.	sustainable development-oriented practices and informing society	method	method	management systems	management systems
Dufour, C., and Draghici, A. (2018). A Quantitative Study on Sustainability Reporting Over the Past 20 Years in the Water Utilities Sector.	reporting resources	reporting	reporting	management systems	management systems
Dufour, C., and Draghici, A. (2018). A Quantitative Study on Sustainability Reporting Over the Past 20 Years in the Water Utilities Sector.	aggregated reporting	reporting	reporting	management systems	management systems

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Bejinariu, A., Mateescu, A., **Dufour, C.** (2018), Study on the policy of renewing product testing equipment to enhance competitiveness	Newer products	asset	asset	external factors	external factors
Bejinariu, A., Mateescu, A., **Dufour, C.** (2018), Study on the policy of renewing product testing equipment to enhance competitiveness	Customer satisfaction	relationship	relationship	contextualization	contextualization
Bejinariu, A., Mateescu, A., **Dufour, C.** (2018), Study on the policy of renewing product testing equipment to enhance competitiveness	Product complexity	technology	technology	technology	technology
Bejinariu, A., Mateescu, A., **Dufour, C.** (2018), Study on the policy of renewing product testing equipment to enhance competitiveness	Organizational strategy	management systems	management systems	management systems	management systems
Bejinariu, A., Mateescu, A., **Dufour, C.** (2018), Study on the policy of renewing product testing equipment to enhance competitiveness	Democratic value promotion	value	value	organizational culture	organizational culture
Bejinariu, A., Mateescu, A., **Dufour, C.** (2018), Study on the policy of renewing product testing equipment to enhance competitiveness	Participation	worker participation	worker participation	organizational culture	organizational culture

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		Author	Independent Reviewer	Author	Independent Reviewer
Bejinariu, A., Mateescu, A., **Dufour, C.** (2018), Study on the policy of renewing product testing equipment to enhance competitiveness	Conflict management	management systems	leadership	management systems	management systems
Bejinariu, A., Mateescu, A., **Dufour, C.** (2018), Study on the policy of renewing product testing equipment to enhance competitiveness	Change management	management systems	leadership	management systems	management systems
Bejinariu, A., Mateescu, A., **Dufour, C.** (2018), Study on the policy of renewing product testing equipment to enhance competitiveness	Decision-making process	responsibility	responsibility	management systems	management systems
Bejinariu, A., Mateescu, A., **Dufour, C.** (2018), Study on the policy of renewing product testing equipment to enhance competitiveness	Risk assessment process	risk assessment	risk assessment	management systems	management systems
Bejinariu, A., Mateescu, A., **Dufour, C.** (2018), Study on the policy of renewing product testing equipment to enhance competitiveness	Data relevance	measurement	measurement	contextualization	contextualization
Bejinariu, A., Mateescu, A., **Dufour, C.** (2018), Study on the policy of renewing product testing equipment to enhance competitiveness	Indicator relevance	measurement	management systems	contextualization	contextualization

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Draghici, A., Ivascu, L., and Sarfraz, M. (2020). Occupational Health and Safety Division of Responsibility: A Conceptual Model for the Implementation of the OHSAS 18001: 2007 Standard.	Internal chain of responsibility	relationship	relationship	responsibility	responsibility
Dufour, C., Draghici, A., Ivascu, L., and Sarfraz, M. (2020). Occupational Health and Safety Division of Responsibility: A Conceptual Model for the Implementation of the OHSAS 18001: 2007 Standard.	OHS accountability	responsibility	responsibility	management systems	management systems
Dufour, C., Draghici, A., Ivascu, L., and Sarfraz, M. (2020). Occupational Health and Safety Division of Responsibility: A Conceptual Model for the Implementation of the OHSAS 18001: 2007 Standard.	OHS responsibility	responsibility	responsibility	responsibility	responsibility
Dufour, C., Draghici, A., Ivascu, L., and Sarfraz, M. (2020). Occupational Health and Safety Division of Responsibility: A Conceptual Model for the Implementation of the OHSAS 18001: 2007 Standard.	Voluntary standards	standards	standards	management systems	management systems

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Draghici, A., Ivascu, L., and Sarfraz, M. (2020). Occupational Health and Safety Division of Responsibility: A Conceptual Model for the Implementation of the OHSAS 18001: 2007 Standard.	OHSAS 18001:2007	standards	standards	management systems	management systems
Dufour, C., Draghici, A., Ivascu, L., and Sarfraz, M. (2020). Occupational Health and Safety Division of Responsibility: A Conceptual Model for the Implementation of the OHSAS 18001: 2007 Standard.	Multilevel stakeholder model	responsibility	responsibility	responsibility	responsibility
Dufour, C., Draghici, A., Ivascu, L., and Sarfraz, M. (2020). Occupational Health and Safety Division of Responsibility: A Conceptual Model for the Implementation of the OHSAS 18001: 2007 Standard.	Organizational goals	objective	objective	organizational culture	organizational culture
Dufour, C., Draghici, A., Ivascu, L., and Sarfraz, M. (2020). Occupational Health and Safety Division of Responsibility: A Conceptual Model for the Implementation of the OHSAS 18001: 2007 Standard.	Safety officer/representative e	responsibility	responsibility	management systems	management systems

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		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Draghici, A., Ivascu, L., and Sarfraz, M. (2020). Occupational Health and Safety Division of Responsibility: A Conceptual Model for the Implementation of the OHSAS 18001: 2007 Standard.	Rules	management systems	management systems	responsibility	responsibility
Dufour, C., Draghici, A., Ivascu, L., and Sarfraz, M. (2020). Occupational Health and Safety Division of Responsibility: A Conceptual Model for the Implementation of the OHSAS 18001: 2007 Standard.	Legal framework	legislation	legislation	external factors	external factors
Dufour, C., Draghici, A., Ivascu, L., and Sarfraz, M. (2020). Occupational Health and Safety Division of Responsibility: A Conceptual Model for the Implementation of the OHSAS 18001: 2007 Standard.	Industry standards	standards	standards	external factors	external factors
Dufour, C., Draghici, A., Ivascu, L., and Sarfraz, M. (2020). Occupational Health and Safety Division of Responsibility: A Conceptual Model for the Implementation of the OHSAS 18001: 2007 Standard.	OHS management system	management systems	management systems	management systems	management systems

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		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Draghici, A., Ivascu, L., and Sarfraz, M. (2020). Occupational Health and Safety Division of Responsibility: A Conceptual Model for the Implementation of the OHSAS 18001: 2007 Standard.	Knowledge tailoring	objective	objective	management systems	management systems
Dufour, C., Draghici, A., Ivascu, L., and Sarfraz, M. (2020). Occupational Health and Safety Division of Responsibility: A Conceptual Model for the Implementation of the OHSAS 18001: 2007 Standard.	OHS obligations	responsibility	responsibility	external factors	external factors
Dufour, C., Draghici, A., Ivascu, L., and Sarfraz, M. (2020). Occupational Health and Safety Division of Responsibility: A Conceptual Model for the Implementation of the OHSAS 18001: 2007 Standard.	Prevention	management systems	management systems	management systems	management systems
Dufour, C., Draghici, A., Ivascu, L., and Sarfraz, M. (2020). Occupational Health and Safety Division of Responsibility: A Conceptual Model for the Implementation of the OHSAS 18001: 2007 Standard.	Risk assessment	risk assessment	risk assessment	management systems	management systems

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Draghici, A., Ivascu, L., and Sarfraz, M. (2020). Occupational Health and Safety Division of Responsibility: A Conceptual Model for the Implementation of the OHSAS 18001: 2007 Standard.	Employee empowerment	worker participation	worker participation	organizational culture	organizational culture
Dufour, C., Draghici, A., Ivascu, L., and Sarfraz, M. (2020). Occupational Health and Safety Division of Responsibility: A Conceptual Model for the Implementation of the OHSAS 18001: 2007 Standard.	Risk identification/elimination/minimization	risk assessment	risk assessment	management systems	management systems
Dufour, C., Draghici, A., Ivascu, L., and Sarfraz, M. (2020). Occupational Health and Safety Division of Responsibility: A Conceptual Model for the Implementation of the OHSAS 18001: 2007 Standard.	Internal/external stakeholders	relationship	relationship	contextualization	contextualization
Dufour, C., Draghici, A., Ivascu, L., and Sarfraz, M. (2020). Occupational Health and Safety Division of Responsibility: A Conceptual Model for the Implementation of the OHSAS 18001: 2007 Standard.	Working conditions	values	values	management systems	management systems

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Draghici, A., Ivascu, L., and Sarfraz, M. (2020). Occupational Health and Safety Division of Responsibility: A Conceptual Model for the Implementation of the OHSAS 18001: 2007 Standard.	Employee hygiene	safety culture	safety culture	management systems	management systems
Dufour, C., Draghici, A., Ivascu, L., and Sarfraz, M. (2020). Occupational Health and Safety Division of Responsibility: A Conceptual Model for the Implementation of the OHSAS 18001: 2007 Standard.	Efficient use of workplace areas	management systems	infrastructure	management systems	management systems
Dufour, C., Draghici, A., Ivascu, L., and Sarfraz, M. (2020). Occupational Health and Safety Division of Responsibility: A Conceptual Model for the Implementation of the OHSAS 18001: 2007 Standard.	Preventive behavior	safety culture	safety culture	organizational culture	organizational culture
Dufour, C., Draghici, A., Ivascu, L., and Sarfraz, M. (2020). Occupational Health and Safety Division of Responsibility: A Conceptual Model for the Implementation of the OHSAS 18001: 2007 Standard.	Individual responsibility	responsibility	responsibility	responsibility	responsibility

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Draghici, A., Ivascu, L., and Sarfraz, M. (2020). Occupational Health and Safety Division of Responsibility: A Conceptual Model for the Implementation of the OHSAS 18001: 2007 Standard.	Ensued responsibility	responsibility	responsibility	responsibility	responsibility
Dufour, C., Draghici, A., Ivascu, L., and Sarfraz, M. (2020). Occupational Health and Safety Division of Responsibility: A Conceptual Model for the Implementation of the OHSAS 18001: 2007 Standard.	Safeguards	risk assessment	risk assessment	management systems	management systems
Dufour, C., Draghici, A., Ivascu, L., and Sarfraz, M. (2020). Occupational Health and Safety Division of Responsibility: A Conceptual Model for the Implementation of the OHSAS 18001: 2007 Standard.	Worker participation	worker participation	worker participation	organizational culture	organizational culture
Dufour, C., Draghici, A., Ivascu, L., and Sarfraz, M. (2020). Occupational Health and Safety Division of Responsibility: A Conceptual Model for the Implementation of the OHSAS 18001: 2007 Standard.	Top-down/bottom-up	relationship	relationship	management systems	management systems

Source	Key elements	Categorization Number 1		Categorization Number 2	
		Author	Independent Reviewer	Author	Independent Reviewer
Dufour, C., Draghici, A., Ivascu, L., and Sarfraz, M. (2020). Occupational Health and Safety Division of Responsibility: A Conceptual Model for the Implementation of the OHSAS 18001: 2007 Standard.	Management responsibilities	relationship	relationship	responsibility	responsibility
Dufour, C., Draghici, A., Ivascu, L., and Sarfraz, M. (2020). Occupational Health and Safety Division of Responsibility: A Conceptual Model for the Implementation of the OHSAS 18001: 2007 Standard.	Responsibility clarification	relationship	relationship	responsibility	responsibility

8.2 Appendix: Organizational Charts

Company Name	Oatly	Distributie Oltenia	ETH Zürich	Ericsson	PWC Hungary
Type of company (private/public)	Private	Private	Public	Private	Private
Integration in a group	No	CEZ Group	No	No	
Industrial sector	Food	Energy supply	Education and Research	Network and telecommunications	Professional services
Key activities	Beverages manufacturer	Electricity distribution	science, technology, engineering and mathematics.	services, software and infrastructure of communication technologies	Consulting in assurances, taxes, advisory, etc …
Product/services proposed	Vegan based drink solutions	Electricity	Higher education and research	Phones and networks solution	Audits, Services and Data analysis
Location	Sweden	Romania	Switzerland	Stockholm	Hungary
Turnover	140 MioUSD (2019)	no statement since incorporated in CEZ Group in 2015	1'888 MioCHF	28 $ Billion	not available
Employees	792	not available	>10k ww	95k worlwide	284k ww
Sustainability reporting History : **- since** **- GRI standard**	2017 no	2016 yes	2009 yes	2014 yes	2018 yes

Company Name	Oatly	Distributie Oltenia	ETH Zürich	Ericsson	PWC Hungary
Brief history	Founded in 1993 by brothers Rickard and Bjorn Öste in Sweden. In may 2021 it is partially introduce in stock market which could value at more than $10 billion	Distributie Oltenia is the legal successor of Electrica Oltenia of 15 March 2007, continuing the exclusive development of electricity distribution business. In September 2015, it is incorporated in the CEZ Group.	Founded in 1854 by the Federal Swiss Government with the state mission to educate engineers and scientists. It is considered as one of the top 3 Europe university and Top 10 worldwide.	Founded by Lars Magnus Ericsson in 1876 as a phone manufacturer, it is owned by the Wallenberg family since 1960. Ericsson is the inventor of Bluetooth technology	In Hungary, Price Waterhouse opened its office in Budapest in 1989. Coopers & Lybrand Kft. was established in the same year. In 1997, Coopers & Lybrand Kft. acquired Dynasoft Rt., which formed its new Management Consulting Services department. In 1998, with the worldwide merger of Price Waterhouse and Coopers & Lybrand, PricewaterhouseCoopers Hungary was formed. Rebranded as PwC Hungary, it has operated since 2011 with two offices – in Budapest and Győr – as one of the leading professional services firms in Hungary.

8.2.1 Appendix: Word Cloud

Figure 8.1. Distributie Oltenia Word Cloud - with "Lemmatize words" option

Figure 8.2. Distributie Oltenia Word Cloud - without "Lemmatize words" option

Figure 8.3. Distributie Oltenia Word Cloud - 50 most frequent words without „Lemmatize function”

Figure 8.4. Distributie Oltenia Word Cloud - 50 most frequent words with „Lemmatize function”

Table 8.1. Distributie Oltenia Word Cloud Components - 50 most frequent words with „Lemmatize function”

Word	Word's length	Frequency	%	Rank
employee	8	158	1.14	1
company	7	151	1.09	2
report	6	150	1.08	3
management	10	143	1.03	4
gri	3	119	0.86	5
energy	6	112	0.81	6
customer	8	102	0.74	7
user	4	102	0.74	7
system	6	93	0.67	9
activity	8	92	0.66	10
sdg	3	88	0.63	11
sustainability	14	81	0.58	12
work	4	81	0.58	12
health	6	80	0.58	14
train	5	79	0.57	15
program	7	77	0.56	16
safety	6	73	0.53	17
stakeholder	11	72	0.52	18
distribution	12	70	0.50	19

Word	Word's length	Frequency	%	Rank
organization	12	68	0.49	20
local	5	67	0.48	21
material	8	66	0.48	22
network	7	65	0.47	23
service	7	62	0.45	24
approach	8	59	0.43	25
development	11	59	0.43	25
electricity	11	59	0.43	25
disclosure	10	56	0.40	28
occupational	12	55	0.40	29
measure	7	52	0.38	30
result	6	52	0.38	30
authority	9	51	0.37	32
consumption	11	51	0.37	32
impact	6	51	0.37	32
area	4	50	0.36	35
project	7	50	0.36	35
topic	5	50	0.36	35
community	9	49	0.35	38
medium	6	49	0.35	38
environmental	13	47	0.34	40
compliance	10	45	0.32	41
consumer	8	45	0.32	41
ensure	6	45	0.32	41
increase	8	45	0.32	41
process	7	45	0.32	41
legal	5	44	0.32	46
datum	5	43	0.31	47
general	7	43	0.31	47
performance	11	42	0.30	49

Figure 8.5. Oatly Word Cloud - 50 most frequent words with „Lemmatize function"

Table 8.2. Oatly Word Cloud Components - 50 most frequent words with „Lemmatize function"

Word	Word's length	Frequency	%	Rank
product	7	113	1.08	1
sustainability	14	108	1.03	2
oat	3	95	0.91	3
work	4	90	0.86	4
climate	7	89	0.85	5
sustainable	11	85	0.81	6
production	10	79	0.75	7
goal	4	74	0.71	8
food	4	72	0.69	9
energy	6	67	0.64	10
company	7	66	0.63	11
us	2	64	0.61	12
increase	8	62	0.59	13
package	7	62	0.59	13
people	6	57	0.54	15

Word	Word's length	Frequency	%	Rank
important	9	50	0.48	16
supplier	8	49	0.47	17
impact	6	47	0.45	18
way	3	46	0.44	19
oatly	5	44	0.42	20
plant-based	11	44	0.42	20
drink	5	43	0.41	22
footprint	9	43	0.41	22
change	6	42	0.40	24
material	8	42	0.40	24
want	4	42	0.40	24
consumption	11	40	0.38	27
employee	8	40	0.38	27
liter	5	40	0.38	27
reduce	6	40	0.38	27
right	5	40	0.38	27
report	6	39	0.37	32
area	4	38	0.36	33
business	8	37	0.35	34
good	4	37	0.35	34
need	4	37	0.35	34
produce	7	37	0.35	34
water	5	37	0.35	34
cow	3	35	0.33	39
sweden	6	35	0.33	39
think	5	35	0.33	39
go	2	34	0.32	42
growth	6	34	0.32	42
time	4	34	0.32	42
renewable	9	33	0.31	45
grow	4	32	0.31	46
ingredient	10	31	0.30	47
start	5	31	0.30	47
now	3	30	0.29	49
world	5	30	0.29	49

Figure 8.6. Ericsson Word Cloud - 50 most frequent words with „Lemmatize function"

Table 8.3. Ericsson Word Cloud Components -
50 most frequent words with „Lemmatize function"

Word	Word's length	Frequency	%	Rank
report	6	170	1.77	1
company	7	144	1.50	2
business	8	137	1.43	3
sustainability	14	131	1.36	4
energy	6	99	1.03	5
product	7	88	0.92	6
compliance	10	80	0.83	7
management	10	75	0.78	8
risk	4	66	0.69	9
information	11	56	0.58	10

Word	Word's length	Frequency	%	Rank
responsible	11	55	0.57	11
employee	8	54	0.56	12
impact	6	53	0.55	13
health	6	51	0.53	14
global	6	49	0.51	15
right	5	49	0.51	15
target	6	49	0.51	15
program	7	48	0.50	18
responsibility	14	48	0.50	18
corporate	9	46	0.48	20
supplier	8	45	0.47	21
work	4	45	0.47	21
human	5	44	0.46	23
security	8	44	0.46	23
incident	8	43	0.45	25
safety	6	43	0.45	25
area	4	40	0.42	27
environmental	13	39	0.41	28
requirement	11	39	0.41	28
concern	7	36	0.37	30
material	8	36	0.37	30
group	5	35	0.36	32
increase	8	35	0.36	32
approach	8	33	0.34	34
focus	5	33	0.34	34
performance	11	33	0.34	34
stakeholder	11	33	0.34	34
audit	5	32	0.33	38
emission	8	32	0.33	38
process	7	31	0.32	40
carbon	6	30	0.31	41
assurance	9	29	0.30	42
climate	7	29	0.30	42
facility	8	29	0.30	42
privacy	7	29	0.30	42
technology	10	29	0.30	42
action	6	28	0.29	47
board	5	28	0.29	47
customer	8	28	0.29	47
development	11	28	0.29	47

Figure 8.7. ETH Zurich Word Cloud - 50 most frequent words with „Lemmatize function"

Table 8.4. ETH Zurich Word Cloud Components –
50 most frequent words with „Lemmatize function"

Word	Word's length	Frequency	%	Rank
research	8	297	1.69	1
report	6	263	1.50	2
sustainability	14	218	1.24	3
education	9	169	0.96	4
development	11	164	0.93	5
university	10	153	0.87	6
student	7	148	0.84	7
dialog	6	142	0.81	8
sustainable	11	142	0.81	8
science	7	90	0.51	10
emission	8	88	0.50	11
energy	6	81	0.46	12

Word	Word's length	Frequency	%	Rank
project	7	80	0.46	13
climate	7	76	0.43	14
department	10	76	0.43	14
goal	4	75	0.43	16
co2	3	73	0.42	17
employee	8	71	0.40	18
management	10	69	0.39	19
work	4	61	0.35	20
information	11	57	0.32	21
programme	9	55	0.31	22
teach	5	55	0.31	22
waste	5	54	0.31	24
travel	6	53	0.30	25
woman	5	53	0.30	25
increase	8	51	0.29	27
heat	4	50	0.28	28
staff	5	49	0.28	29
commission	10	47	0.27	30
stakeholder	11	47	0.27	30
swiss	5	47	0.27	30
system	6	47	0.27	30
study	5	46	0.26	34
gri	3	45	0.26	35
scientific	10	45	0.26	35
provide	7	44	0.25	37
researcher	10	44	0.25	37
group	5	43	0.24	39
environment	11	42	0.24	40
eq	2	42	0.24	40
technology	10	42	0.24	40
mobility	8	41	0.23	43
offer	5	41	0.23	43
service	7	41	0.23	43
reduce	6	40	0.23	46
federal	7	39	0.22	47
period	6	39	0.22	47
approach	8	38	0.22	49
demand	6	38	0.22	49

Figure 8.8. PWC Hungary Word Cloud - 50 most frequent words with „Lemmatize function"

Table 8.5. PWC Hungary Word Cloud Components - 50 most frequent words with „Lemmatize function"

Word	Word's length	Frequency	%	Rank
responsible	11	138	1.93	1
report	6	116	1.62	2
business	8	104	1.46	3
service	7	76	1.06	4
sustainability	14	73	1.02	5
financial	9	61	0.85	6
operation	9	60	0.84	7
hungary	7	59	0.83	8
client	6	56	0.78	9
employee	8	54	0.76	10
firm	4	52	0.73	11
company	7	49	0.69	12

Word	Word's length	Frequency	%	Rank
management	10	45	0.63	13
partnership	11	43	0.60	14
staff	5	36	0.50	15
network	7	35	0.49	16
provide	7	34	0.48	17
people	6	33	0.46	18
tax	3	33	0.46	18
team	4	33	0.46	18
event	5	32	0.45	21
organisation	12	32	0.45	21
work	4	32	0.45	21
member	6	31	0.43	24
hungarian	9	30	0.42	25
professional	12	30	0.42	25
quality	7	30	0.42	25
communication	13	29	0.41	28
global	6	29	0.41	28
market	6	29	0.41	28
policy	6	28	0.39	31
system	6	27	0.38	32
development	11	26	0.36	33
partner	7	26	0.36	33
strategy	8	26	0.36	33
survey	6	26	0.36	33
train	5	25	0.35	37
social	6	24	0.34	38
standard	8	24	0.34	38
activity	8	23	0.32	40
colleague	9	23	0.32	40
office	6	23	0.32	40
change	6	21	0.29	43
information	11	20	0.28	44
local	5	20	0.28	44
stakeholder	11	20	0.28	44
support	7	20	0.28	44
value	5	20	0.28	44
advisory	8	19	0.27	49
conduct	7	19	0.27	49

Figure 8.9. Cumulative 5 sustainability reports Word Cloud - 50 most frequent words with „Lemmatize function"

Table 8.6. Cumulative 5 sustainability reports Word Cloud Components - 50 most frequent words with „Lemmatize function"

Word	Word's length	Frequency	%	Rank	Documents
report	6	738	1.26	1	5
sustainability	14	611	1.04	2	5
company	7	430	0.73	3	5
employee	8	377	0.64	4	5
energy	6	367	0.63	5	5
research	8	347	0.59	6	5
management	10	341	0.58	7	5
business	8	317	0.54	8	5
work	4	309	0.53	9	5
development	11	291	0.50	10	5

Word	Word's length	Frequency	%	Rank	Documents
sustainable	11	273	0.47	11	5
product	7	228	0.39	12	5
responsible	11	220	0.38	13	5
service	7	206	0.35	14	5
system	6	203	0.35	15	5
increase	8	201	0.34	16	5
climate	7	200	0.34	17	5
education	9	200	0.34	17	5
goal	4	198	0.34	19	5
health	6	192	0.33	20	5
impact	6	186	0.32	21	5
information	11	178	0.30	22	5
student	7	177	0.30	23	5
gri	3	176	0.30	24	4
activity	8	175	0.30	25	5
area	4	175	0.30	25	5
risk	4	174	0.30	27	5
stakeholder	11	174	0.30	27	5
project	7	173	0.29	29	5
university	10	165	0.28	30	5
material	8	159	0.27	31	5
network	7	154	0.26	32	5
provide	7	153	0.26	33	5
train	5	153	0.26	33	5
supplier	8	150	0.26	35	5
environmental	13	148	0.25	36	5
compliance	10	146	0.25	37	5
customer	8	146	0.25	37	4
emission	8	143	0.24	39	5
consumption	11	142	0.24	40	5
dialog	6	142	0.24	40	1
change	6	141	0.24	42	5
approach	8	140	0.24	43	5
process	7	140	0.24	43	5
reduce	6	138	0.24	45	5
global	6	133	0.23	46	5
people	6	133	0.23	46	5
program	7	131	0.22	48	5
safety	6	131	0.22	48	4
ensure	6	120	0.20	50	5

8.2.2 Appendix: Code cloud

Figure 8.10. 5 documents code cloud

Figure 8.11. Oatly code cloud

Figure 8.12. Distributie Oltenia code cloud

Figure 8.13. Ericsson code cloud

Figure 8.14. ETH Zurich code cloud

Figure 8.15. PWC Hungary code cloud

8.2.3 Appendix: Document Portrait

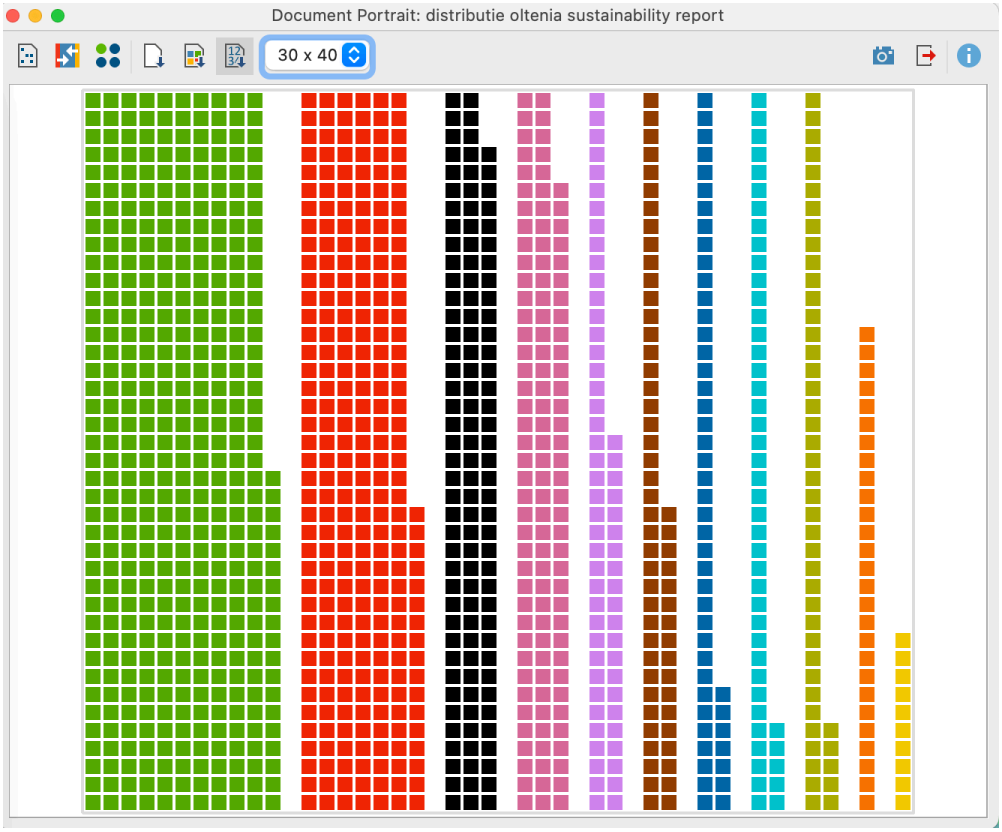


Figure 8.16. Document Portrait based on Code Frequency – Distributie Oltenia

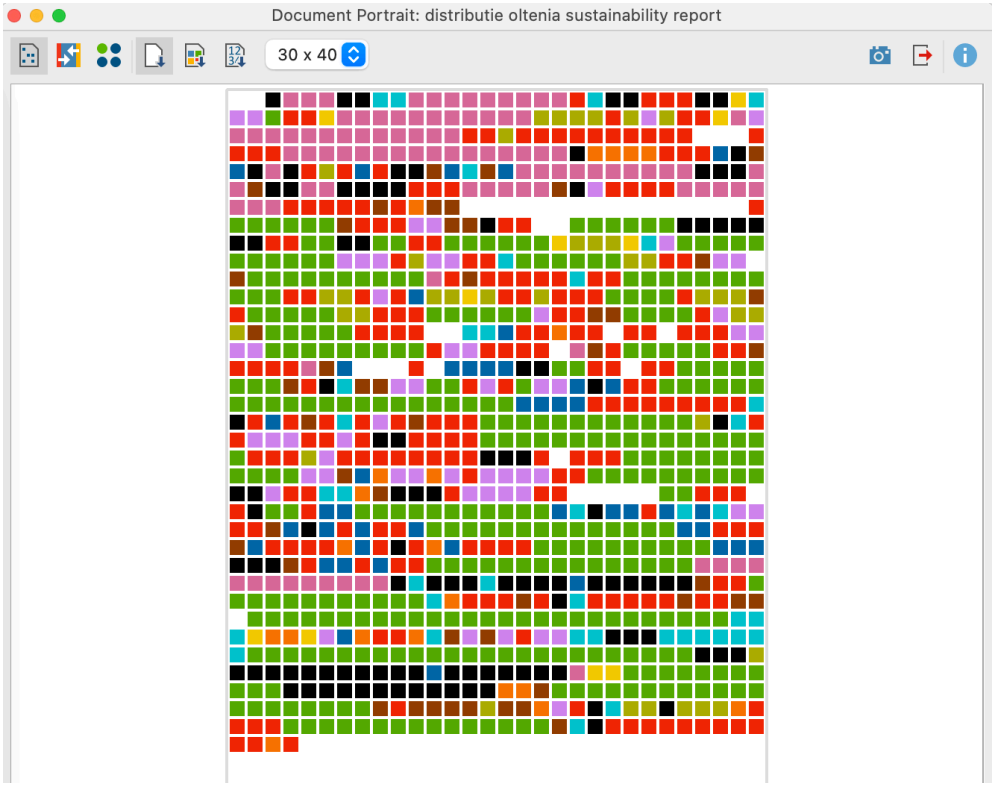


Figure 8.17. Document Portrait based on Coded and Uncoded Segments - Distributie Oltenia

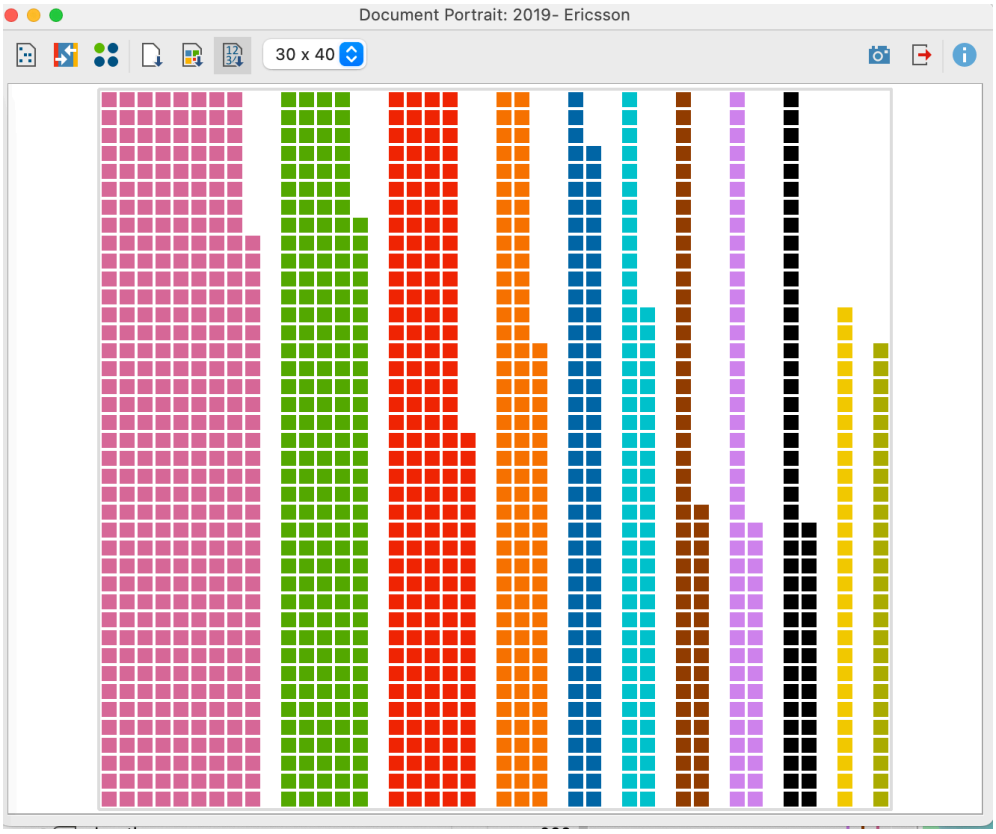


Figure 8.18. Document Portrait based on Code Frequency – Ericsson

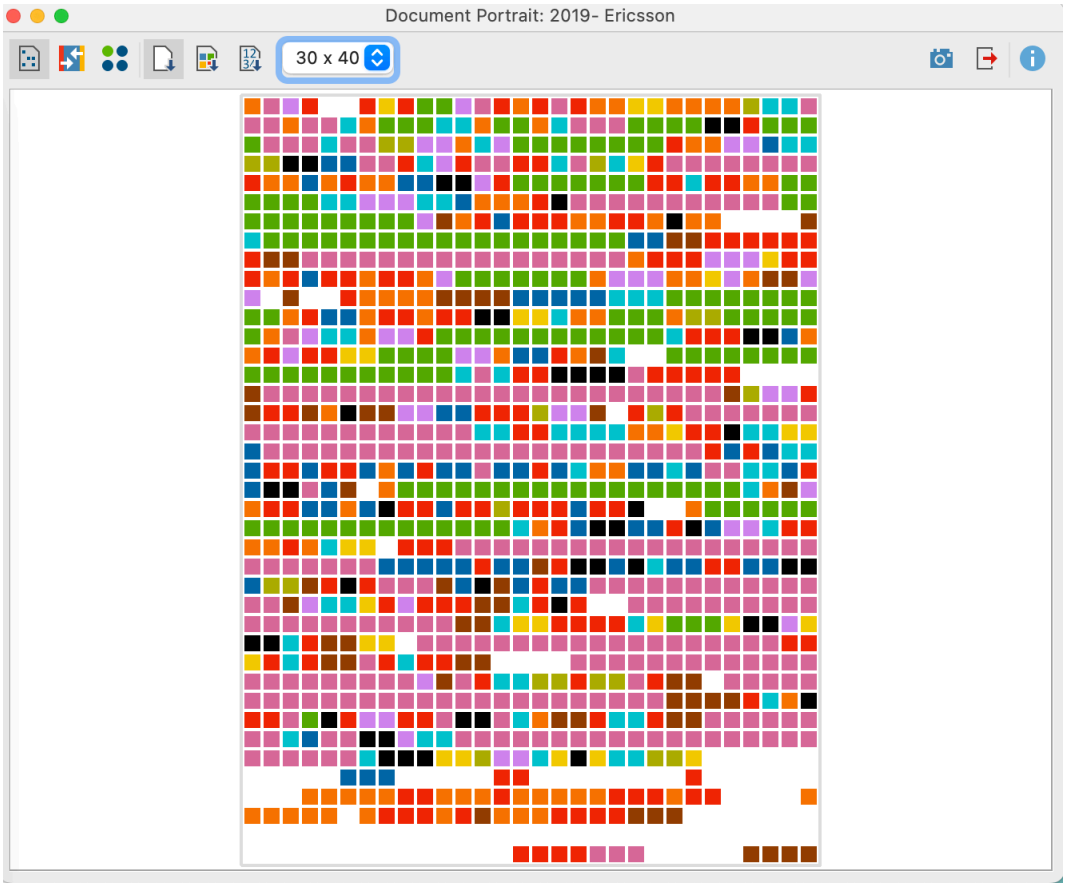


Figure 8.19. Document Portrait based on Coded and Uncoded Segments -Ericsson

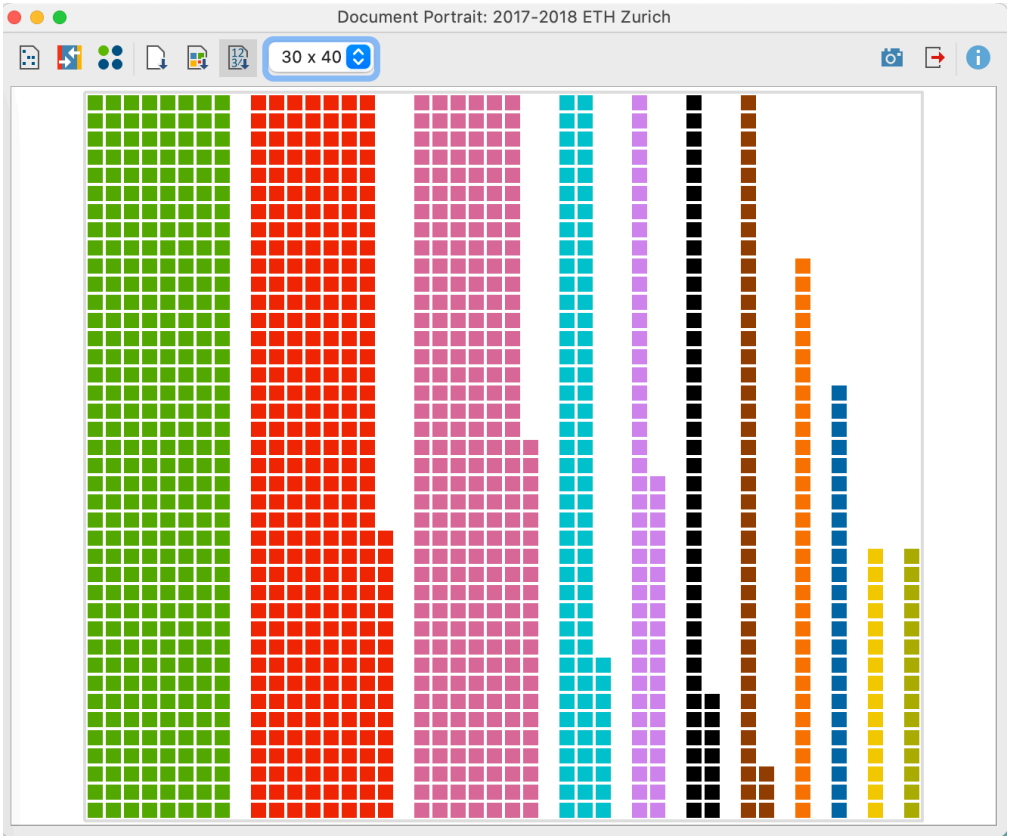


Figure 8.20. Document Portrait based on Code Frequency – ETH Zurich

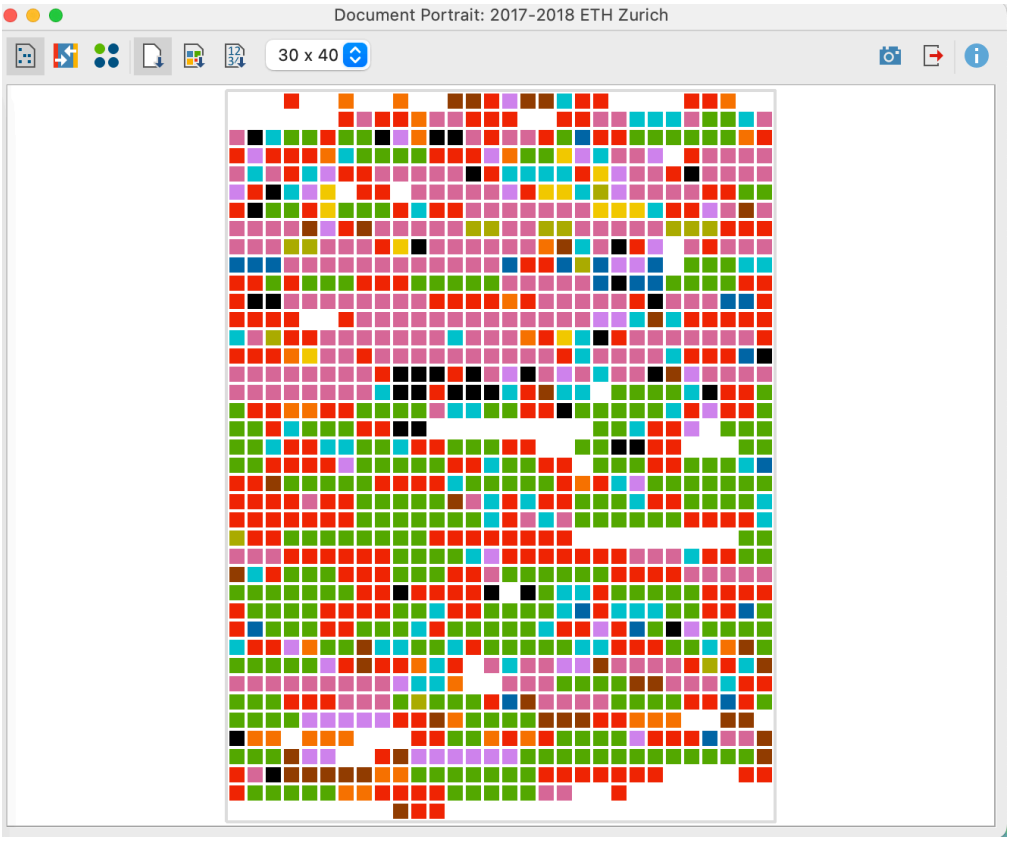


Figure 8.21. Document Portrait based on Coded and Uncoded Segments - ETH Zurich

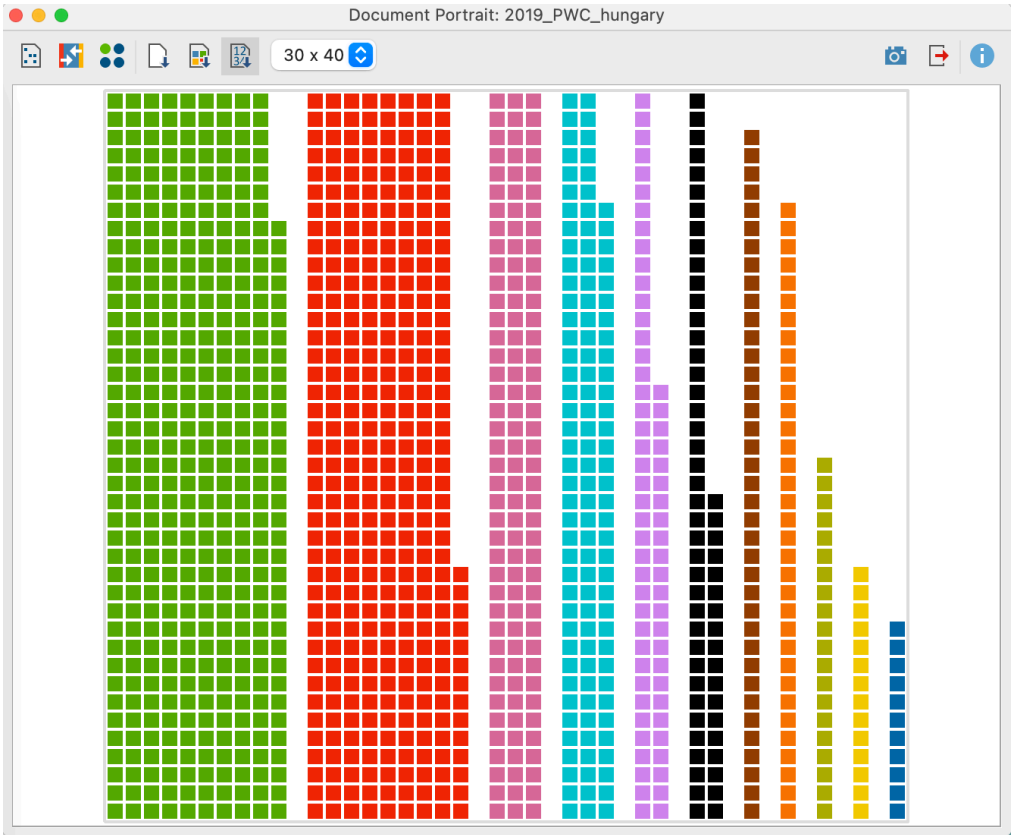


Figure 8.22. Document Portrait based on Code Frequency – PWC Hungary

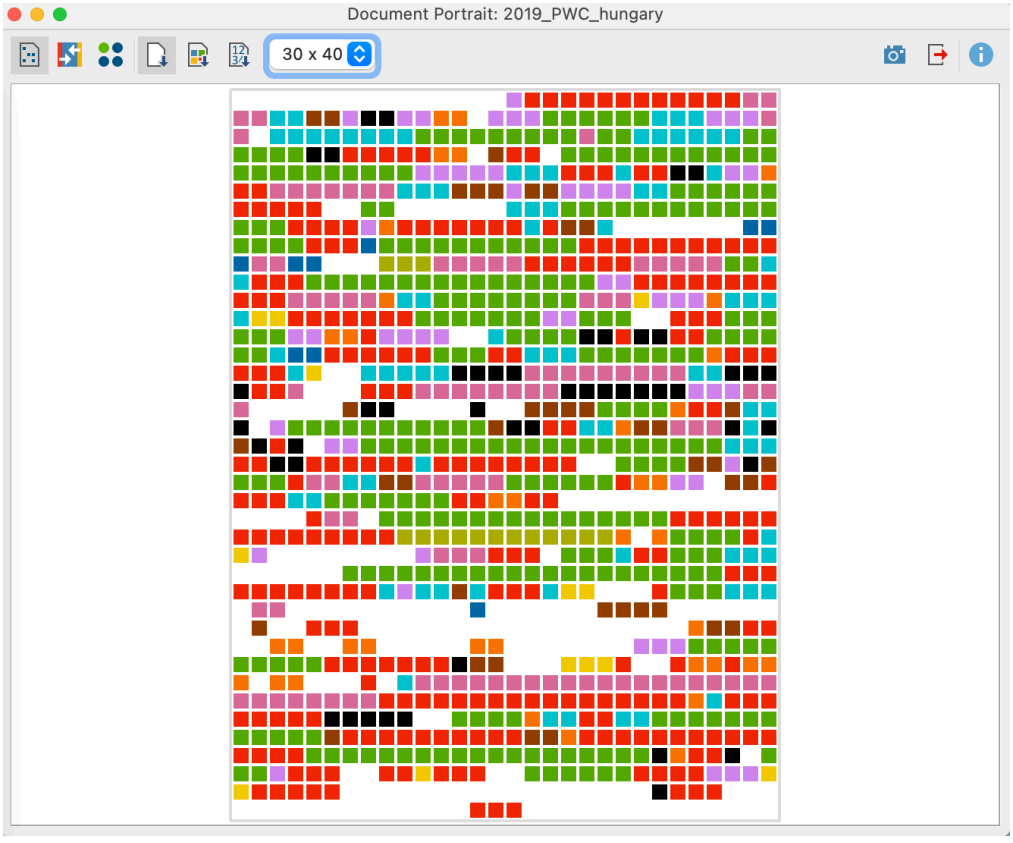


Figure 8.23. Document Portrait based on Coded and Uncoded Segments -PWC Hungary

8.2.4 Appendix: Codeline

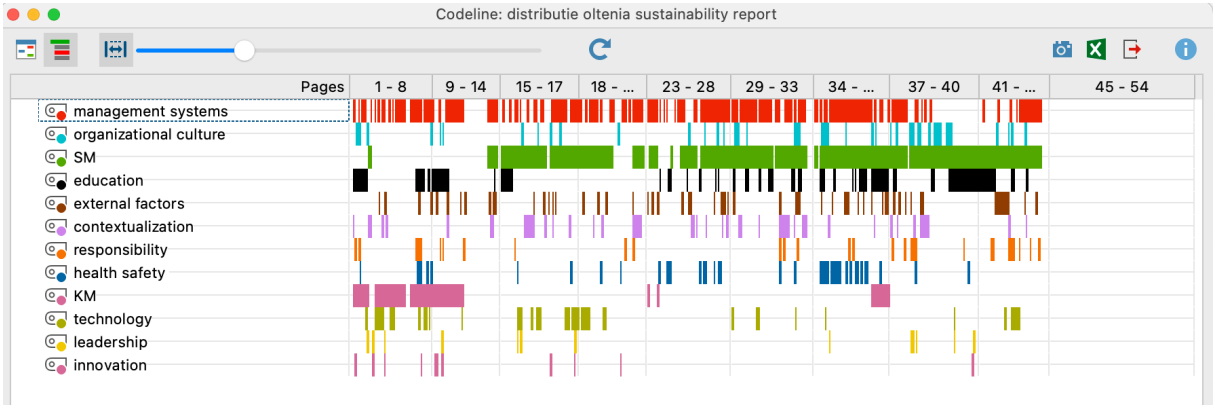


Figure 8.24. Codeline - Distributie Oltenia

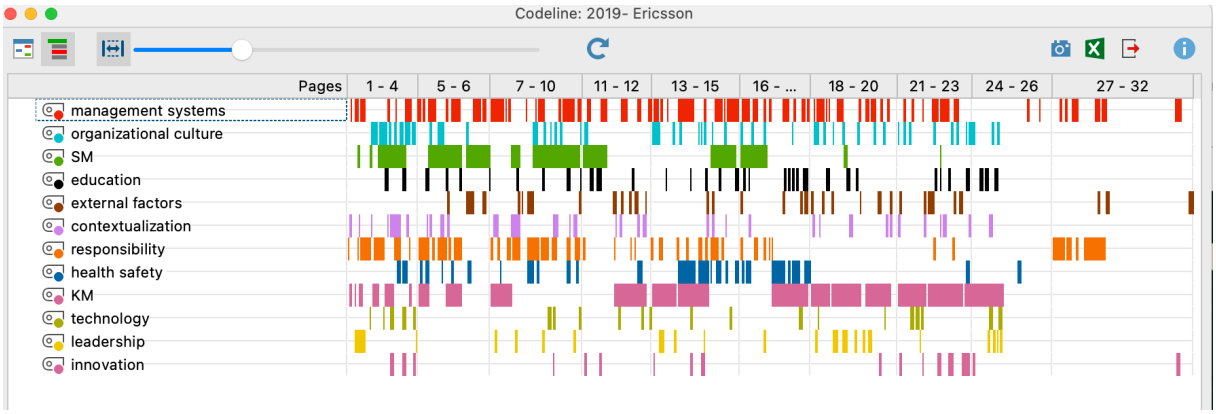


Figure 8.25. Codeline – Ericsson

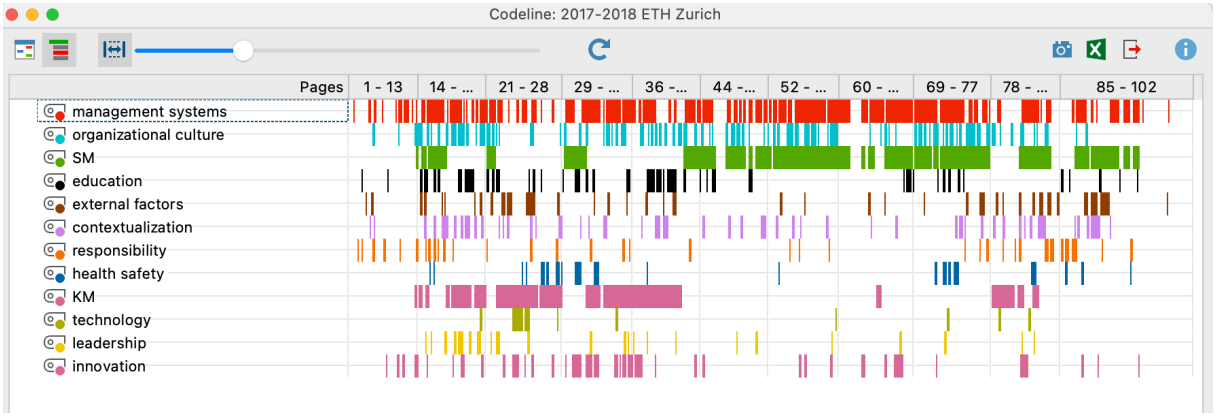


Figure 8.26. Codeline - ETH Zurich

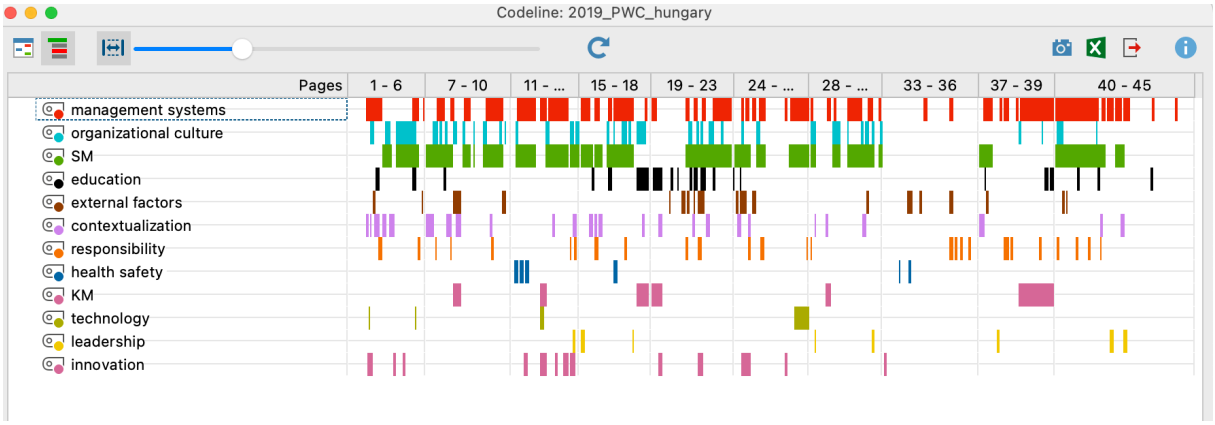


Figure 8.27. Codeline - PWC Hungary

8.2.5 Appendix: Code matrix browser

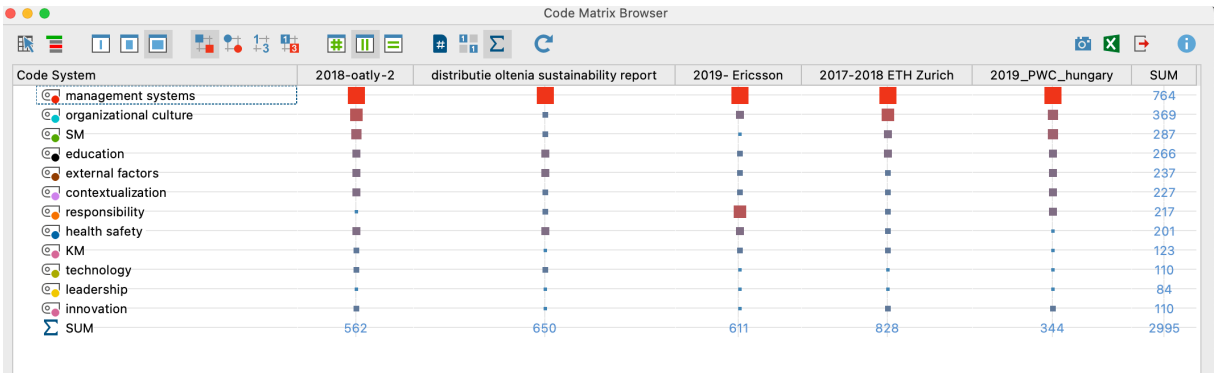


Figure 8.28. Calculation of symbol size refers to the column – qualitive representation

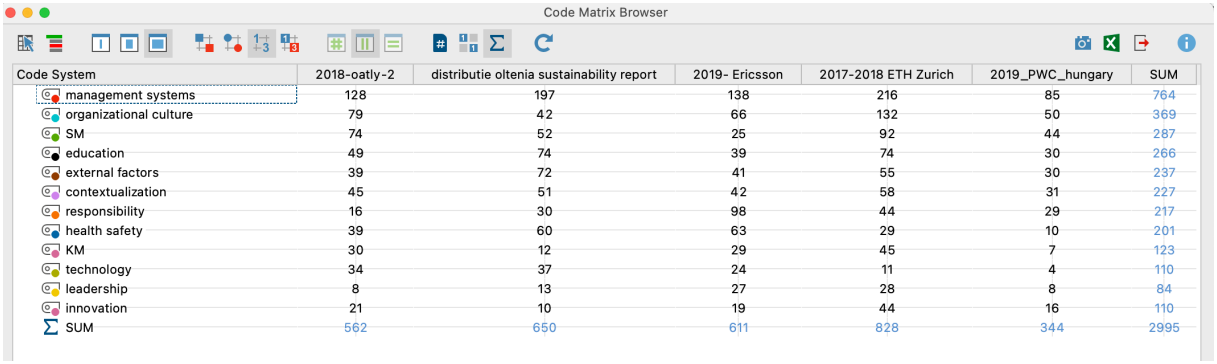


Figure 8.29. Calculation of symbol size refers to the column – quantitative representation

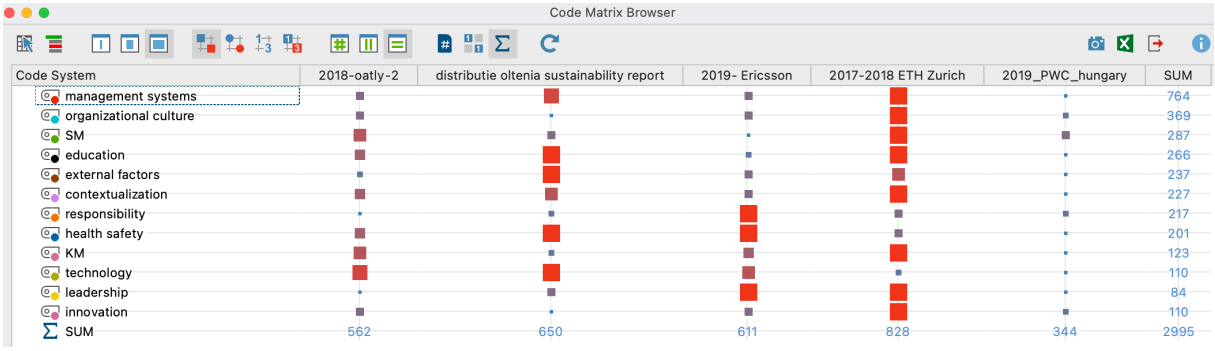


Figure 8.30. Calculation of symbol size refers to the row – qualitative representation

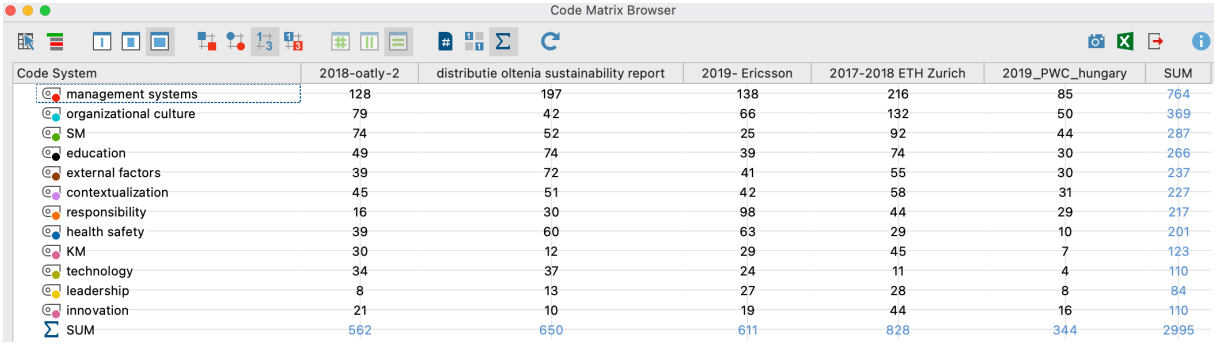


Figure 8.31. Calculation of symbol size refers to the row – quantitative representation

8.2.6 Appendix: Code Relations Browser

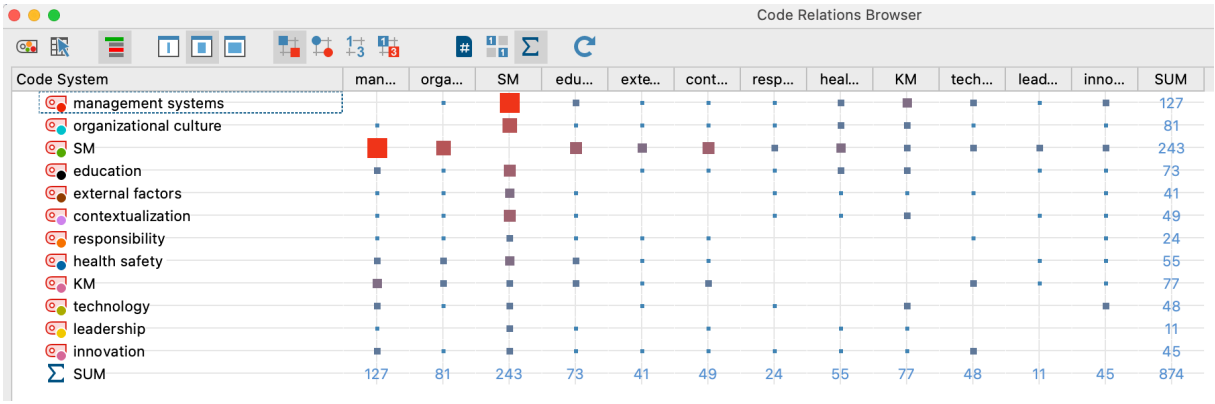


Figure 8.32. Code relations for Oatly – co-occurrence over coded segment – qualitative representation

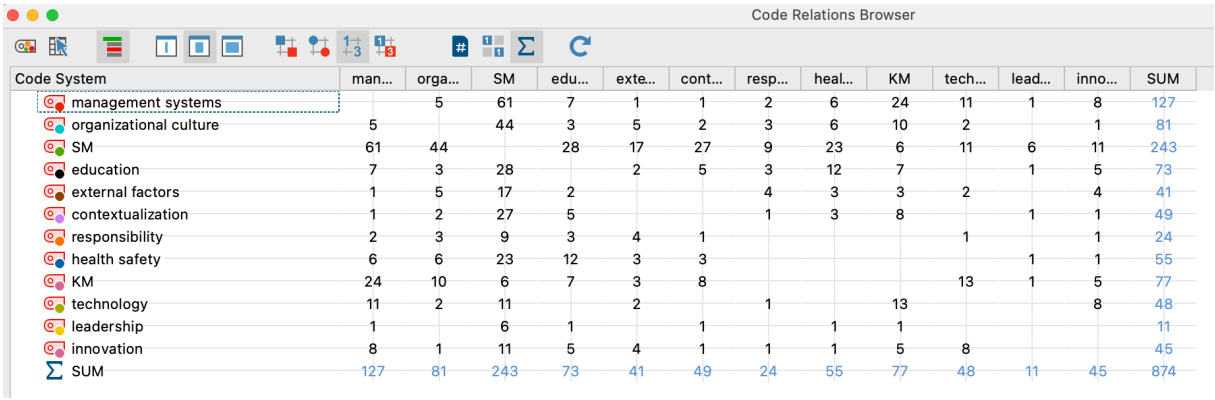


Figure 8.33. Code relations for Oalty – co-occurrence over coded segment – quantitative representation

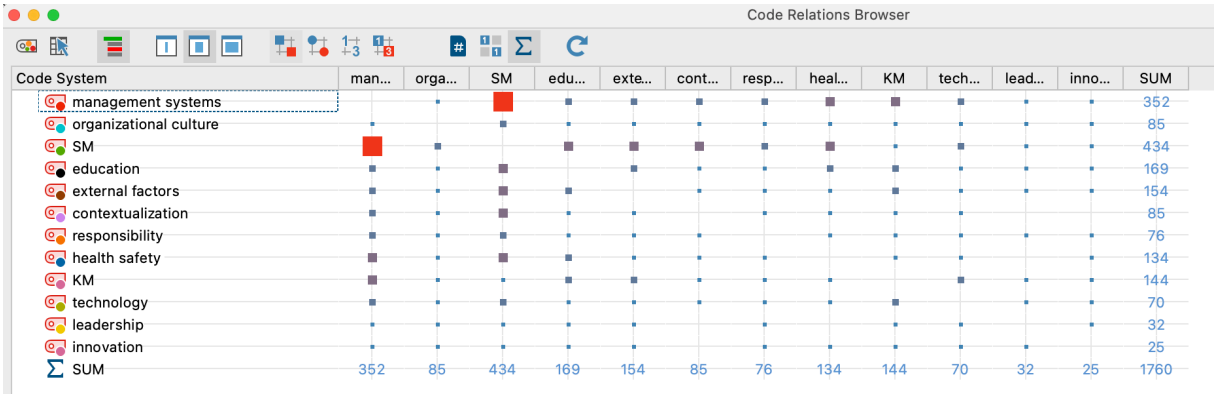
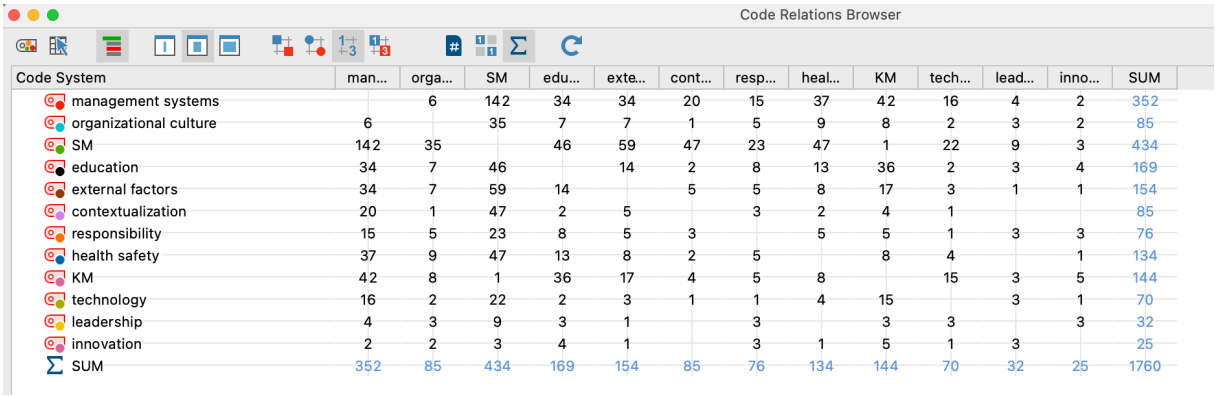
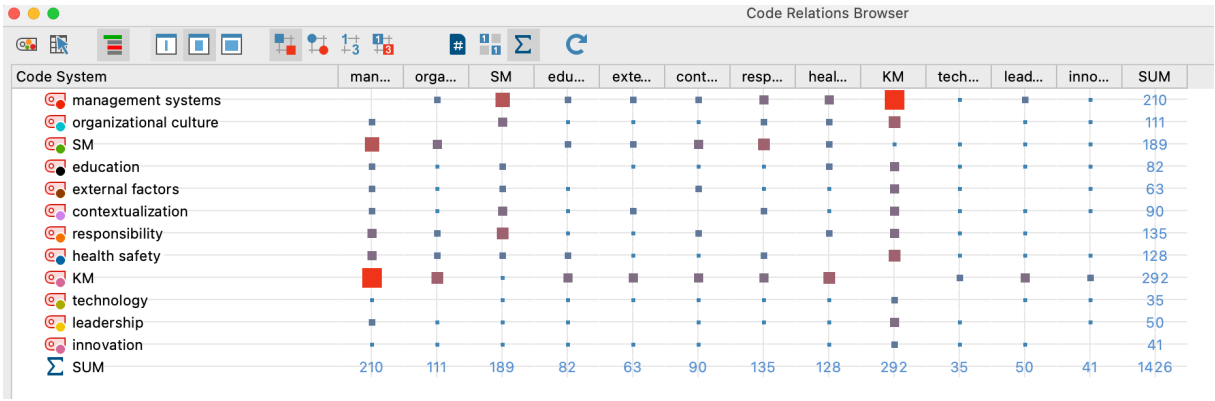


Figure 8.34. Code relations for Distributie Oltenia – co-occurrence over coded segment – qualitative representation



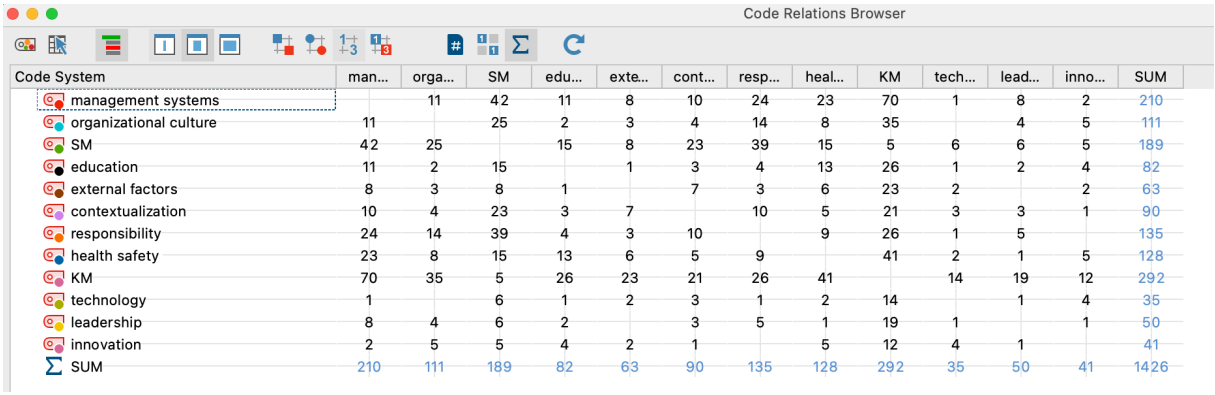
Code System	man...	orga...	SM	edu...	exte...	cont...	resp...	heal...	KM	tech...	lead...	inno...	SUM
management systems		6	142	34	34	20	15	37	42	16	4	2	352
organizational culture	6		35	7	7	1	5	9	8	2	3	2	85
SM	142	35		46	59	47	23	47	1	22	9	3	434
education	34	7	46		14	2	8	13	36	2	3	4	169
external factors	34	7	59	14		5	5	8	17	3	1	1	154
contextualization	20	1	47	2	5		3	2	4	1			85
responsibility	15	5	23	8	5	3		5	5	1	3	3	76
health safety	37	9	47	13	8	2	5		8	4		1	134
KM	42	8	1	36	17	4	5	8		15	3	5	144
technology	16	2	22	2	3	1	1	4	15		3	1	70
leadership	4	3	9	3	1		3		3	3		3	32
innovation	2	2	3	4	1		3	1	5	1	3		25
SUM	352	85	434	169	154	85	76	134	144	70	32	25	1760

Figure 8.35. Code relations for Distributie Oltenia – co-occurrence over coded segment – quantitative representation



Code System	man...	orga...	SM	edu...	exte...	cont...	resp...	heal...	KM	tech...	lead...	inno...	SUM
management systems													210
organizational culture													111
SM													189
education													82
external factors													63
contextualization													90
responsibility													135
health safety													128
KM													292
technology													35
leadership													50
innovation													41
SUM	210	111	189	82	63	90	135	128	292	35	50	41	1426

Figure 8.36. Code relations for Ericsson – co-occurrence over coded segment – qualitative representation



Code System	man...	orga...	SM	edu...	exte...	cont...	resp...	heal...	KM	tech...	lead...	inno...	SUM
management systems		11	42	11	8	10	24	23	70	1	8	2	210
organizational culture	11		25	2	3	4	14	8	35		4	5	111
SM	42	25		15	8	23	39	15	5	6	6	5	189
education	11	2	15		1	3	4	13	26	1	2	4	82
external factors	8	3	8	1		7	3	6	23	2		2	63
contextualization	10	4	23	3	7		10	5	21	3	3	1	90
responsibility	24	14	39	4	3	10		9	26	1	5		135
health safety	23	8	15	13	6	5	9		41	2	1	5	128
KM	70	35	5	26	23	21	26	41		14	19	12	292
technology	1		6	1	2	3	1	2	14		1	4	35
leadership	8	4	6	2		3	5	1	19	1		1	50
innovation	2	5	5	4	2	1		5	12	4	1		41
SUM	210	111	189	82	63	90	135	128	292	35	50	41	1426

Figure 8.37. Code relations for Ericsson – co-occurrence over coded segment – quantitative representation

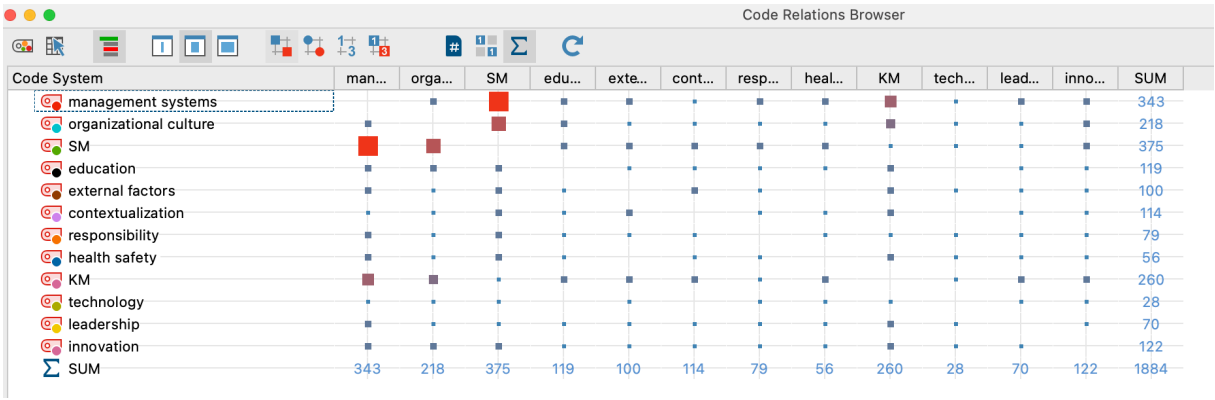


Figure 8.38. Code relations for ETH Zurich – co-occurrence over coded segment – qualitative representation

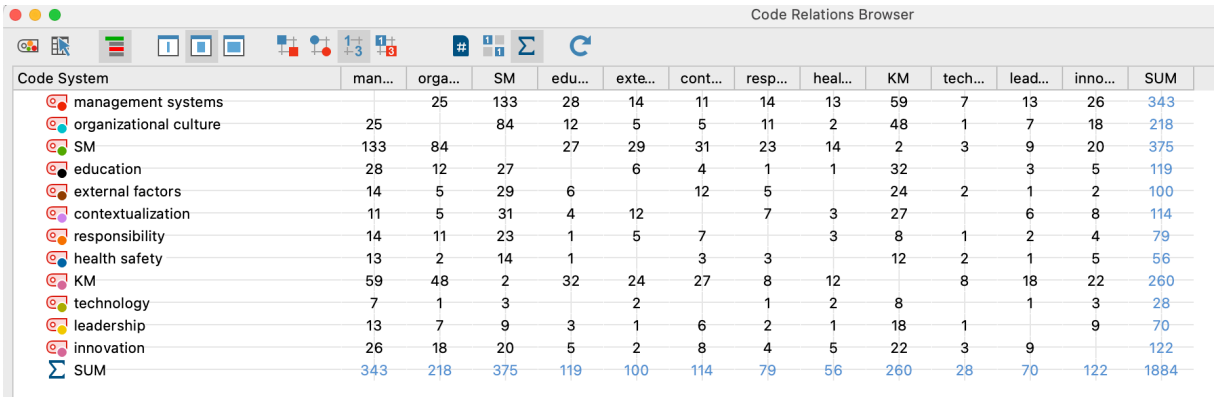


Figure 8.39. Code relations for ETH Zurich – co-occurrence over coded segment – quantitative representation

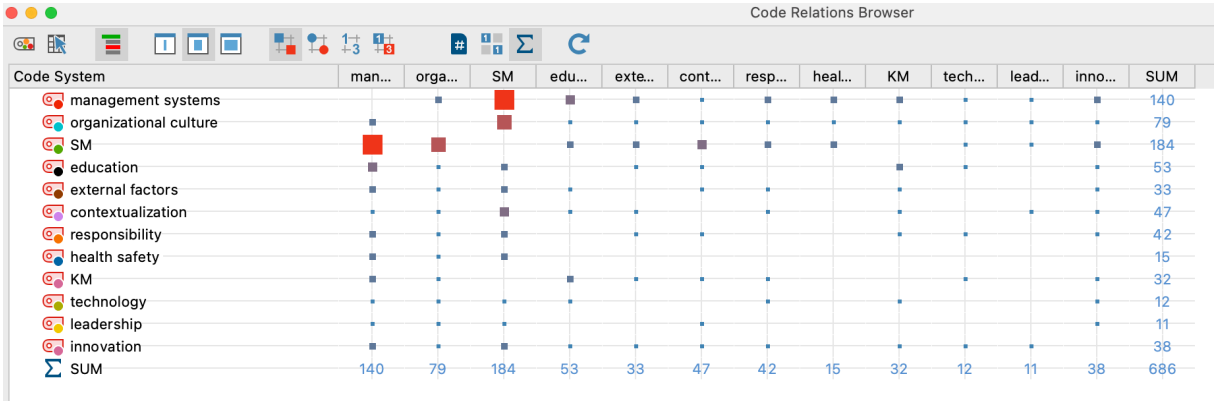
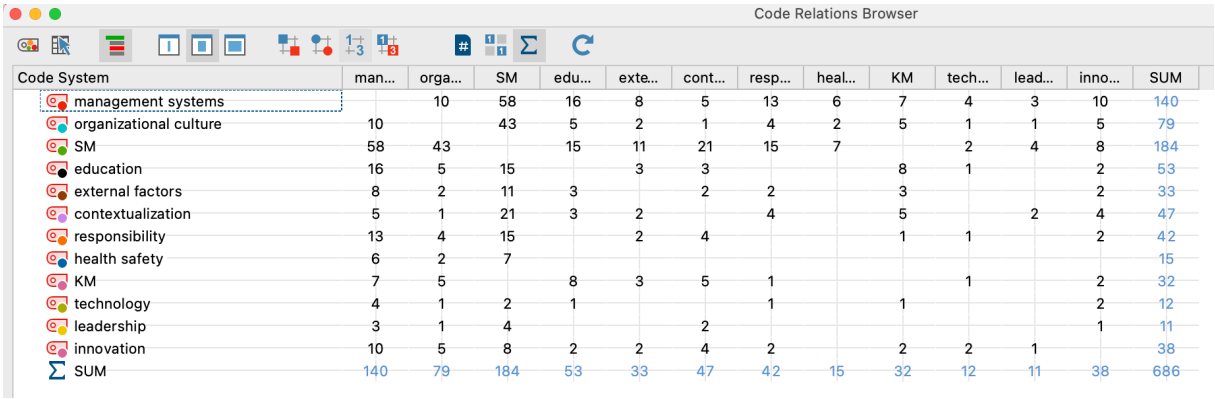


Figure 8.40. Code relations for PWC Hungary – co-occurrence over coded segment – qualitative representation



Code System	man...	orga...	SM	edu...	exte...	cont...	resp...	heal...	KM	tech...	lead...	inno...	SUM
management systems		10	58	16	8	5	13	6	7	4	3	10	140
organizational culture	10		43	5	2	1	4	2	5	1	1	5	79
SM	58	43		15	11	21	15	7		2	4	8	184
education	16	5	15		3	3			8	1		2	53
external factors	8	2	11	3		2	2		3			2	33
contextualization	5	1	21	3	2		4		5		2	4	47
responsibility	13	4	15		2	4			1	1		2	42
health safety	6	2	7										15
KM	7	5		8	3	5	1			1		2	32
technology	4	1	2	1			1		1			2	12
leadership	3	1	4			2						1	11
innovation	10	5	8	2	2	4	2		2	2	1		38
SUM	140	79	184	53	33	47	42	15	32	12	11	38	686

Figure 8.41. Code relations for PWC Hungary – co-occurrence over coded segment – quantitative representation

8.2.7 Appendix: Code Map

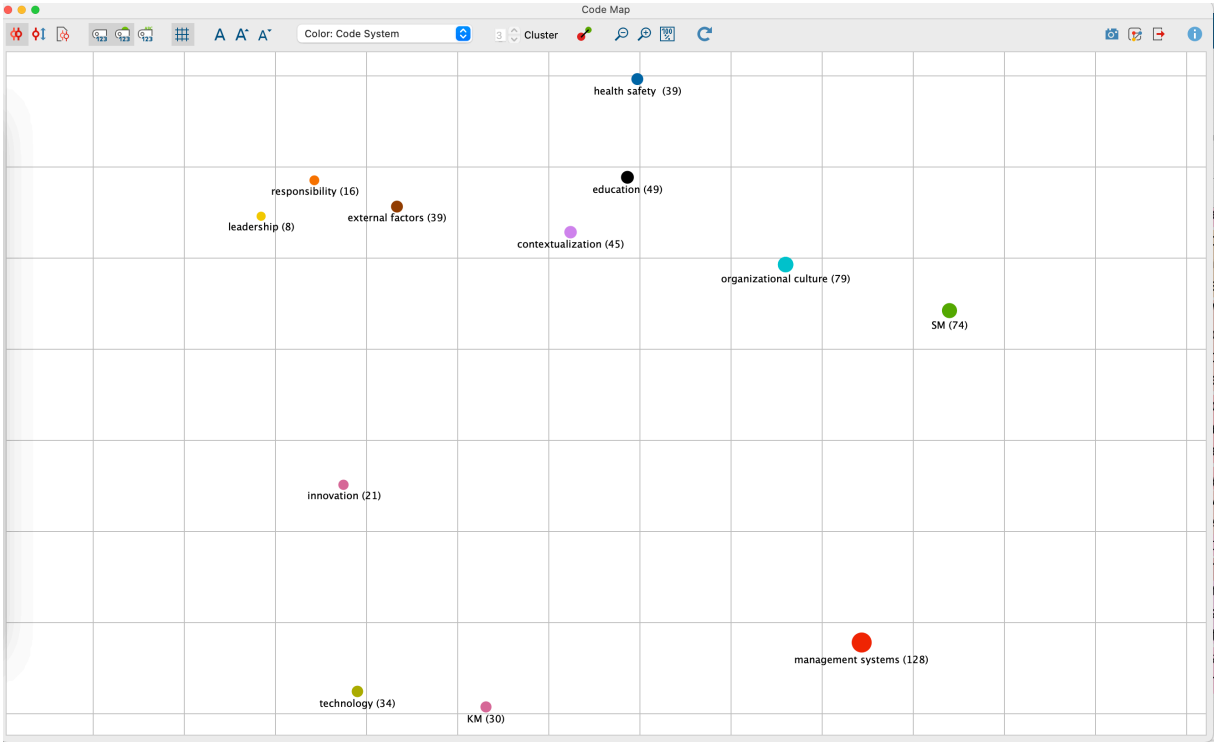


Figure 8.42. Code map for Oatly - similarity between codes based on co-occurrence of code in a segment without code relations

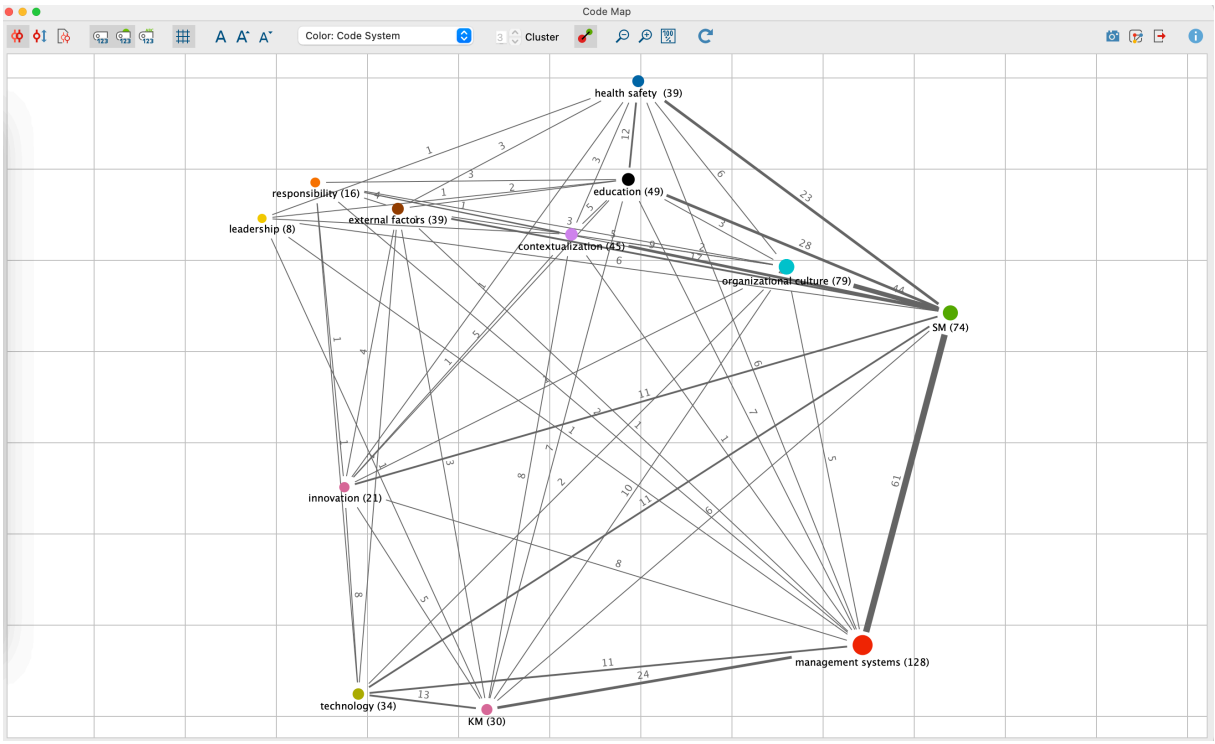


Figure 8.43. Code map for Oatly - similarity between codes based on co-occurrence of code in a segment with code relations

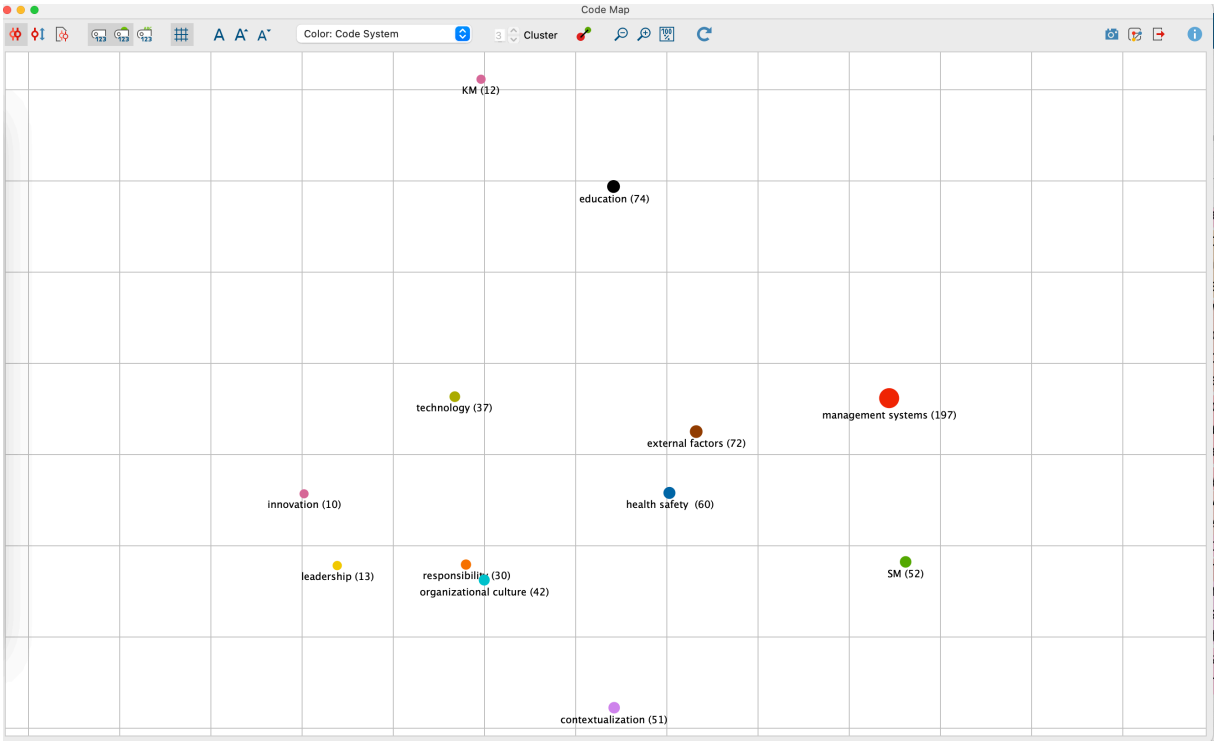


Figure 8.44. Code map for Distributie Oltenia - similarity between codes based on co-occurrence of code in a segment without code relations

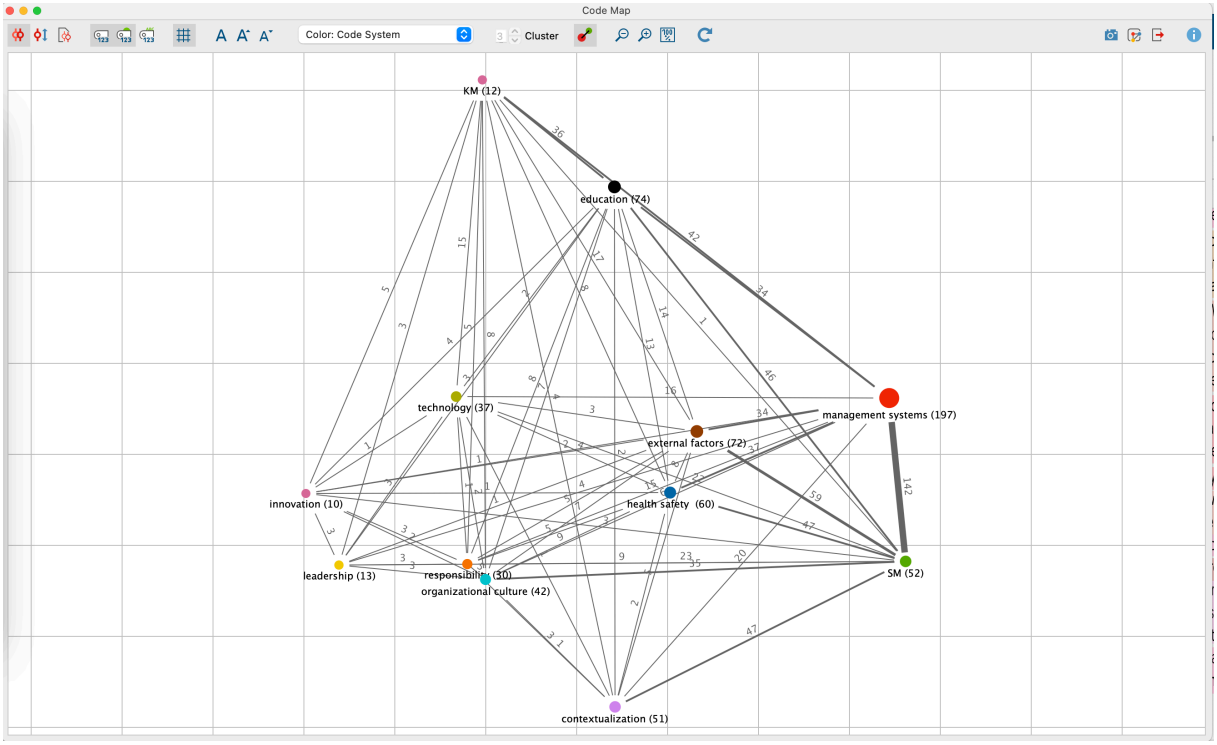


Figure 8.45. Code map for Distributie Oltenia - similarity between codes based on co-occurrence of code in a segment with code relations

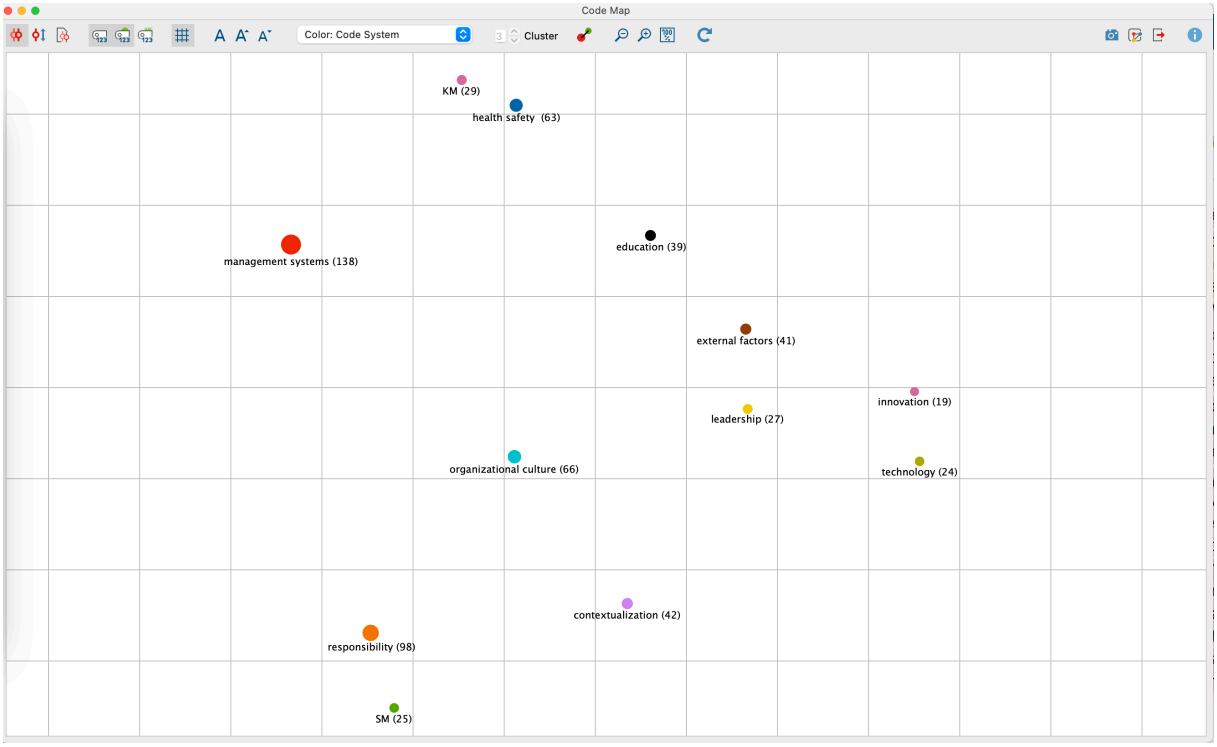


Figure 8.46. Code map for Ericsson - similarity between codes based on co-occurrence of code in a segment without code relations

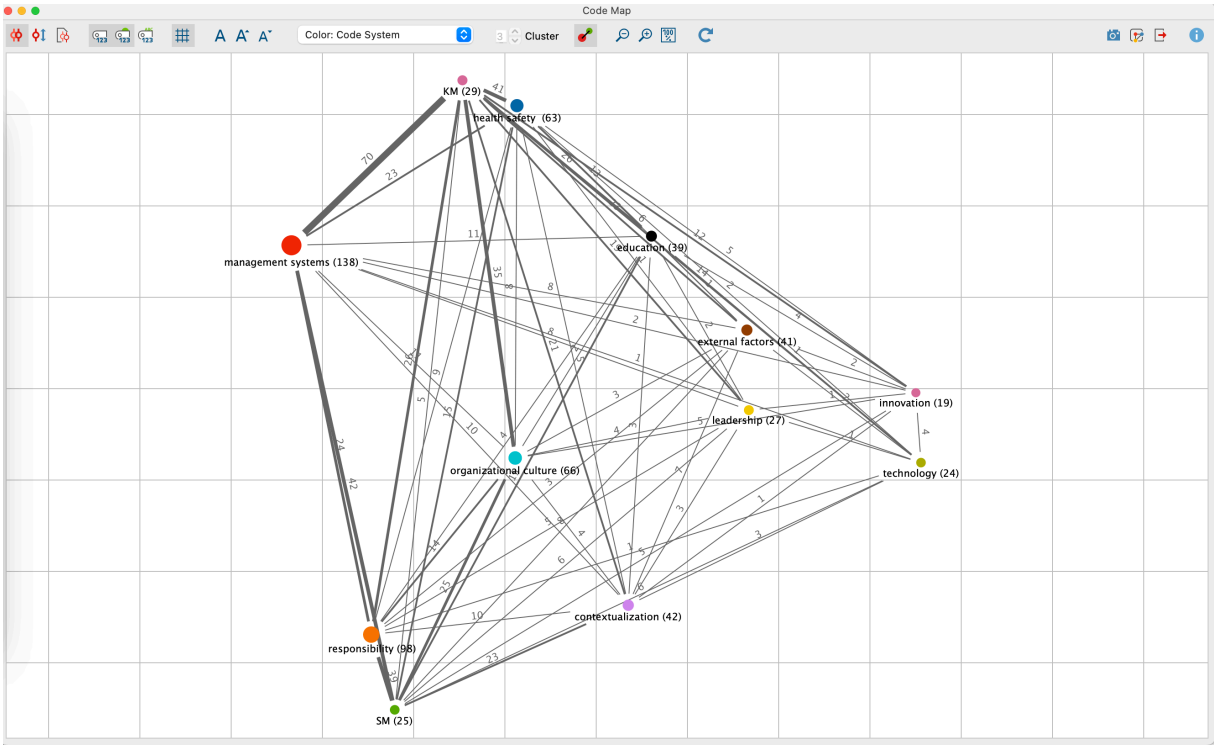


Figure 8.47. Code map for Ericsson - similarity between codes based on co-occurrence of code in a segment with code relations

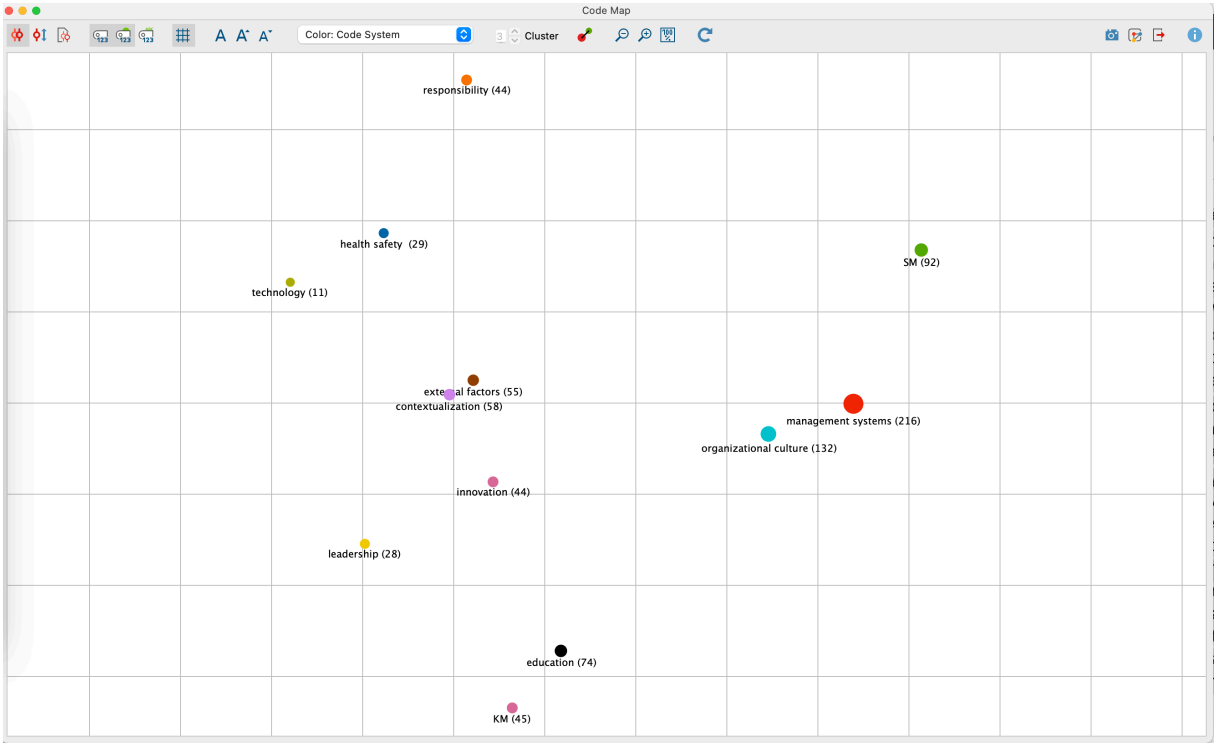


Figure 8.48. Code map for ETH Zurich - similarity between codes based on co-occurrence of code in a segment without code relations

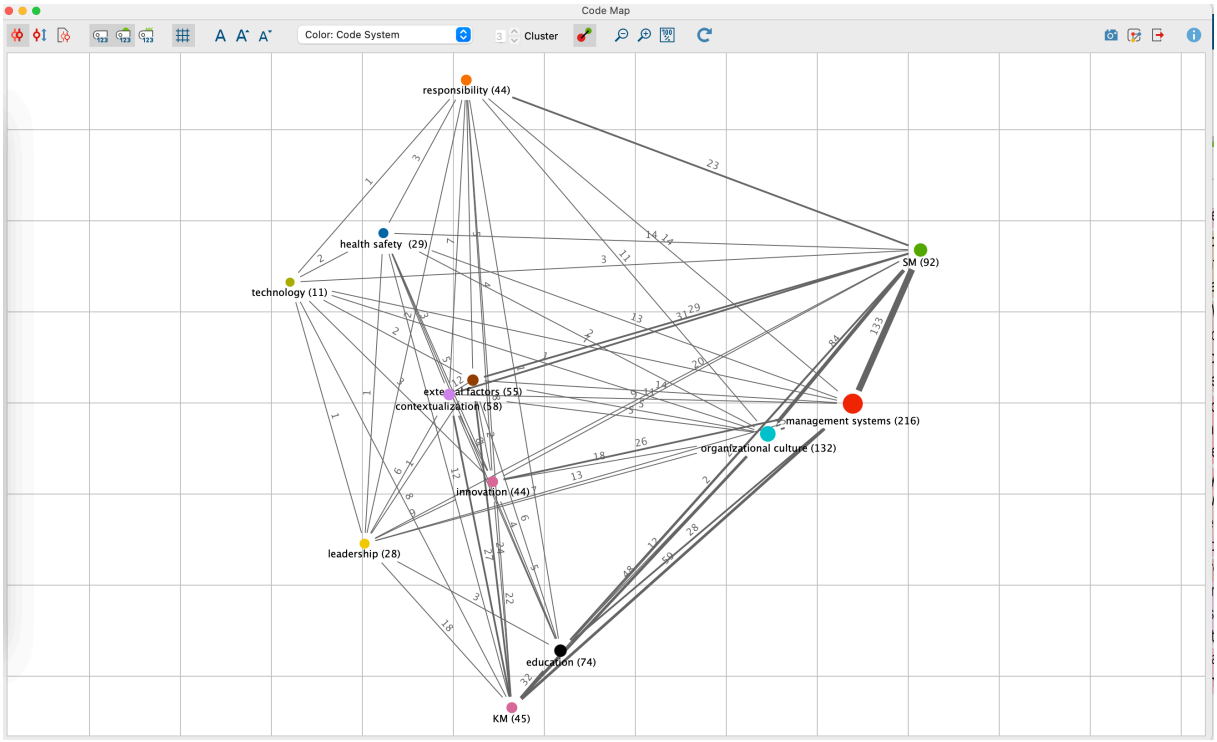


Figure 8.49. Code map for ETH Zurich - similarity between codes based on co-occurrence of code in a segment with code relations

Figure 8.50. Code map for PWC Hungary - similarity between codes based on co-occurrence of code in a segment without code relations

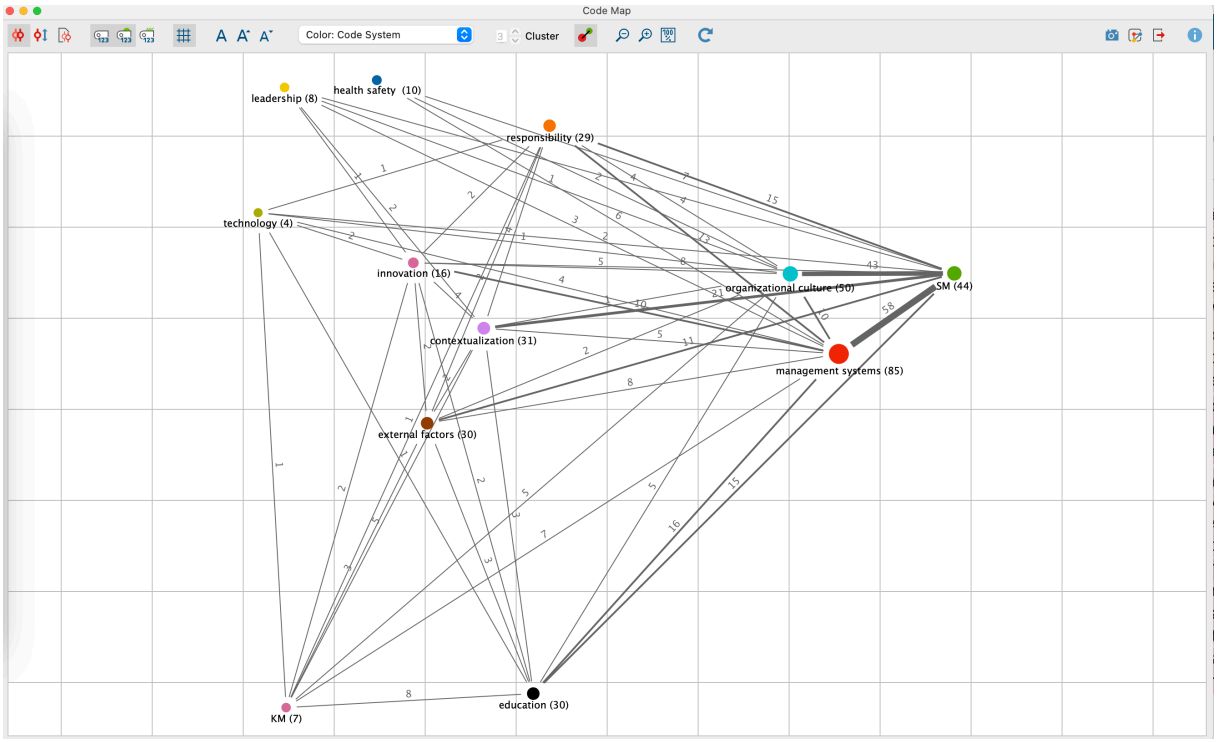


Figure 8.51. Code map for PWC Hungary - similarity between codes based on co-occurrence of code in a segment with code relations

8.3 Appendix: CV

PERSONAL INFORMATION

Corina-Monica RUSNAC (DUFOUR)
corina.dufour@student.upt.ro

WORK EXPERIENCE

Starting June 2020	Public service administrative employee, Switzerland
Starting October 2016	Secretary of the school commission, Switzerland
October 2012 – August 2013	Deputy Manager of Gas Distribution Unit, GrDF – GDF SUEZ, France *team management, activity planning, end-to-end maintenance of gas distribution network elements, budget management and reporting, in charge of work safety*
October 2011-October 2012	Project manager, GrDF- GDF SUEZ, France *Design and setup of an activity planning and programming department: determining the scope, work breakdown structure, KPI definition, internal procedures, workflows design*
May – September 2011	Process Engineer Internship, NAFTA AS – GDF SUEZ & EoN, Slovakia *Remote control of gas storage facilities and open space gas leakage and fire detection system design*
February – August 2010	Project Manager, Internship, CLUSTER Logistique Rhône-Alpes, France *Supply chain performance assessment of the Rhône-Alpes region (France)*
February– June 2010	Research Internship : LIESP Laboratory, INSA Lyon, France *Sustainable development criteria integration in supply chain models: application to the pharmaceutical environment*
May – September 2009	Methods Engineer Internship, SNCF, France *Maintenance process design; subsequent IT system conception, development and implementation*
2008 – 2009	IT Manager, EVOLIA CONSEILS & Industrial Engineering Section, INSA Lyon, France *Workflow design, development and implementation*

EDUCATION AND TRAINING

2017 - 2021	Politehnica University Timisoara, Romania PhD program in the field of Engineering and Management	PhD Degree
2014	Coursera and University of Michigan Statement of Accomplishment: Introduction to Finance	
2010 – 2011	Mines ParisTECH Engineering School & French Gas Association Major: Distribution Gas Management & Engineering	Masters Degree
2009 – 2010	National Institute of Applied Sciences - INSA Lyon, Major: Informatics - Decision Making	Master of Research
2005- 2010	National Institute of Applied Sciences - INSA Lyon, Major: Industrial Engineering	Engineering Degree

PERSONAL SKILLS

Language Skills	Romanian – mother tongue French – Fluent English – Fluent Spanish – General knowledge Italian – General knowledge
Software/Systems Skills	Programming - *Turbo Pascal, Visual Fox Pro, Java, VBA* WEB - *HTML* Data Bases – *MySQL* CAO - *Solid Edge, CATIA* ERP & CAPM - *Incoplan, SAP* Office - *MS Office*

8.4 Appendix: List of Publications

A. Scientific articles published in ISI index journals

1. **Dufour, C.M.,** Pană, A. M., Dumitrel, G. A., & Neag, N. P. (2021). Occupational Health and Safety in Higher Education: Case-Study for the Implementation of the Knowledge-Creating Spiral. Acta Technica Napocensis-Series: Applied Mathematics, Mechanics, and Engineering, 64(1-S1). WOS:000621232900018
2. **Dufour, C.M.**, Draghci, A., Ivascu, L., & Sarfraz, M. (2020). Occupational Health and Safety Division of Responsibility: A Conceptual Model for the Implementation of the OHSAS 18001: 2007 Standard. Human Systems Management, 39(4), 549-563. WOS:000592803300007
3. **Dufour, C.M.**, Ivascu, L., Mateescu, A., & Draghici, A. (2019). A proposed inventory of sustainable development indicators for the manufacturing process assessment. Quality-Access to Success, vol. 20 (Supplement 1), 253-258. WOS:000459686300044
4. Rennung, F., Paschek, D**., Dufour, C.M.**, Draghici A. (2018) Managing Complexity in Large-Scale Business Projects. A Theoretical Model. Acta Technica Napocensis Series-Applied Mathematics. Mechanics and Engineering, 61(3), Special Issue: SI ICPR-AEM 25-26.07.2018, pp. 169-178. WOS:000451702200022
5. Rennung, F., Paschek, D., **Dufour, C.M**., Draghici A. (2018) Managing Complexity in Large-Scale Business Projects. Experimental Validation of the Proposed Model; Acta Technica Napocensis. Series-Applied Mathematics MechanicsaAnd Engineering, 61(3), Special Issue: SI ICPR-AEM 25-26.07.2018, pp. 179-190. WOS:000451702200023

B. Scientific articles published in conference proceedings having WoS (ISI Thomson / Clarivate Analytics Proceedings)

1. Ivascu, L., Artene, A., Turi, A., Balan, M., **Dufour, C.** (2019). OSH-Sustainability Connection: Innovation, Education, and Benefits. In MATEC Web of Conferences (Vol. 290, p. 12017), Bondrea I; Cofaru NF; Inta M. (Eds.), Proceedings of the 9th International Conference on Manufacturing Science and Education (MSE 2019): Trends in New Industrial Revolution, June 05-07, 2019, Sibiu, Romania, EDP Sciences. WOS:000569367700146
2. Gaureanu, A., Ivascu, L., **Doufur, C.** (2019). Highlights of OSH training quality: continuous training of trainers. In MATEC Web of Conferences (Vol. 290, p. 12017), Bondrea I; Cofaru NF; Inta M. (Eds.), Proceedings of the 9th International Conference on Manufacturing Science and Education (MSE 2019): Trends in New Industrial Revolution, June 05-07, 2019, Sibiu, Romania, EDP Sciences. WOS:000569367700149
3. **Dufour, C.**, Pana, A. M., Dumitrel, G.A. (2019). Occupational Health and Safety Education: the Prevention and Protection Plan In University Chemical Laboratories, In Chova, L.G., Martinez, A.L., Torres, I.C. (Eds.), Proceedings of the 12th Annual International Conference of Education, Research and Innovation (ICERI), Nov. 11-13, 2019, Seville, Spain. WOS:000530109201095
4. **Dufour, C. M**., Draghici, A. (2018). Gas distribution companies: How can knowledge management promote occupational health and safety?. In Occupational Safety and Hygiene VI (pp. 607-611). CRC Press. Arezes P.M.,

Baptista J.S., Barroso M.P., Carneiro P., Cordeiro P., Costa N., Melo R.B., Miguel A.S., & Perestrelo G. (Eds.), Procedings of the 6th International Symposium on Occupational Safety and Hygiene (SHO), March 26-27, 2018, Guimaraes, Portugal. WOS:000460606900107

C. Scientific articles published in journals index in international databases

1. Paschek, D., Mocan, A., **Dufour, C. M.,** & Draghici, A. (2017, December). Organizational knowledge management with Big Data. The foundation of using Artificial Intelligence. Balkan Region Conference on Engineering and Business Education, vol. 3(1), pp. 301-308. De Gruyter Poland (eISSN 2391-8160). (SCOPUS, EBSCO, Google Scholar, ProQuest etc.)
2. **Dufour, C.,** & Draghici, A. (2018). A Quantitative Study on Sustainability Reporting Over the Past 20 Years in the Water Utilities Sector. Buletinul Științific al Universității Politehnica Timisoara – Seria Inginerie și Management, 4(1), 19-22 (CEEOL, Google Scholar, Index Copernicus)
3. Bejinariu, A., Mateescu, A., **Dufour, C.** (2018). Study on the Policy of Renewing Product Testing Equipment to Enhance Competitiveness. Procedia-Social and Behavioral Sciences, 238 (2018), pp. 632-637 (Prostean G., Bakacsi G., Leduc S., Brancu L. (Eds.), Challanges and Innovation in Management and Entrepreneruship, ISSN 1877-0428) (Google Scholar, SienceDirect)

D. Scientific articles published in conference proceedings index in international databases

1. Gaureanu, A., Mocan, A., Weinschrott, H., & **Dufour, C.** (2017). A Proposed Model for Evaluate Organizational Safety Culture. In Proceedings of the Management, Knowledge and Learning International Conference & Technology, Innovation and Industrial Management (MakeLearn and TIIM 2017)- Management Challenges in a Network Economy, Lublin, Poland, May 2017, pp. 285-292, ToKnowPress, (Google Scholar, EconPaper/RePec)
2. Gaureanu, A., Draghici, A., **Dufour, C**., & Weinschrott, H. (2018, October). The Organizational Safety Culture Assessment. in Ahram T., Karwowski W., Taiar R. (Eds.), Human Systems Engineering and Design, Proceedings of the 1st International Conference on Human Systems Engineering and Design (IHSED2018): Future Trends and Applications, CHU-Universite de Reims Champagne-Ardenne, France, Advances in Intelligent Systems and Computing, vol. 876, 25-27 Oct. 2018, pp. 728-736. Springer, Cham. (SCOPUS, DBLP, EI Compendex, INSPEC, WTI Frankfurt eG, zbMATH, Japanese Science and Technology Agency (JST), SCImago)
3. **Dufour, C**., Draghici, A., & Paraschiva, A. (2019, October). The Impact of Knowledge Management on Intellectual Capital. A Research Approach Using Skandia Navigators. In International Symposium in Management Innovation for Sustainable Management and Entrepreneurship (pp. 431-444). Springer, Cham. (Google Scholar, SpringerLink)
4. **Dufour, C**., & Draghici, A. (2020). Stakeholder Management in Risk Management–Considerations on the ISO 31000 Standard. Management. In Proceedings of the Management, Knowledge and Learning International Conference & Technology, Innovation and Industrial Management (MakeLearn and TIIM 2020) - Expanding Horizons Business, Management and Technology for Better Society, 20–22 May 2020, Online Conference, pp. 111-118. (Google Scholar, EconPaper/RePec)