UNIVERSITY OF LJUBLJANA
FACULTY OF ECONOMICS

MASTER'S THESIS

AN ANALYSIS OF DESIGN THINKING AND INNOVATION MANAGEMENT APPROACHES IN EUROPEAN BUSINESS SCHOOLS: THE CASE OF THE FACULTY OF ECONOMICS, UNIVERSITY OF LJUBLJANA

Ljubljana, January 2017 GIEDRĖ ŠADEIKAITĖ

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

"Innovation distinguishes between a leader and a follower."
– Steve Jobs (Gallo, 2010, p. 7)

In January 2016, the World Economic Forum released its "The Future of Jobs Report" which highlights that disruptive changes of business models will significantly affect the employment landscape and current business environment in the coming years (World Economic Forum, 2016b). The foreseen transformations will be so immense that employers will seek employees for the jobs that have not existed only five years before. As these trends are accelerating, individuals, businesses and governments need to anticipate and adjust to new skills requirements, since the so-called skill gap will continue to grow in the foreseeable future (World Economic Forum, 2016b).

The report emphasises that 35 per cent of so-called core skills sought by employers will change between 2015 and 2020, primarily in business-related industries such as financial services and investments both in developed and emerging markets (World Economic Forum, 2016a). Moreover, compared to 2015, by 2020, complex problem solving will still remain at the very top of the list of the most demanded skills. This will be followed by critical thinking, which appears in the second place of the list, and creativity will have jumped up the list from the tenth to the third place, mirroring its increasing importance in the job markets of the future (World Economic Forum, 2016a, 2016b).

According to the report, due to the rapid pace and extensive scale of changes among the demanded set of skills, well-targeted actions are necessary to be taken today to prepare the workforce with "future-proof" skills in order to avoid an increase in unemployment and inequality (World Economic Forum, 2016b). To address these challenges and ensure long-term resilience of labour markets, education systems have been in particular called upon to rethink and adjust the content and teaching practices to the needs of the 21st century (World Economic Forum, 2016a, 2016b).

Despite the fact that the nature of entrepreneurship is to initiate change through innovation and creativity, scholars argue that business tends to lack innovativeness, primarily because entrepreneurial education relies on teaching methods that are mostly based on precedents of the past aiming to reduce risks and failures (Bridge & O'Neill, 2012; Kent, 1990; Plaschka & Welsch, 1990; Vesper & McMullen, 1988). Scholars like Chia (1996), Dearing (1997), Ghoshal (2005) and Kirby (2004) have all emphasised that a more systematic approach to creativity development during education process (through changes of teaching methods and new approaches to curriculum design) can enhance students' creativity and innovation skills, as well as aptitudes. Within this context, Neck and Greene (2011) have suggested that **design thinking** can be one of the potential approaches to be employed in entrepreneurship education in order to encourage students to think more creatively and reactively. Ghoshal (2005) additionally highlighted that creativity and innovation skills among the workforce can better address interests

and needs of customers resulting in prosperous business and more fulfilling employment prospects.

The purpose of this thesis is to analyse and understand what benefits implementing a so-called design thinking approach (combined with the traditional teaching and learning practices) can bring in fostering creativity and the culture of innovation in the context of business schools in addressing the aforementioned issues. Based on these and other considerations, and the fact that there is not a single established definition of design thinking, I attempted to answer the following research questions:

- What is a design thinking approach and how can it be understood in the context of business schools (and business education)?
- Does design thinking help to develop skills and attitudes among students which are important for entrepreneurship? How can these skills influence students' creativity and capability to innovate?
- Does the implementation of a design thinking approach in business education significantly foster innovation uptake during the educational process and beyond?
- Does the implementation of design thinking enhance business education relevance for practice?

In terms of structure, my thesis is broadly divided into a theoretical and an empirical part. The theoretical part is based on a review of relevant scientific and professional literature, and presents the general framework of entrepreneurship education with the focus on creativity and design thinking. In addition, I analyse existing definitions of design thinking, its processes and characteristics, its application in innovation and business as well as its relevance in business schools and business education.

The empirical part of my master thesis is based on a combination of case study analysis and an online survey (n=102) carried out among business students at the Faculty of Economics, University of Ljubljana. Throughout the empirical research, I have attempted to test whether design thinking contributes to skills and attitude development that enhance innovation uptake and the relevance of business education. I have aimed to analyse the causal link between the implementation of a design thinking approach and the increased innovation uptake among students during and after education process. Based on my empirical results, in the end I outlined potential theoretical and practical implications of my research, and further put forward a series of recommendations for education policy makers with regards to design thinking approach implementation in other European business schools as well as in other regions.

While some content taught at business schools will always require traditional teaching methods, design thinking can significantly complement learning and teaching approaches in business education. Changing landscapes and skills requirements of job markets imply that everyone needs to alter their skills and qualifications to ensure that they can be successful in their chosen careers. Given the current business landscape context, I consider my master thesis to be a timely

contribution to the discussion on how education institutions, particularly European business schools, can better adjust to the changing needs of business landscapes and better prepare their students for job markets.

1 ENTREPRENEURSHIP EDUCATION IN BUSINESS SCHOOLS

1.1 Creativity as a part of entrepreneurship education

The fundamental nature of entrepreneurship is to initiate change through innovation and creativity. Bridge and O'Neill (2012, p. 296) described entrepreneurship as a creation process of a new enterprise which provides an original product or service. It is important that this product or service would be considerably different compared with competitors in its content, marketing or the way production is organised (Bridge & O'Neill, 2012, p. 296). Given this, entrepreneurship and entrepreneurial education should focus on empowering students to create new opportunities and implement them in very often uncertain environment. This makes it particularly relevant in today's fast-moving business world.

Nevertheless, arguments exist that the most prevailing approaches to entrepreneurship education are based on precedents of yesterday which aim to predict future actions (Neck & Greene, 2011, p. 55). As many businesses still lack innovation, students are introduced to using existing models in order to reduce the risk of failure (Neck & Greene, 2011, p. 61). Yet, by reproducing the same kinds of business, the same forms of economies are replicated. Thus, the dynamic approaches to learning entrepreneurship are widely accepted as the measure that can assist stepping out of this "vicious circle" (Neck & Greene, 2011, p. 61). Moreover, the more turbulent and uncertain the business environment, the fewer benefits might be obtained from business-as-usual approaches compared to businesses functioning in a stable setting (Dunne & Martin, 2006, pp. 513–514). Furthermore, as illustrated by the success of visionary entrepreneurs like late Steve Jobs, Elon Musk, Bill Gates, and Richard Branson, or successful companies such as IKEA, Amazon.com, Body Shop, Procter & Gamble, Virgin, or Starbucks, today firms must increasingly pursue market-driving and not market-driven strategies (Kumar, Scheer, & Kotler, 2016; Neck & Greene, 2011).

On the other hand, one must not neglect that learning foundational principles of business design, social responsibility, decision-making, leveraging failure, opportunity identification is essential for successful entrepreneurship (Neck & Greene, 2011, p. 56). However, for more than two decades scholars from various fields have suggested that entrepreneurship should be introduced differently from common management. Analytical and qualitative tools, based on left-side brain thinking and overspecialised methods taught in management cannot solve comprehensive, interdisciplinary and ill-defined issues (Kent, 1990, p. 284; Plaschka & Welsch, 1990, p. 61; Vesper & McMullen, 1988). These shortfalls can be successfully addressed by presenting broader views to students, tying up entrepreneurship and entrepreneurs' success to the motivation which goes far beyond single economic value towards wider societal impact (Giacalone, 2004; Neck & Greene, 2011, pp. 56–58).

Companies that apply unlike strategies compared to their strategic choices in the past are most likely to succeed (Ansoff, 1991, p. 455). Whereas managers in traditional business apply what they know and tend to choose between predetermined alternatives mostly based on past experience, design approaches encourage opting for totally new inexperienced solutions (Dunne & Martin, 2006, pp. 513–514). Diverse opportunities can be more easily explored through creativity, more flexible and even opportunistic strategies and working methods (Goold & Quinn, 1990, p. 54; Ansoff, 1991, p. 457).

Entrepreneurs commonly possess characteristics such as: risk-taking, self-confidence, a need for achievement, high internal locus of control, desire for autonomy, creativity and opportunism (Kirby, 2004, pp. 511–512). They apply more intuitive and holistic approaches which require more synthesis, lateral reasoning and unsystematic exploration (Kirby, 2004, p. 513). These traits are reflected in entrepreneurs' inclination towards achievements through non-conventional thinking, to challenge prevailing assumptions, as well as be flexible and adaptable when solving problems (Kirby, 2004, pp. 511–513).

Existing evidence from managerial and entrepreneurship educators confirms that creativity can be one of the leading factors in business as well as personal success. It is necessary for achieving already set goals and in strategy formulation. In addition, it permits to explore possibilities which have not been examined previously. Yet, some examples indicate that there is lack of systematic approach to creativity development among higher education students (Morrison & Johnston, 2003, pp. 145–148). As a result, this is likely to be a consequence of the fact that nowadays leaders lack creativity which could potentially be achieved, if during educational process future managers are taken out of their comfort zone and challenged to think creatively (Lazar, 2015).

Provided that creativity is introduced into the curriculum systematically and coherently, it can have multiple benefits (Morrison & Johnston, 2003, pp. 145–146). In particular, better understanding of the nature and role of creativity helps to overcome obstacles to the creative processes and develop problem-solving skills individually and in teams. Creativity also plays a significant role in identifying entrepreneurial opportunities and possible commercial application within different social and economic contexts. Finally, it usually leads to improved communication and presentation skills, as well as team building and team working capabilities (Morrison & Johnston, 2003, pp. 146–148).

Therefore, creativity plays, or should play, a significant role in business education curricula. However, it is of crucial importance that creativity and non-traditional teaching methods, such as design thinking, are integrated in the curricula in a coherent and systematic manner in order to attain desired changes in students' thinking. Creativity, as well as interdisciplinary approaches to problem-solving, are two key elements of design thinking. Thus, I will further analyse its relevance to business education in the following section.

1.2 Design thinking relevance to business education

In the late 1990s, the National Committee of Inquiry into Higher Education in the Dearing Report emphasised the need to develop entrepreneurship through innovative approaches to programme design (Dearing, 1997, p. 201). Herbert Simon was calling upon launching a knowledge platform on how design processes can assist in management already in 1996 (Dunne & Martin, 2006, p. 512). In essence, the shift to involve design thinking in business and business school contexts encouraged managers to approach issues in the way designers do. For example, it promoted thinking broadly about a particular problem, developing profound understanding of users and context, and recognising the value of diverse contribution of others (Dunne & Martin, 2006, p. 512).

Kirby (2004, p. 510) indicated that creative entrepreneurial skills could be taught at business schools and universities. However, according to Chia (1996, pp. 410–411), this requires the major shift in intellectual and educational priorities. Similarly, Dunne and Martin (2006, p. 513) claimed that rather than understanding designers, managers should become ones. The authors also argued that, as MBA programmes receive much criticism both from academia and practitioners as lacking relevance for practice, business schools should explore how design thinking could address these issues (Dunne & Martin, 2006, p. 512).

Changing business environments also make educators reconsider their learning and teaching methods and approaches. Currently, two extremes are present within business education. On the one side, formal entrepreneurship education instructs students on how to be expert employees rather than successful businesspersons. On the other side, it trains graduates only for venture creation, or starting and running business (Gibb, 2002a, pp. 140–142). Provided business schools aim towards creating innovative entrepreneurs, appropriate and fundamental transformations are required (Gibb, 2002b).

Content wise, critical thinking, the ability to assess, communication, social networking, time-management, negotiation, problem-solving, and leadership skills are a set of skills that business courses need to develop in their students as future entrepreneurs (Rae, 1997). In addition, as discussed before, future managers and entrepreneurs should not underscore creativity and willingness to take risks either (Kirby, 2004, p. 517). De Bono (1970) highlighted that developing critical thinking in business courses leads to objective, analytical and logical associations resulting in one or, at the best, a few solutions to a proposed problem. Creativity, on the other hand, is related to lateral thinking resulting in more than one potential solution through numerous associations (de Bono, 1970).

Given constant socio-economic and environmental changes globally, professionals whose education will enable them to envisage and innovate are and will continue to be highly valued (Kanter, 1984, p. 354). Therefore, business school programmes should place greater focus not on educating managers about entrepreneurship but rather for it. This, for example, includes

behaviours, skills, attributes and moral responsibilities that go beyond exclusively commercial interest (Ghoshal, 2005, pp. 75–76; Kirby, 2004, p. 514).

In terms of learning and teaching methods, different methodologies can be used to encourage students to think more creatively and more reactively (Neck & Greene, 2011, p. 64). Design thinking can be perceived as one of the potential options for this task. Dunne and Martin (2006, p. 512) argued that design thinking would encourage students to think broadly about issues, develop a thorough understanding of users, and recognise the value in cooperating with others. Ghoshal (2005, p. 81) importantly noted that, "[...] companies survive and prosper when they simultaneously pay attention to the interests [and values] of customers, employees, shareholders, and [...] even the communities in which they operate".

Neck and Greene (2011, p. 65) emphasised that a design thinking approach would empower students to recognise and act upon venture opportunities once they actively use observation, fieldwork, and understand the value creation across stakeholder groups. However, this way of learning is particularly difficult to develop through traditional teaching styles and techniques based on standard competences which are still common in the majority of business schools (Kirby, 2004, p. 517).

Despite all the benefits design thinking could bring to management education, it is essential to highlight that design thinking is intended not to replace, but rather complement learning and teaching approaches in business education. While some content typically taught in business schools will require traditional teaching methods, design thinking could contribute in the way this content is applied and implemented in practice and/or educational settings. Furthermore, such a combined approach would potentially enable broader and more holistic views of students leading them to more successful careers and personal fulfilment.

2 DESIGN THINKING AND INNOVATION MANAGEMENT

2.1 Definition and characteristics of design thinking

The concept of design thinking is widely accepted and gaining ground in practice by managers in diverse fields. However, no clear definition exists of what design thinking is, the concept itself is largely undeveloped and fundamental methods are poorly understood (Dunne & Martin, 2006, p. 512; Plattner, Meinel, & Leifer, 2010, p. 45). Nevertheless, existing definitions, regardless of whether they are coming from academia or practice, draw the attention on two essential characteristics. In particular, new product and service development process aims at satisfying human needs and improving human capabilities, and this process is based on the cooperation between different disciplines.

In his book "The Sciences of the Artificial", Simon (1969, p. 114) argued that "[d]esign [...] is concerned with how things ought to be, with devising artefacts to attain goals". Design theory intends to broaden capabilities of design through the use of technology, tools of artificial

intelligence and operations research (Simon, 1969, p. 114). Based on these early definitions, design thinking can be determined as a methodology that uses available technologies and operational knowledge to create solutions that expand human capabilities and create improvements.

Dunne and Martin (2006, p. 517) referred less to what design thinking is, but rather what lays behind its process, i.e. "[d]esign thinking is the way designers think: the mental processes they use to design objects, services or systems, as distinct from the end result of elegant and useful products". The scholars additionally argued that design thinking actually "[...] results from the nature of design work: a project based work flow around "wicked" problems" (Dunne & Martin, 2006, p. 517).

Rittel in a seminar in 1967 referred to so-called "wicked problems" as "[the] class of social system problems which are ill-formulated, where the information is confusing, where there are many clients and decision makers with conflicting values, and where the ramifications in the whole system are thoroughly confusing" (Churchman, 1967, p. B141). According to Rittel and Webber (1973, pp. 155–163), as societies are pluralistic in nature and their social problems are complex, we cannot identify a single best from a variety of potential solutions. Buchanan (1992, pp. 15–16) claimed that it is difficult to establish well-grounded theory of design because "wicked problems" introduce "fundamental indeterminacy" in searching for solutions to social issues. The notion of "wicked problems" partially explains the fact that a clear definition of design thinking is still missing in the theory of design and management.

Faste (1994, pp. 2–3) defined design thinking as a method of creative act that encompassed a variety of diverse strategies and techniques from quick brainstorming to prototyping. According to the scholar, different professions solve diverse issues differently by using the tools and methodologies which are they are best familiar with (Faste, 1981, p. 85); accordingly, an interdisciplinary approach allows having holistic solutions.

More recent definitions suggest that design thinking is a human-centric methodology for innovation which incorporates human, technological and business elements in formulating, designing and solving a problem (Plattner et al., 2010, p. xiv). It is a process where through multidisciplinary cooperation of design, engineering, business and social sciences, new products, services and systems are produced. Design thinking encourages collaborative environment where the emphasis is placed on learning through fast conceptual prototyping (Plattner et al., 2010, p. xiv).

Practitioners also proposed to consider design thinking as "a methodology for innovation that systematically integrates human, business, and technical factors in problem-forming, problem-solving, and design" (Plattner et al., 2010, p. 52). It is "[...] a human-centred set of methods and tools that combines approaches found in design and ethnography with technology and business skills" (Core elements, 2014). Another potential description of design thinking emphasised the

significance of creativity, individual needs and social factors, process of learning as well as the importance of aesthetics of final outcome products (Plattner et al., 2010, p. 53).

Brown, CEO of the global design firm IDEO and one the most well-known practitioner and promoter of design thinking, described it as "[...] a discipline that uses the designer's sensibility and methods to match people's needs with what is technologically feasible and what a viable business strategy can convert into customer value and market opportunity (Brown, 2008a, para. 1). In practice, IDEO applies a human-centred design-based approach, considers technological possibilities and requirements for business growth to help other firms and organisations to innovate and grow (About IDEO, 2014).

In academic environment design thinking is defined as "[...] a process and a mindset" (Mindset – Design Thinking, 2015, para. 1). The key potential of design thinking is to develop user-centred holistic solutions which are expressed through collaborative creativity and daily innovation culture (Background – Design Thinking, 2015, Mindset – Design Thinking, 2015). The Hasso Plattner Institute of Design at Stanford University characterised design thinking as "[...] a human-centred, prototype-driven process for innovation that can be applied to product, service, and business design (Hasso Plattner Institute of Design at Stanford in Cohen, 2014, para. 2). In other words, design thinking can be considered as a methodology to actualise concepts and ideas (Cohen, 2014, para. 5).

According to the online Business Dictionary, innovation is the process of turning an idea or invention into a good or service that creates greater or different value (Innovation, 2015). In the business context, innovation is mostly related to satisfying customers' needs and expectations (Innovation, 2015). It is important that any innovation would be something new, original or improved, and something that creates value (Dance, 2008). With this in mind, innovation management can be understood as the management of innovation processes in terms of both product and organisational innovation.

Although there is no common agreement of what exactly design thinking is, currently co-existing definitions highlight some major concepts that are essential for design thinking to take place. Scientific literature emphasises the importance of satisfying human needs and extending human capabilities. In addition, since design thinking aims to address so-called "wicked problems" in complex social context, creativity and interdisciplinary approach in this process becomes fundamental.

While practitioners endorse these design thinking features, their focus lies on design thinking as a methodology for innovation. For them, design thinking is both a process and a mindset to solve problems and create business value. Ensuring technological feasibility and cooperation among disciplines in practical terms becomes the means for providing better and more desirable solutions that potentially can offer greater profits.

Given both the academic and practitioners perspectives, design thinking can be considered as a tool for fostering innovation in businesses, institutions and society as a whole. Design thinking merges the knowledge of diverse disciplines, technological potential and creativity to turn this combination into human-centred solutions. These solutions generate value for users as well as enhance economic benefits for creators and producers (Brown, 2008a, 2008b; Faste, 1994; About IDEO, 2014; Plattner et al., 2010).

In the next section, I review the history and evolution of design thinking concept. I turn my attention particularly to the issue of how design thinking approach became relevant in management and innovation. I also overview the purposes that design thinking should serve to be a truly human-centred approach.

2.2 History of design thinking

It is hard to put the history of design thinking development into a concrete timeline or trace it from a single subject. As a concept, design thinking is relatively new and not well-established in scientific literature. Academic discourse on how it differs from other work and value creation approaches lacks coherence (Kimbell, 2009, p. 2). Different literatures on design research, management, and organisation studies usually provide diverse interpretations of the ancestry of design thinking.

Changes in organisational culture, technological advancements and societal changes that enabled engineers and designers to work closer with the end-users were the key reasons that influenced the development of the design thinking concept. Businesses also needed to search for different approaches to product development and innovation to satisfy ever-growing needs of users, who search not only for functionality but also for sort of experiences. The importance of creating positive human experiences in the concrete contexts has also contributed to the rise of design thinking in the first decade of the 21st century. Exclusive focus on human needs differentiated it from other types of methods for innovation and the ways work is organised.

While participatory methodology and methods (as the very beginning of the design thinking approach) can be traced back to earlier democracies, more recent references to design thinking date back only to the early 1960s (Di Russo, 2012, para. 5). In this regard, the conceptualisation of design thinking began with the attempt to bring design and design methods into the framework of rational science in the modern movement of design in the 1960s (Cross, 2001, p. 49). The aim was to produce works based on the values of science such as objectivity and rationality (Cross, 2001, p. 50). Likewise, Simon (1969, p. 55) defined design as the means to translate current conditions into preferred ones.

Involvement of potential users into the development process of goods and services could guarantee that human needs for rationality, change of conditions and objectivity are met. As the ancestor of design thinking, participatory methodology was in practice employed in Scandinavia to foster cooperation between researchers and employees in companies (Ehn & Sandberg, 1976).

Such collaboration allowed workers to improve their working situation, enhance their experience and enabled them to deal more effectively with unfamiliar situations (Ehn & Sandberg, 1976).

Around the 1980s, participatory design and interaction design became synonyms (Di Russo, 2012, para. 7). This happened due to the fact that participatory design used many techniques that were mostly used in the sciences. While these techniques included usability testing, mock-ups, prototyping and role playing, the users' experiences were still neglected (Di Russo, 2012, paras 7–9). To address this drawback, co-design or collaborative design started to take place as an option. The key purpose of the co-design was to turn passive users into cooperative designers that re-focused and transformed participatory design into a user-centred design (Di Russo, 2012, paras 7–9).

Later, the importance of end-users and their needs increased, and they were placed in the very centre of design methods and techniques. Norman and Draper (1986, pp. 54–55) indicated that it is essential to take into account the wide range of users, potential physical and technology limitations, as well as time and economic constrains. They highlighted that the key objective of the user-centred design was to provide meaningful and user-friendly tools to connect people and systems (Norman & Draper, 1986, p. 55). Finally, the authors argued that the user-centred design should begin with and be dominated by the needs of the users in order to serve them (Norman & Draper, 1986, p. 61). Given this, we can observe that for the first time in history user-centred design took into account not only the functionality or efficiency of products or services but also the users and their environment. Such a broader approach to design provided the basis for development of innovation which could satisfy increasing needs across more diverse consumers and segments.

In the mid-1990s, service design methodology started to appear as a new design methodology. The progress from participatory design to user-centred design and more focus on users' experiences extensively shaped this new methodology (Di Russo, 2012). Instead of only concentrating on end-costumers, service design practitioners attempted to cooperate with all relevant stakeholders to enhance the value of a product. This process not only fostered knowledge creation and exchange, but made both end-users and designers to engage in the actual design process (Di Russo, 2012; Kimbell, 2009).

I consider service design as one of the most important steps in the development of the so-called design thinking approach from the perspective of innovation and management. Service design embedded a holistic approach in design methodology, extended the definition of who are the ultimate users of a particular product or service, and involved all stakeholders who were affected and/or interacted with them (Di Russo, 2012). Bringing relevant stakeholders together enabled both engineers and management to cooperate more closely facilitating two key changes in business. Companies could diversify their products and services, and at the same time, thoroughly examine how consumers use them and if they truly satisfy their needs.

Around the 1990s, terms like user-centred design and human-centred design were used nearly interchangeably, as in both cases end-users were involved in the product development process. However, in the late 1990s, the trends shifted from the focus on technology-driven to human-driven design. This was the moment when human-driven design methodology became more like a mindset rather than just a combination of tools (Di Russo, 2012). According to Rouse (1991, p. 4), human-centred design should concentrate not only on the performance, productivity, economics or competitiveness but also on the roles of humans in complex systems. Rouse (1991, p. 4) emphasised that human-centred design should serve three purposes, namely:

- To enhance human abilities which are identified, understood and cultivated in design process;
- to assist in overcoming human limitations;
- to foster user acceptance that can better explain users' preferences and concerns.

Service design initiated the extensive holistic approach in design methodology that facilitated the rise of human-centred design involving all stakeholders and types of innovation (Di Russo, 2012). Brown (2008b) explained that, based on a human-centred design philosophy, innovation can only take place when people's needs are well observed and understood. Norman and Draper (1986, p. 61) also noted that the final design product should result from the collaboration between different disciplines.

Approaching human needs from many different perspectives has a greater potential to resolve wider societal issues. Buchanan (1992, p. 14) claimed that complexity of issues addressed by designers randomly can be solved by the knowledge of a single discipline. He stated that it is particularly difficult to discover foundations of design thinking in the fine arts, the natural and social sciences as all areas are interconnected (Buchanan, 1992, pp. 5–10). While historically design has not played a significant role in innovation processes (Brown, 2008b), scholars like Buchanan (1992, p. 10) argued that different areas and dimensions of design thinking provide grounds for shared invention by reconsidering problems and solutions.

Moreover, Johansson and Woodilla (2013) highlighted the existence of two different discourses of design thinking, referring to the so-called "designerly thinking" discourse and the management discourse of design thinking. According to the authors, the so-called "designerly thinking" discourse began in the 1960s and mainly referred to design thinking as a way designers think and work. This discourse has developed within the design discipline field. The main originators of the "designerly thinking" discourse were Simon (1969) with the notion of the science of the artificials and rationalism, Schön (1983) reflecting pragmatism of design in action, and Buchanan (1992) highlighting the "wicked" problems as the main design subject (Johansson & Woodilla, 2013, pp. 126–130; Schmiedgen, Rhinow, Köppen, & Meinel, 2015, p. 134).

Among more recent originators of "designerly thinking" important to mention are Bryan Lawson (2006) and Nigel Cross (2001, 2006) who focused on the notion of designerly ways of knowing. In particular, Lawson (1980) noted that when solving problems, designers are more solution-

oriented while scientists tend to focus more on the problem itself and its analysis. Building on Lawson's idea, Cross (2001, 2006) added that designers solve problems based on synthesis rather than thorough analysis. Krippendorff (2006) concentrated his work on creating meaning in design discourse and semantics (Johansson & Woodilla, 2013, pp. 126–130; Schmiedgen et al., 2015, p. 134).

On the other hand, according to Johansson and Woodilla (2013), the so-called management discourse of design thinking started in the 2000s and was mainly linked with the management practitioners' ways of using design thinking in their work. Design consultancies such as IDEO, formed in 1991, were among the main promoters of the design thinking approach as a tool solving problems and fostering innovation in business (Schmiedgen et al., 2015, p. 134). These ideas were mainly directed towards company managers by showcasing success cases how design thinking works and how it can be applied in different contexts by linking it with innovation research (Schmiedgen et al., 2015, p. 134).

Other originators of the management discourse of design thinking were Boland and Collopy (2004), and Martin (2009a, 2009b). Boland and Collopy (2004, pp. 3–19) argued that the greatest imperfection of traditional managers' thinking is the so-called "decision attitude" compared with design thinking or "design attitude". The authors emphasised that managers traditionally base their decisions using risk assessments and economic analysis techniques to evaluate different predefined alternatives. In such a process, managers' key task is to choose rationally among the existing alternatives. Contrarily, design thinking or "design attitude" offers managers opportunity to create new alternatives and analogies using design thinking and only then to choose the best possible, newly designed alternative (Boland & Collopy, 2004, pp. 3–19).

Dunne and Martin (2006) and Martin (2009a, 2009b) highlighted theory development in the field of cognitive and management science and planning theories, by using thriving examples of production companies that apply design thinking approach in their processes. The scholars argued for the importance to combine induction, deduction and abduction as the ways of reasoning, which I will analyse in greater detail in the following section, to identify best potential solutions to problems. Dunne and Martin (2006) in particular became some of the main proponents of the management discourse of design thinking and started the discussion of design thinking in management education.

Whereas the "designerly thinking" and the management discourse of design thinking differ substantially in their scope and advancements in terms of theory development, we can easily observe that the management discourse of design thinking was heavily influenced by the school of thought of the "designerly thinking" discourse. However, in my thesis, while I will focus mainly on the management discourse of design thinking in the following literature review and empirical study, some elements of the "designerly thinking" discourse will also be used at times.

Having summarised the history of design thinking and explaining the two existing discourses of design thinking, in the following part I explore processes behind design thinking and analyse

how problems and solutions are identified. I also attempt to explain the differences between design thinking approach and common problem definition practices. Finally, I describe design thinking process and compare it to business process emphasising the elements which are needed for design thinking process to be successful.

2.3 Design thinking as an innovation in management education

In this section, I analyse how design thinking approaches, brought to business schools through so-called **d.schools**, can complement traditional business education, generate broader knowledge and experience among students. I also explore what changes design thinking brings in terms of teaching and learning.

Entrepreneurs are those who innovate and deliver new solutions (Kao, 1997, pp. 237–238). The more relevant managerial education is to the needs and realities of contemporary business and society, the less future entrepreneurs will be discouraged to obtain business education (Neck & Greene, 2011, p. 56). Innovation in education is perceived as one of the most crucial means by which education institutions can meet global existing challenges (Blândul, 2015, p. 485).

Innovation in education does not only relate to the implementation of new information technologies. Fostering teaching attractiveness implies value transformation, information content, and changes in teaching and learning methods (Blândul, 2015, p. 485). According to Matsuda and Cohen (2014), innovation in education is required to be implemented simultaneously in all components of educational activities. Provided this is not the case, the overall quality of curricula and academic students' achievements may be negatively affected.

Kirby (2004, p. 517) noted that entrepreneurial education should provide the enterprising environments and use approaches to learning that foster entrepreneurial capabilities and aptitudes alongside business expertise. Therefore, for the purpose of research within my master thesis, I focus mostly on teaching and learning processes with particular attention to design thinking, which can enhance management education relevance in practice, while at the same time build on management curricula and theory.

Design thinking in higher education can be easily compared to experimental learning tools and techniques. This comparison is particularly based on similarities in their processes. Experiential learning process is the process where knowledge is created transforming experiences and new observations (Kolb & Kolb, 1984, p. 41). Like in the 5-step design thinking process (discussed in Chapter 2.5), the experiential learning process is based on four learning cycle steps, namely: experiencing, reflecting, thinking, and acting – where experiences provide basis for observation and reflection (Kolb & Kolb, 2005, p. 193).

By looking at how learning is organised in management education compared with other disciplines (e.g. the arts), one can easily identify differences. Management education is mostly organised based on texts used in scientific and academic discourse whereas the experiential

learning follows the demonstration-practice-production-critique logic, common in art education (Kolb & Kolb, 2005, pp. 202–203). In this regard, the areas where the major changes can be introduced to management education through design thinking include: better theory-practice integration, less focus on linear argumentation, more focus on students' performance, expressions of students' skills and ideas, more individualised attention and introduction of diverse learning styles (Kolb & Kolb, 2005, pp. 202–203).

Apart from the teaching and the learning methods themselves, class setting also matters. Such class is expected to involve specialists from different areas combined with inclusive and student-centred approach (Morrison & Johnston, 2003, p. 149). Morrison and Johnston (2003, pp. 151–152) emphasised that in relaxed but challenging class environment students become more self-confident, independent and creative thinkers. In classes that resemble more the professional work setting rather than conventional classrooms, students are encouraged to initiate changes through innovation and entrepreneurial behaviour (Morrison & Johnston, 2003, pp. 151–152). Evidence showed that developing coherently creativity and creative thinking during such classes also has positive sustainable long-term effects on students' further learning and careers (Morrison & Johnston, 2003, p. 156).

Design thinking combined with traditional teaching and learning can foster creation of stronger links between theory and practice. It pays more attention to students' expression of ideas and performance through active engagement in the learning process. At the same time, it is essential in business education to maintain a balance between traditional teaching and learning methods and techniques, as well as new ones, such as design thinking or other experiential learning techniques, and content. Similarly, in business, according to Leavy (2010, p. 9), companies aiming to succeed should master both, i.e. classical work of a traditional firm with prototyping features coming from design and art education.

2.4 d.schools in business education

Design school – (or d.school) is the way how design thinking methods and techniques are introduced, taught and developed in business education, as well as in other disciplines. The origins of the very first d.school come from Stanford in 1958 by establishing a Product Design major and the graduate-level Program in Design (History, 2016). It was the time when Professor John Arnold proposed for the first time the idea that design engineering should be human-centred and applied to education.

The curriculum of the design programme was formalised in the mid-1960s making it one of the first inter-departmental programmes at Stanford named as the Joint Program in Design (History, 2016). Later, other professors continued to develop the multidisciplinary curriculum that merged disciplines of art, technology throughout the 1980s and added a business elements emphasis in the 1990s. Since its establishment in 1958, the design programme continues in refining human-centred methodologies and instruction practices of the school (History, 2016).

In 2003, the Hasso Plattner Institute of Design or, d.school, was founded at the School of Engineering at Stanford University (Hasso Plattner Institute of Design at Stanford, 2012). Based on methods of engineering, design, the arts, social sciences and business, design thinking courses aim to develop solutions to a number of real-world challenges in innovative and human-centred ways (Hasso Plattner Institute of Design at Stanford, 2012). It is noteworthy to emphasise that d.school courses have become one of the most attractive courses in already highly selective Stanford (Korn & Silverman, 2012; Perlroth, 2013). The interest continues to raise as per an increasing number of applications received every year (Hasso Plattner Institute of Design at Stanford, 2012).

In Europe, the Hasso-Plattner-Institut School of Design Thinking in Potsdam, established in October 2005 at the University of Potsdam, has become the first well-known d.school for innovation in Europe (Background – Design Thinking, 2015). It is based on the same methods, as its "mother" at Stanford, where design thinking continues to evolve and be developed (Background – Design Thinking, 2015).

Innovation is essential for business schools' success and attractiveness. This can also be supported by the variety of rankings and listings of the most innovative business degrees nationally, regionally and globally. Such rankings include Top 20 Most Innovative MBA Programs, the 10 Most Innovative Business School Courses, Innovation MBA Rankings or 50 Most Innovative Business Schools in America, among others (Business Management Degree, n.d.; TOP MBA, 2015; Master's in Business Degree Guide, 2014; Stanley, 2010). However, the European business schools that have already established d.schools or that are implementing design thinking techniques in their teaching are not well-known.

In this regard, for example, the Faculty of Economics at the University of Ljubljana (hereinafter: FELU) in Slovenia established its d.school based on design thinking techniques developed at Stanford as early as 2006. However, this is not well known (Ellermann, 2015, p. 5). Currently, Kaunas University of Technology (hereinafter: KTU) in Lithuania is in the process of integrating design thinking as part of their pedagogic methodology and a way to enhance innovation (KTU, 2015). Also, Business School of University of Deusto in Spain applies design thinking methodology in their Programme for Leadership Development, and in some other areas/programmes as well (Deusto Business School, 2015).

While a global directory of schools applying design thinking to different extent in their pedagogic methods exists (Design Thinking in Schools K12 Directory, 2015; Krummeck, 2013), to the best of my knowledge, no regional or global network uniting higher education institutions that implement design thinking has been established so far. Therefore, I will attempt to analyse and investigate this issue in the following chapters of my master thesis.

2.5 The design thinking process and its characteristics

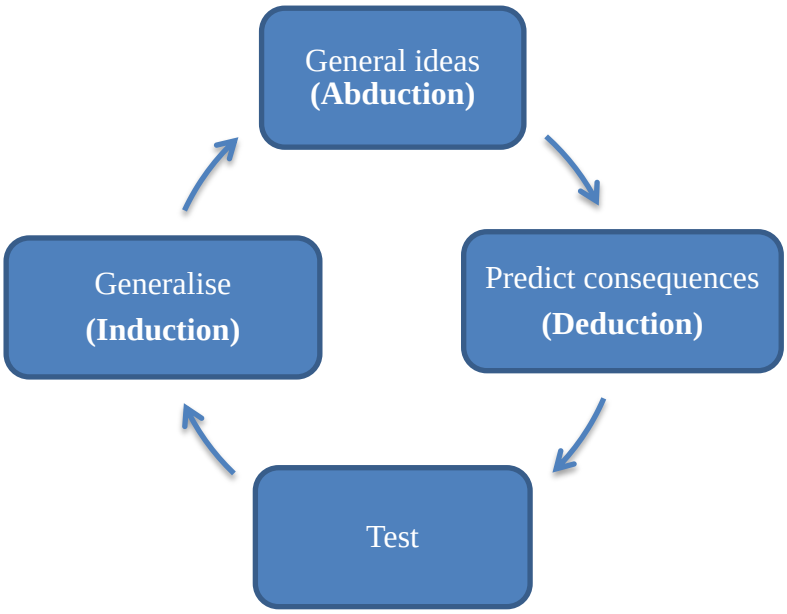
Currently, there is no accepted definition or theory of design thinking (Johansson & Woodilla, 2010). Alexander (1964, p. I–102) stated that the process of design is an error-correcting development aiming to invent new things or organisation forms. Likewise, as an integrative discipline, the design is not linear *per se* and neither are the myriad processes involved behind it (Buchanan, 1992, pp. 13–18). As problems addressed by designers and businesses globally are not linear, neither design thinking nor decision making are linear processes. Consequently, profound, non-linear analysis, a holistic and systematic approach, as well as synthesis are necessary to apply in order to invent new products and/or services (Buchanan, 1992, pp. 13–18).

Similarly, according to Dunne and Martin (2006, p. 517), the design thinking process is a project-based process, which is one of the key differences compared to managers' work founded mainly on ongoing and permanent assignments. Design thinking involves the following (Dunne & Martin, 2006, pp. 517–518):

- Inductive reasoning or generalisation from specific;
- deductive reasoning based on logic;
- abductive reasoning founded on process of establishing explanations which are of crucial importance in establishing new ideas.

Besides, the authors also identified a testing step in the design thinking process which brings three forms of reasoning into one design thinking process (see Figure 1).

Figure 1. The Design Thinking Process

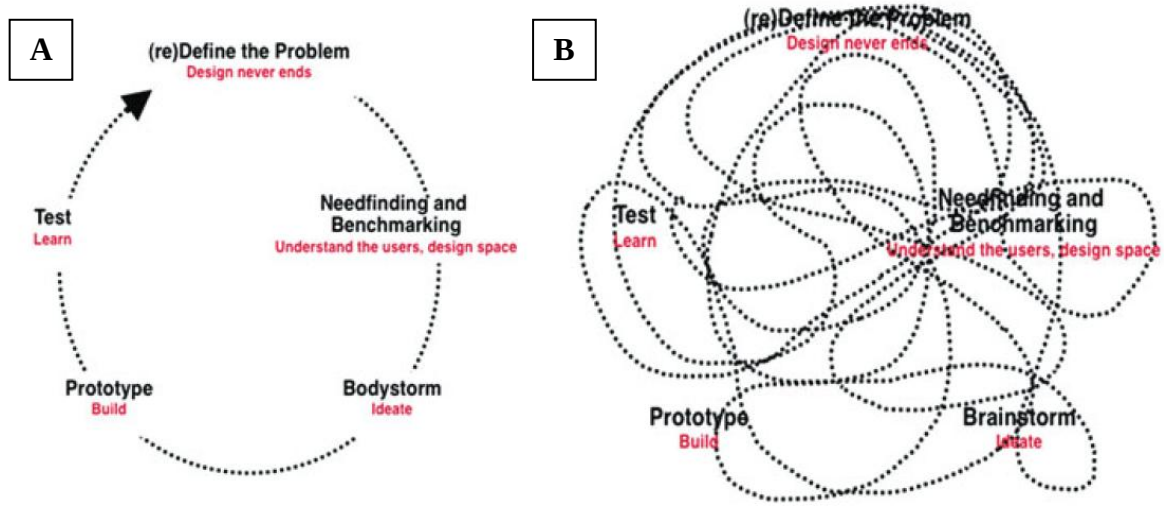


Source: D. Dunne & R. Martin, *Design Thinking and How It Will Change Management Education: An Interview and Discussion*, 2006, p. 518.

Such a process enables generation of new ideas on the one hand, while on the other, it also enables analysis and evaluation of their general application and impact of changes for some components (Dunne & Martin, 2006, p. 519). This indicates another difference compared to managerial thinking. The design thinking process is not considered in terms of constrains but rather as stimulus/stimuli for creative solutions and new invention opportunities (Dunne & Martin, 2006, p. 519). While Simon (1969), and Boland and Collopy (2004) argued that constrains are limiting the creative process, the analysis of design thinking definitions suggests that the entire design thinking process aims to find solution to human and society constrains in terms of their needs.

According to Plattner et al. (2010, p. xiv), usually problem definition and solution process is understood as a five-step process, as shown in Figure 2A. If a test does not provide support for a proposed prototype, the cycle repeats again. In design thinking, interaction of nearly the same major steps among each other occurs frequently (see Figure 2B). However, practice and expertise are required to know when the stages will be changed and which stage should follow (Plattner et al., 2010, p. xiv).

Figure 2. Problem Definition and Solution Process within Design Thinking



Source: H. Plattner et al., *Design Thinking: Understand – Improve – Apply*, 2010, p. xiv.

Based on the presented theoretical frameworks of design thinking process, design thinking promoters at Stanford suggest a design thinking process which is divided into five steps, namely (Hasso Plattner Institute of Design at Stanford, 2013, pp. 1–5):

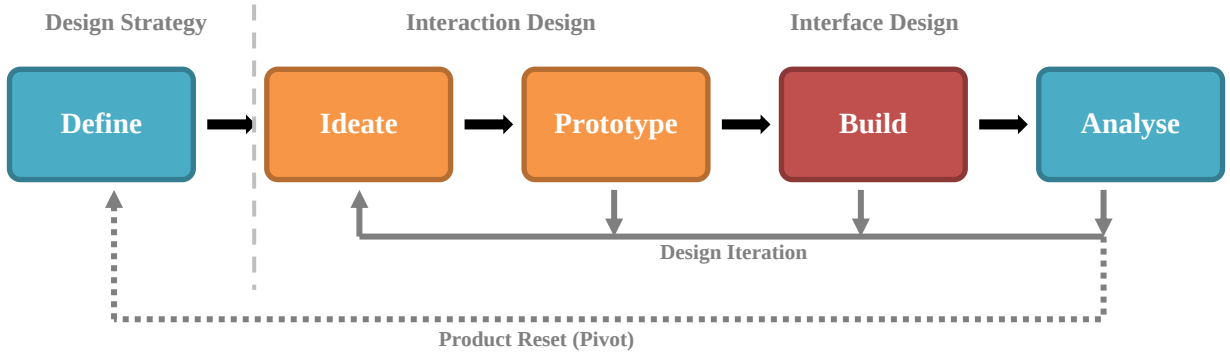
- Empathise – meaning to get a broad understanding of the experiences of users that you are designing through the techniques such as observation, interaction and immersion.
- Define – identify users' point of view based on the processed and synthesised findings of the empathy work.
- Ideate – investigate as wide as possible variety of potential solutions enabling a step further from the obvious to ideas.

- Prototype – turn the ideas into a physical form that would allow further exploration and learning experiences.
- Test – at this step the high-end products are being tested and refined based on the feedback received further advancing the knowledge of users and refining the original viewpoint.

It is worth noting that all the five steps are not necessarily sequential. As in the design thinking process many creative and analytical multidisciplinary methods are used, Hasso Plattner Institute of Design at Stanford (Our point of view, 2015, paras 3–4) suggests that learning through action many times brings new insights leading to unpredicted solutions. Repetition of all the steps as many times as possible permits design thinking practitioners to personalise, internalise and apply design thinking methodology to address diverse issues and solve challenges of different businesses (Our point of view, 2015, paras 3–4).

Some other instances of the design thinking process used in practice show that it can be adjusted to different needs of a concrete user. For example, the design thinking process, adapted by company ZURB is based on another set of steps shown in Figure 3 (Zmijewski, 2014; Design Process, 2015). Moreover, the process cycle reflects the iteration of all steps, as proposed by Hasso Plattner Institute of Design at Stanford and described above, and, additionally, is sub-divided into three sections of design strategy, interaction design and interface design (Zmijewski, 2014; Design Process, 2015). Such an approach enables more profound understanding of design process when compared to business functioning procedures in terms of strategy formulation at strategic management level and value chain of product and/or services creation and introduction at operational management level.

Figure 3. Design Thinking Process at ZURB



Source: *Design Process*, 2015.

The essence of the design thinking process is to combine technical feasibility, economic viability and desirability by the users (Plattner et al., 2010, p. xxi). As further Plattner et al. (2010, p. xxi) explained, design thinking and its underlying process, is based on four rules:

- The human rule highlights that design activities are social in their nature and for this reason successful innovation should always focus on the "human-centric point of view". This means that technical problems shall be solved with the aim to satisfy human needs.
- The ambiguity rule emphasises the need for experimentation yet at the limits of knowledge and where one still is able to control the events. The importance is one's ability to see things differently since every design thinker needs to preserve ambiguity.
- The re-design rule underlines the importance of seeing how human needs were addressed in the past. While taking into account technological and social changes, better predictions can be made with regard to future social and technical circumstances as current design is actually a re-design of the previous one.
- The tangibility rule draws attention to the importance of conceptual prototyping as a major activity in design thinking because it serves as a means of communication.

Likewise, other authors highlight a further list of qualities that design thinking requires. Although these characteristics include a human-centred approach, they go beyond creativity. They emphasise a more constructive approach to the design thinking process. These features and ways of working explained by Owen (2006, pp. 23–25) include:

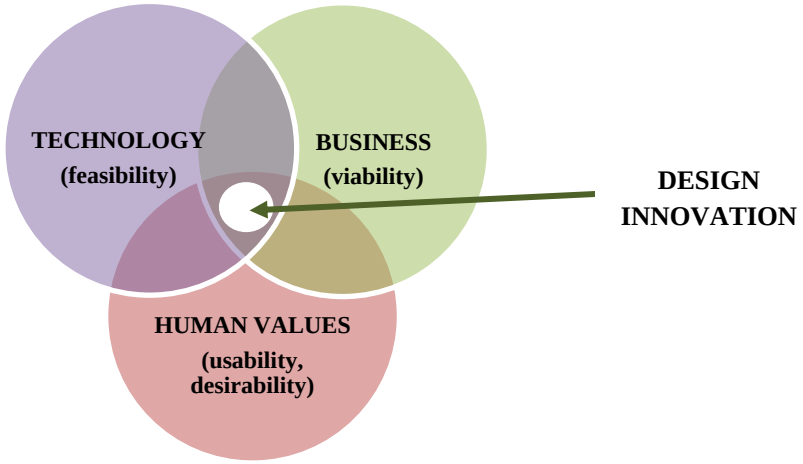
- Conditioned inventiveness – as designers direct their efforts to inventing, they keep in mind that every final product or service would be produced within the human-centred and environment-centred frameworks.
- Human-centred focus which is based on the fact that design is a client-directed process in order to satisfy concrete needs.
- Environment-centred concern is related to the fact that environmental and humankind interests are at the same level and nowadays only sustainable design can be noticeable.
- Ability to visualise and present a full picture.
- Tempered optimism can result in proactive manners of working where lows and highs in interest and motivation are controlled by professionalism.
- Bias for adaptivity refers to design thinking characteristic to fit users' evolving needs exceptionally.
- Predisposition toward multi-functionality stands for design thinking ability to keep the whole picture in mind while focusing on specific problems. For instance, a solution to environmental problem in local community is supposed to provide environmental as well as social and economic benefits.
- Systematic vision is required to create holistic solutions that the design thinking approach aims at.
- View of the generalist is likely to provide more creative solutions especially that design thinking is multidisciplinary in its nature.
- Ability to use language as a tool for expressing relationships in innovative solutions where visual presentation is not enough.
- Affinity for teamwork is essential working not only with clients but also in multidisciplinary teams.

- Facility for avoiding the necessity of choice is based on the fact that instead of choosing between competing alternatives, the best qualities of the two best potential solutions are combined into a new configuration.
- Self-governing practicality refers to design thinkers' ability to combine inspiration rise with practicality, realistic cost and effective functionality.
- Ability to work systematically with qualitative information is important in order to find information and gain insight into complex issues. In order to provide systematic solutions one needs to be able to conceptualise, evaluate and communicate results to the wider public.

Despite these characteristics, it is noteworthy to say that design thinking is nearly never evaluated well enough through appropriate testing (Owen, 2006, p. 26). When it comes to learning, project-oriented methods are expected to be the most effective and preferred ones (Owen, 2006, p. 26). This goes in line with the statement that through numerous repetition of the design thinking process steps, new ideas and unpredicted solutions evolve. As Brown, president of IDEO, indicated in one of his speeches, being human-centred, collaborative, participatory and experimentation-driven are the key attributes of design thinking (Armstrong, 2013, para. 4).

Accordingly, the design thinking process is one of the three key elements of design thinking in addition to multidisciplinary teams and variable space (Core elements, 2014). Design thinking is like a glue that holds interdisciplinary teams strongly together and allows to create cooperative culture (Core elements, 2014). The working space endorses interactive processes through creation of mobility and adaptable working environment to explore different perspectives (Core elements, 2014). The interactive process (see Figure 4) is directed to indicate people's hidden needs, to match them with feasible technology and viable business strategy. The result of this process can be products, services, processes as well as events and policies (Core elements, 2014).

Figure 4. Interlink of Human Needs, Technology and Business Strategy in the Design Thinking Process



Source: *Our Point of View*, 2015.

In summary, the design thinking process involves inductive, deductive and abductive reasoning, which can be successfully implemented in practice through a five-step process (empathise, define, ideate, prototype and test). The testing phase allows controlling, if a concrete solution indeed addresses a concrete human need in the best possible way given the technological development and business viability. Importantly, the design thinking process can be adjusted depending on challenges diverse users aim to solve. Design thinking process requires numerous repetition and systematic view. Such an approach ensures that a proposed solution is the most optimal and tangible one to resolve a concrete issue.

2.6 Applications of design thinking in innovation and business

Given the rise of considerable social and environmental issues the global community has been facing in the new millennium, human-centred design was transformed from a method into a mindset. This transformation emphasises the importance and involvement of all stakeholders. Buchanan (1992, p. 8) emphasised that a thorough understanding of design thinking advances cooperation and mutual benefit among the practitioners aiming for meaningful innovation. The author considered design thinking as the new liberal art where specialised knowledge from different fields is essential to address complex issues of humankind as it provides interconnection of thoughts, signs, things and actions (Buchanan, 1992, pp. 14–20).

Design thinking can be applied in a variety of fields and areas. Buchanan (1992, p. 16) argued that design subject is indeed universal as it may be applied to any sphere of human experiences. In a similar vein, other scholars argued that design thinking methodology can be successfully used even for an advisory function in governments or companies (Owen, 2006, p. 17). A set of creative characteristics, multidisciplinary approach and flexibility can bring some additional fresh views particularly when addressing complex political matters (Owen, 2006, pp. 17–23). According to Buchanan (1992, pp. 9–10), the main four areas of design thinking application involve:

- Design of symbolic and visual communications;
- design of material objects;
- design of activities and organised services;
- design of complex systems or environments for living, working, playing, and learning.

As I noted in Chapter 1.2 on the history of design thinking, I will focus mostly on the management discourse of design thinking. In this regard, as promoted by design consultancies like IDEO, design thinking can be successfully applied in all management-related issues as a tool to solve problems and enhance innovation (Schmiedgen et al., 2015, p. 134).

Innovation takes place only when new questions and ideas are being considered (Buchanan, 1992, p. 11). In such circumstances, design thinking serves as a tool bringing new and explicit insights and understanding in shaping new creative solutions to compound problems (Owen,

2006, pp. 17–22). Creativity is what synthesises current knowledge into new tangible products and services. Creatively combining both design thinking and science thinking can provide better solutions than using only one of the approaches (Owen, 2006, pp. 17–22).

While design thinking is mostly applied in such fields as information technology (e.g. Brooks, 2010), business and education (e.g. Dunne & Martin, 2006), design thinking would also be more easily applied in other areas, if there was a clear definition of the concept and its processes (Dorst, 2011, p. 521). Dorst (2011, pp. 525–531) argued that the value of design thinking lies not in general adoption of something vague as design thinking, but rather in the application of specific professional practices and deliberate manners of reasoning.

Nevertheless, if applied and adopted purposefully, design thinking practices can bring significant value in terms of innovation. In competitive business environment where innovation is more important than ever, design thinking might play a significant role in fostering a company's competitive advantage (Green, 2009, para. 8). As evidence shows, due to the fact that design thinking ultimately provides intuitive and empowering experiences to users, it makes it easier to apply it and scale across different business sections (Sarrazin & Yeon, 2015, paras 9–14).

With design thinking gaining more significance in the business world, some of the most well-known international firms are using design thinking for their innovation processes. Visa, Teach For America, JetBlue, Gates Foundation, Mozilla Foundation, PepsiCo, Palo Alto Medical Foundation, Procter & Gamble, General Electric, NewSchools Venture Fund, Stanford Trauma Center, Motorola, Google, Apple, Zappos and Cirque du Soleil are on the list of companies using design thinking to deepen and explore their innovation methodology (Armstrong, 2013; Green, 2009; Our point of view, 2015).

The list of concrete examples of products, services and/or holistic solutions created by using design thinking includes:

- Products: antiperspirant, dissector systems, baby incubators, cement products and packages, science projects;
- digital user experience design (e.g. dashboards, websites, marketing campaigns, working conditions and collaboration spaces);
- complex analogue and digital product-service systems (e.g. improved pharmacy experience, pick-up services, healthcare, shopping, invoicing, price plans);
- software applications (e.g. financial advice, business intelligence, sailing analytics, collaboration, database applications, reporting, mobile games) (Schmiedgen et al., 2015, p. 95).

Design thinking was also used in developing new business models, events, job role definitions, recruitment processes, strategies, curricula, internal processes, among others (Schmiedgen et al., 2015, p. 95).

For example, in the 1990s Proctor & Gamble (hereinafter: P&G) faced a major crisis in its 165-year of existence (Leavy, 2010, p. 10). At that time its revenue declined by 3 – 4 per cent, the profit remained flat and seven out of top ten P&G's brands were losing their market share. Instead of relying on the same methods like customers' surveys and focus groups, P&G started to implement new techniques from design thinking practitioners. This was done aiming to restructure P&G as a design organisation (Leavy, 2010, pp. 10–11).

In June 2000, a new CEO took a position and in a 3-year period the situation changed completely. The profit was growing by 15 per cent annually and thirteen out of top fifteen brands rose in their market share. In the period from 2003 to 2008, the revenue nearly doubled from 42 billion USD to 81 billion USD and the net profit grew by approximately 2.5 times from 4.6 billion USD to 11.8 billion USD providing the basis for sustainable company's growth (Leavy, 2010, pp. 10–12). Despite that no single factor can be assigned to such success, long-term commitment, real dialogue with diverse stakeholders and search for new business opportunities can be part of an answer. Facilitating environment where design thinking methods can be established and maintained leading to sustainable long-term results is also essential (Leavy, 2010, pp. 10–12).

Cultural aspects also have to be considered and all processes have to be adjusted in every company when turning it into a design thinking firm (Leavy, 2010, p. 12). These changes include financial planning and reward systems, as well as guidelines on how diverse constrains will be viewed and dealt with. In most of traditional business any constrains are typically considered as obstacles, whereas in design firms they are seen as new business opportunities. Appropriate understanding among key stakeholders, board members and stock analysts need to be established too. As most of these actors are trained based on analytical thinking, not all of them might consider the design thinking approach as value-adding and value-creating activity (Leavy, 2010, p. 12).

In terms of learning process in an academic environment, as a pioneer of d.schools, Stanford's design school endorses creativity development in every field of studies and particularly encourages risk-taking (Roethel, 2010). Although it does not grant a degree, evidence exists that design thinking helps students to reveal their creativity and create practical products. Examples of such products include the following: an incubator Embrace that assists raising the body temperature of low-birth-weight infants which costs less than 1 per cent compared to traditional incubators; a cheap and energy-efficient d.light that replaces candles in rural areas in Africa and Asia; and a Pulse News Readers app enabling its users to see photos and articles from the chosen websites on a single page (Roethel, 2010).

Innovation is a business competence that can be learned and developed (Armstrong, 2013, para. 2). Design thinking can indeed be applied in a variety of fields from business to policy making as well as academia. As previously mentioned examples indicate, innovation capacity can be successfully fostered in academic environment leading to more innovative businesses in the future. However, it is important to adopt design thinking not as a vague or fashionable concept,

but as particular professional practices and ways of reasoning. Similarly, design thinking implementation in firms requires shifting the entire culture of business processes and establishing understanding among relevant key stakeholders.

2.7 Criticism of the design thinking approach

Despite numerous fields where design thinking can be effectively adopted and the benefits that come from its application, I will also address some criticism that is related to this concept. Design thinking has, particularly in the past decades, become one of the hot buzzwords in business and management. It has been hailed as a new approach to innovation and value-creation believed to foster significant change.

However, there is currently neither an accepted definition nor theory of design thinking (Johansson & Woodilla, 2010). Some authors emphasised the fact that even creative professionals usually provide definitions of design thinking, which are very superficial and very broad at the same time (Petersen, 2014). Thus, a concrete and well-established definition of the design thinking concept would permit better practical application. There would also be fewer opportunities for various manipulations of the design thinking approach and its application.

Teams provide knowledge and experience, and their contribution is critical in the design thinking process (Petersen, 2014). As cross-functional teams are one of the main characteristics of design thinking, team dynamism and the issues of modifying team configurations have to be considered. A team reflects the dynamics of the design thinking process itself which should result in breakthrough innovations that currently consist of only 10 per cent of all new product developments (Petersen, 2014).

Nussbaum (2011, paras 1–9), one of the most prominent former advocates of design thinking, claimed that despite successes in applying design thinking, it should not be turned into a linear, by-the-book methodology. By implementing design thinking like Six Sigma or other efficiency-based approaches, companies at best deliver incremental change and innovation. Nonetheless, design thinking offers creativity embedded in business processes as well as efficiency culture that results in considerable cultural and organizational changes (Nussbaum, 2011, paras 1–9).

Additionally, Walters (2011a) urged that such issues as how to involve and motivate employees along design thinking processes in a firm, and the real value of every achievement would be considered well in advance. The author provided balanced criticism towards design thinking as he neither neglected benefits that design thinking can potentially bring to a concrete company in terms of creativity and innovation. According to Walters (2011b), while proper implementation of design thinking is essential, it cannot be the answer to every problem a company is facing. Adapting design thinking approach to a firm's own internal cultures and conditions are among the success factors why design thinking brought significant positive results in companies such as P&G, or General Electric (Walters, 2011a).

Petersen (2014) argued that design thinking becomes valuable from a society's perspective only when it is applied by business and generates breakthrough innovation which creates value for society. To foster its acceptance, better understanding and more cooperative use by all stakeholders remain one of the key issues. Design thinking will remain appealing, when it provides breakthrough innovation rather than only incremental improvements in business. Potential growth, scalability and culture will be likely affected by the future developments of design thinking and its application in business (Petersen, 2014).

So far I have defined the concept of design thinking, described its evolution, highlighted its applications as well as summarised its critiques. I have also analysed the importance of creativity in entrepreneurship education in business schools and why design thinking is relevant to business education. Since more business schools are eager to implement or are already applying the design thinking approach in their learning process, it is worth analysing its benefits and potential drawbacks in a concrete academic setting.

3 EMPIRICAL STUDY

3.1 Research hypotheses

After discussing existing design thinking definitions, presenting the main elements and steps of the design thinking process and showing how design thinking can contribute in fostering innovation, I have formulated the following research hypotheses to analyse what effects design thinking brings in the context of European business education:

H1: Design thinking has a positive impact on students' skills and attitudes which fosters their capability to innovate.
H2: Design thinking increases so-called innovation uptake during the education process.
H3: Design thinking enhances the relevance of business education for practice.
H4: Demographic characteristics do not have a significant influence on design thinking knowledge and use.
- **H4a:** Gender does not have influence on design thinking knowledge and use.
- **H4b:** Age does not have influence on design thinking knowledge and use.
- **H4c:** Average income does not have influence on design thinking knowledge and use.
- **H4d:** Education level does not have influence on design thinking knowledge and use.

I aimed to test the causal linkage between the implementation of the design thinking approach and skills and attitudes development, the increased innovation uptake during the education process and the relevance of business education for practice. As the literature review suggests, these are the three broad issue areas used as key arguments why design thinking should be brought into business education.

Given the fact that there is no established definition of design thinking and its processes can be relatively easily adapted to different contexts, the design thinking approach is often subject to

misinterpretations. This tends to lead to vague understanding what design thinking is and its value in business education and businesses. Hence, a constructive analysis based on existing examples can facilitate better understanding how design thinking contributes in fostering creativity and the culture of innovation in business education and business practice.

3.2 Research approach

To implement the empirical research I have chosen FELU as my case study setting, where the design thinking approach has been implemented since 2006. Currently, design thinking is employed in different courses and across diverse programmes of the faculty.

Firstly, I provided background information on design thinking implementation at FELU based on available secondary data sources. Secondly, I used a quantitative study approach by conducting a survey in order to explore further design thinking effects in the concrete business school context and to test my research hypotheses. A web-based survey in the English language was distributed to students who attend classes and courses that are taught based on the design thinking approach. I analysed the data and the results by using SPSS statistical software package.

Based on the findings from my empirical study, I then drew conclusions whether including the design thinking approach in the teaching and learning process in the concrete business school context brings benefits. Particularly, I focused on whether design thinking contributed to the development of skills and attitudes that improve students' capability to innovate, foster innovation uptake during the educative process, and if relevance of business education increases for practice.

Also, I used the results from the empirical research to see if the current attributes of the design thinking definition are relevant in the business education context, and if various demographic characteristics influence on the knowledge and the use of design thinking in practice. Finally, the empirical research allowed me to identify the potential practical applications of my research and formulate possible suggestions to policy makers, as well as recommendations for future research on the topic.

3.3 Data and data collection

I gathered my primary data for the empirical study with the help of an online questionnaire, which is an efficient technique for collecting replies from large samples (Saunders, Lewis, & Thornhill, 2009). The survey was aimed to capture the added-value of the design thinking approach during and after the educative process, particularly with regard to enhancing creativity and developing other skills and attitudes that are valuable in fostering innovative capabilities and innovation among students. I created an online questionnaire in the English language, using the EnKlikAnketa (www.1ka.si) survey platform. I then distributed the survey link based on a snowball or network sampling technique, which is a non-probability sampling technique

(Goodman, 1961). Therefore, my results should by no means be generalised to either the whole FELU student population, or otherwise.

To collect my primary data I sent out my questionnaire to several professors at FELU who teach their courses or some of the classes based on design thinking, and asked them to distribute the questionnaire among their current and former students. I also sent the survey to a number of friends from FELU, who were asked to fill in the questionnaire and to forward it to their friends at FELU. The questionnaire was also posted on the relevant FELU social media groups of international and Slovenian students to increase respondent coverage.

In addition, I used two types of secondary data for a descriptive case study of design school activities of the FELU in my research. Past studies on design thinking at FELU provided better understanding how design thinking approach is implemented at the faculty and how it links with the strategy of the FELU. Other available online sources allowed to explore what outputs and results were achieved through the FELU d.school.

3.4 Methodology

The main objective of my research is to analyse, if, in practice, the design thinking approach implementation during the learning process contributes: to skills and attitudes development, enhance innovation uptake and the relevance of business education for practice. I also intended to check whether the findings from the quantitative study are in the line with the ones from the exploratory case study.

Before the quantitative research, the descriptive case study analysis aimed to provide a broader understanding why design thinking was chosen to implement in FELU a decade ago. In this part of my research I looked at what benefits of design thinking were identified by FELU for its academic community and the strategic objectives. I also compared if the achieved results are in line with the main arguments as suggested by the literature review.

As a research method based on past studies, a case study provides a more detailed explanation and a holistic view of a social issue at hand and complements a quantitative research (Gülseçen & Kubat, 2006; Zainal, 2007, p. 1). A case study method has been extensively used to measure effectiveness and efficiency of particular initiatives in education and management areas (Zainal, 2007, p. 1), thus making it an appropriate method to employ in my research.

The survey is based on the theoretical constructs analysed in Chapters 1 and 2. To increase the validity and reliability of the empirical study of the survey, I also employed already existing studies on design thinking use in education process and business enterprises. While these studies are rather scarce, segmented and do not represent consistent data in terms of study subject or timeline, they provide additional insights on potential use and benefits the design thinking approach can bring into innovation process.

The questionnaire (see Appendix A) is divided into three parts. Part 1 of the questionnaire consists of a screening question if a respondent attended any course or the entire programme based on the design thinking approach and thus is able to provide informative responses to the questions of the survey. Also, this part consists of general questions on how a respondent learnt of design thinking, how often s/he uses design thinking and how many years of experience of using it s/he has.

Part 2 is the central part of the survey and in this part respondents had to evaluate by five-point Likert scale the statements related to what design thinking is for them. The Likert scale ranges from 1 = "strongly disagree" to 5 = "strongly agree". Every statement in this list is based on the literature review in the previous chapters and the existing case studies showcasing design thinking application in practice. The statements in this list are divided into four parts and they are summarised in Tables 1 – 4.

The first part included a general question what design thinking is for a respondent and is mostly related to the design thinking in terms of definition, as described in Chapter 2.1. The statements are listed in Table 1 below.

Table 1. Constructs and their Background: Design Thinking Definition

STATEMENT	**ADAPTED FROM / BASED ON**
What design thinking is:	
a) A holistic and systematic approach for creating solutions	Owen, 2006
b) A method / methodology which enables innovation	Johnson, 2011; Krigsman, 2011; Schinke, 2014; Schmiedgen et al., 2015; Shui and Menning, 2015; Tripathy, 2015
c) An iterative process for innovation and adaptation to change	Johnson, 2011; Köppen, 2014, 2015a, 2015b; Krigsman, 2011; Schinke, 2014; Schmiedgen, 2015a; Schmiedgen et al., 2015; Tripathy, 2015
d) A toolbox – a collection of tools and techniques for user research and group creativity	Johnson, 2011; Köppen, 2014, 2015b; Schmiedgen et al., 2015
e) A mindset – a way of thinking	Johnson, 2011; Köppen, 2015a; Krigsman, 2011; Schinke, 2014; Schmiedgen et al., 2015
f) A corporate culture that influences institution's organisational structure	Köppen, 2015a, 2015b; Krigsman, 2011; Schinke, 2014; Schmiedgen, 2015a, 2015b; Schmiedgen et al., 2015; Tripathy, 2015
g) An approach to create solutions that are technological feasible and commercial viable	Hasso Plattner Institute of Design at Stanford (Our point of view, 2015)

The following set of statements aims to measure the construct of skills and attitude development through design thinking. This set of statements refers to the research hypothesis 1 and is summarised in Table 2.

Table 2. Constructs and their Background: Skills and Attitude Development

STATEMENT	ADAPTED FROM / BASED ON
What design thinking is in terms of skills and attitudes development:	
a) Design thinking increases creativity and out-of-the-box thinking within teams	Köppen, 2015a; Mitroff Silvers, 2016; Owen, 2006; Roethel, 2010; Schinke, 2014; Schmiedgen, 2015a, 2015b; Schmiedgen et al., 2015; Shui and Menning, 2015; Tripathy, 2015
b) Design thinking encourages ability to work in interdisciplinary teams	Hasso-Plattner-Institut (Core elements, 2014)
c) Design thinking improves collaboration and knowledge transfer in teams across disciplines and organizational levels	Johnson, 2011; Köppen, 2015a, 2015c, 2015d; Krigsman, 2011; Li, 2013; Schinke, 2014; Schmiedgen, 2015a, 2015b; Schmiedgen et al., 2015; Shui and Menning, 2015
d) Design thinking enforces ability for brainstorming and co-creation in teams	Köppen, 2015a; Li, 2013; Schinke, 2014; Schmiedgen, 2015b; Schmiedgen et al., 2015
e) Design thinking requires adaptable and variable space for co-creation	Hasso-Plattner-Institut (Core elements, 2014); Li, 2013; Morrison and Johnston, 2003; Schinke, 2014
f) Design thinking improves ability to focus on users' needs and user-centeredness	Köppen, 2015a, 2015b, 2015d; Krigsman, 2011; Li, 2013; Mitroff Silvers, 2016; Owen, 2006; Quora database (What are some of the best case studies of design thinking being successful?, 2016); Schinke, 2014; Schmiedgen, 2015a, 2015b; Schmiedgen et al., 2015; Hasso Plattner Institute of Design at Stanford (Our point of view, 2015); Tripathy, 2015
g) Design thinking enhances teaching and training formats	Köppen, 2015a; Krigsman, 2011; Schmiedgen et al., 2015; Tripathy, 2015

The statements in Table 3 are related to the innovation process construct. This construct is related to the research hypothesis 2 on the design thinking potential to increase so-called innovation uptake during the education process.

Table 3. Constructs and their Background: Innovation Process

STATEMENT	ADAPTED FROM / BASED ON
What design thinking is in terms of innovation process:	
a) Design thinking serves as a means for creative product/service development	Johnson, 2011; Köppen, 2015a, 2015b, 2015c; Krigsman, 2011; Li, 2013, 2013; Nussbaum, 2011; Schinke, 2014; Schmiedgen et al., 2015; Tripathy, 2015
b) Design thinking helps to improve service and experience design	Köppen, 2015a; Schmiedgen, 2015b; Schmiedgen et al., 2015; Tripathy, 2015
c) Design thinking fosters customers' engagement in creation process	Johnson, 2011; Köppen, 2014; Krigsman, 2011; Li, 2013; Schinke, 2014; Schmiedgen, 2015a; Schmiedgen et al., 2015; Shui and Menning, 2015; Tripathy, 2015
d) Design thinking serves as a means for improving the market-driven innovation process	Köppen, 2015a; Mitroff Silvers, 2016; Schinke, 2014; Schmiedgen et al., 2015; Shui and Menning, 2015; Tripathy, 2015
e) Design thinking helps in creating new business models and go-to-market strategies	Johnson, 2011; Schmiedgen et al., 2015; Tripathy, 2015

The following seven statements summarised in Table 4 measure business education relevance for practice construct and correspond to the research hypothesis 3.

Table 4. Constructs and their Background: Business Education Relevance for Practice

STATEMENT	ADAPTED FROM / BASED ON
What design thinking is in terms of business education relevance for practice:	
a) Design thinking enhances relevance of managerial education	Neck and Greene, 2011; Blândul, 2015
b) Design thinking fosters teaching attractiveness	Blândul, 2015
c) Design thinking enhances experiential learning which enhances knowledge applicability in practice	Kolb and Kolb, 2005
d) Design thinking better integrates theory and practice and focuses less on linear argumentation	Kolb and Kolb, 2005
e) Design thinking serves as an enabler for knowledge development and transfer	Köppen, 2015a, 2015d, Schmiedgen, 2015a, 2015b
f) Design thinking serves as a means for effective problem solving	Johnson, 2011; Köppen, 2015a, 2015b, 2015d; Krigsman, 2011; Li, 2013; Mitroff Silvers, 2016; Owen, 2006; Schinke, 2014; Schmiedgen, 2015a; Schmiedgen et al., 2015; Shui and Menning, 2015; Tripathy, 2015
g) Design thinking encourages prototyping and experimentation in testing potential solutions	Köppen, 2014, 2015a, 2015c, 2015d; Krigsman, 2011; Li, 2013; Mitroff Silvers, 2016; Plattner et al., 2010; Schmiedgen et al., 2015; Shui and Menning, 2015; Tripathy, 2015

Part 3 is the last part of the questionnaire and it provided insight into socio-demographic background of the respondents. To the best of my knowledge, no studies exist on the socio-demographic characteristics influencing the perception of the design thinking approach or its effectiveness. However, the data provide general information about the sample and if any socio-demographic characteristic such as gender, age, income level, graduation title, employment status, industry and type of organisation have any impact on perceptions of design thinking benefits.

4 FINDINGS FROM EMPIRICAL STUDY

4.1 Case study of design thinking at FELU

The FELU was established in 1946 as part of the University of Ljubljana (O fakulteti – Ekonomska fakulteta, 2015, para. 1). The FELU mission is to "[...] broaden horizons and build competences for socially responsible management of business and economic challenges" (Mission & Vision, 2016, para. 1). The teaching and learning activities are based on integrity, cooperation, responsibility, knowledge and academic freedom principles which are the core values of the faculty (Mission & Vision, 2016, para. 4).

The objective of the FELU is to become "by 2025 […] the school of choice in business and economics in Central Europe for doing research, learning and creating sustainable development solutions" (Mission & Vision, 2016, para. 2). To achieve its vision, the faculty constantly aims improve the quality of teaching, increase internationalisation and excel internationally comparable research (Mission & Vision, 2016; Awards of excellence, 2016).

Also, during the seventy years of its existence, the faculty achieved the three most renowned accreditations: the European Quality Improvement System (EQUIS), the American Association to Advance Collegiate Schools of Business (AACSB) accreditation, and the accreditation of The Association of the MBAs (EFnet Portal, 2016a; Facts & Figures, 2016). The received accreditations position FELU among the top 1% of business and economic schools globally, showing the highest standards and excellence in teaching, curriculum, and students' involvement (EFnet Portal, 2016a; Facts & Figures, 2016).

The objectives and the content of entrepreneurship education at FELU have changed over time due to changes of the economic system caused by the state's transition from a former Yugoslavia to an independent state. Keeping these shifting conditions in mind, the faculty observed the need for introduction of entrepreneurship, including the development of start-ups and SMEs in their programmes (Ellermann, 2015, p. 4). As a result, FELU established its d.school as early as in 2006 based on design thinking techniques developed at Stanford, where the approach originates from (EFnet Portal, 2006; Ellermann, 2015, p. 5). While the design thinking approach was developed as a universal problem-solving and idea-generating approach that can be applied in multiple disciplines, FELU was one of the first universities that connected it with entrepreneurship education, as discussed in Chapters 1 and 2.

Although design thinking is not included into the FELU or the University of Ljubljana strategic goals, the importance of entrepreneurship is highlighted in the Strategy of the university as the way to transfer knowledge into practice (Ellermann, 2015, p. 6; Strategy, 2016). Also, the fact that FELU has a certain level of autonomy to introduce changes in the course such as teaching methods used if they correspond to goals of the courses, contributed to design thinking establishment and "hands-on" application at the faculty (Ellermann, 2015, pp. 6–7).

FELU put in place nearly all aspects of the design thinking approach in practice, namely thorough understanding of potential users' needs and problems, generation of ideas, prototyping and testing as well as iterative ways of process organisation, as described in Chapter 2.5 (Ellermann, 2015, p. 5). However, it is hard to achieve the multi-disciplinarity of the teams as students from other faculties, specifically Faculties of Chemistry, Civic and Geodetic Engineering, Computer and Information Science, and Natural Science are not continuously involved in the FELU d.school activities (Ellermann, 2015, pp. 5–6).

Currently, design thinking is applied in several courses in the undergraduate, graduate and MBA programmes. Also, the design thinking approach is being used in extra-curricular activities, such as start-up weekends, entrepreneurship education in schools and for unemployed persons (Ellermann, 2015, pp. 5–15). The main purpose of design thinking courses at FELU is to create feasible business ideas and help to enhance a hands-on, action-oriented mindset and skills among students. Despite such challenges as: a high number of students (approx. 400 students in the Slovenian track and 150 students in the English track), managing students' motivation, performance and satisfaction levels, financial resources, as well as combining traditional and creative teaching methods such as design thinking, the number of design thinking courses are

constantly increasing and design thinking is gradually involved into other courses (Ellermann, 2015, pp. 11–13).

The FELU community and partners benefitted from learning about design thinking during such events as "ALUMNI & Design Thinking", "Afternoon for HR Managers", the Society of Young Researchers of Slovenia workshop on design thinking, Global Leadership Academy, Ljubljana Summer School and Executive Summer School, Family Business Academy and FELU's Centre for Business Excellence Education Days (EFnet Portal, 2012a, 2012b, 2015a, 2015c, 2015d, Global Leadership Academy: Programme Structure, 2016; Executive Summer School, 2016; Family Business Academy: Lecturers, 2016; FELU, 2016; Facts & Figures, 2016; Izobrazevalni dnevi centra poslovne odlicnosti Ekonomske fakultete, 2015; Raziskovalni center Ekonomske fakultete, 2013). Similarly, design thinking is successfully applied in such projects as Researchers' Night 2014, "Re-design Ljubljana experience", Ernst & Young Autumn School and Mercator Summer School "Meet your first employer" (EFnet Portal, 2014, 2015b, 2015e, 2016b). Finally, thanks to design thinking at FELU, such start-ups as Printbox and Optiprint were created (Ellermann, 2015, pp. 21–22; Optiprint, 2016; Ugodno barvno tiskanje, kopiranje in skeniranje, 2016). Design thinking also contributed to the successful growth of Kibuba d.o.o. company, established in 2004 (Ellermann, 2015, pp. 21–22; Kibuba, 2016).

For instance, Optiprint d.o.o. was established at FELU in July 2009 with the major activity to lease multifunctional colour printers to businesses (Our story, 2016). Today the company provides services to more than 2500 international businesses through franchises in Slovenia, Croatia, Bosnia and Herzegovina, Serbia and Romania (Our story, 2016; Our Services, 2016; Izkaznica podjetja, 2016). Customers can print over 20.000 colour pages at a fixed monthly fee allowing them to reduce their printing expenses from 50 to 80 per cent (Most Competitive Colour Printing, 2016; Our Services, 2016; Ekipa, 2016). Currently, Optiprint d.o.o. has 17% of the market share and its sales revenues are constantly growing each year. Sales revenues increased by 35% compared to 2014 and reached € 1.318.064 in 2015 (Optiprint d.o.o., 2016). The company started to show a profit in 2012, which is growing each year and has reached € 299.489 in 2015, a 24% increase compared to 2014. EBITDA is also positive and increased to € 469.286 in 2015, which is a 27% rise compared to the year before. The number of employees has increased to 15 in the year 2015 (Optiprint d.o.o., 2016).

Similarly, Printbox d.o.o. was launched in May 2012 as a market innovation for a low-cost self-service copying, printing, and scanning of documents (About us, 2016). Currently over 160 Printbox kiosks around Slovenia provide services to more than 75.000 users (About us, 2016). Now the Printbox concept is being implemented in the Bulgarian, French, Irish, Romanian and Zambian markets (Low cost color printing, copying and scanning, 2016). The company employed 9 persons. Although Printbox d.o.o. had only 0.32% of the market share, it has generated € 373.423 in net sales and has created € 216.376 value added in 2015 (Print Boks d.o.o., 2016). While EBITDA has remained negative in 2015, it has improved compared to 2014 (Print Boks d.o.o., 2016).

Although a sport equipment store Kibuba d.o.o was established 2 years before the FELU d.school, the design thinking approach contributed to its success, according to its owner (Ellermann, 2015, pp. 21–22). The company's sales revenues are growing steadily and have reached € 2.174.577 in 2015, showing a 25% increase compared to 2014 (Kibuba d.o.o., 2016). Net sales increased 106%, compared to 2014, and were at € 46.162 in 2015. EBITDA is positive and augmented by 50% up to € 106.011 in 2015, compared to the year before. The number of employees has increased to 11 in the year 2015 (Kibuba d.o.o., 2016).

These three companies are concrete and tangible examples of feasible and successful business ideas and potential improvements in companies, generated thanks to the FELU d.school. As the main lessons learned at FELU suggest, the design thinking approach implementation helps to explore concrete problems of real clients, generate valuable and feasible business ideas, attract business practitioners that overall contribute to strengthened practical component of entrepreneurship education at FELU (Ellermann, 2015, pp. 21–23). Also, design thinking fosters creativity in students, including those who usually do not think creatively, and enhance a shift in the mindset simultaneously increasing self-confidence (Ellermann, 2015, pp. 21–23).

4.2 Findings from the survey

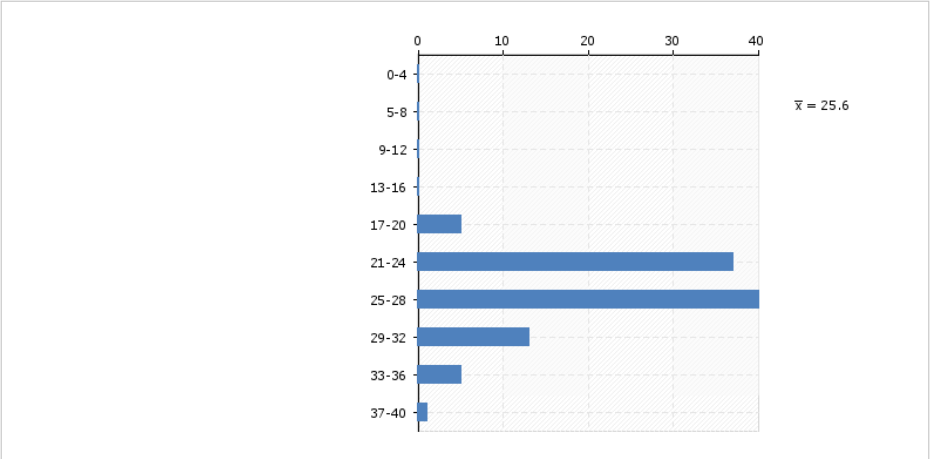
As mentioned in Chapter 2.3, the data for the quantitative study was collected through an online questionnaire created in www.1ka.si. The data collection was performed from 13 May to 27 June 2016. During this period, a total of 280 questionnaires were retrieved. However, I excluded 178 questionnaires from further analysis due to excessive missing values. The final sample I used for the analysis thus consisted of 102 (n=102) surveys having the status "completed".

In the following sections, I present the results of my survey. To start, I describe my sample characteristics based on the respondents' demographics and their overall knowledge about the concept of design thinking. Then, I focus on the obtained data. First, I perform data reliability analysis complemented by exploratory factor analysis to assess my constructs. Then I present the results of testing my hypotheses.

4.2.1 Descriptive statistics: sample characteristics

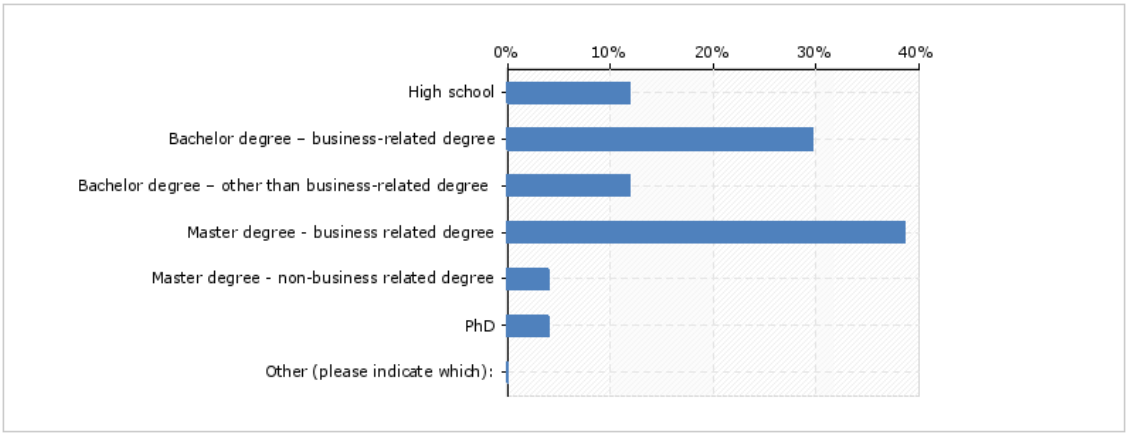
In this part, I present the key demographic characteristics of my sample. From 102 respondents, 43 (42%) are female and 59 (58%) are male. The two most represented age groups in the sample are respondents between 21 and 24 years (37%), followed by those between 25 and 28 years (40%). The average age of the respondents is 25.6 years which allows to presume that the majority of respondents are either in their senior year of studies or they have already obtained a degree.

Figure 5. Distribution of Age Groups of the Respondents in the Sample (n=102)



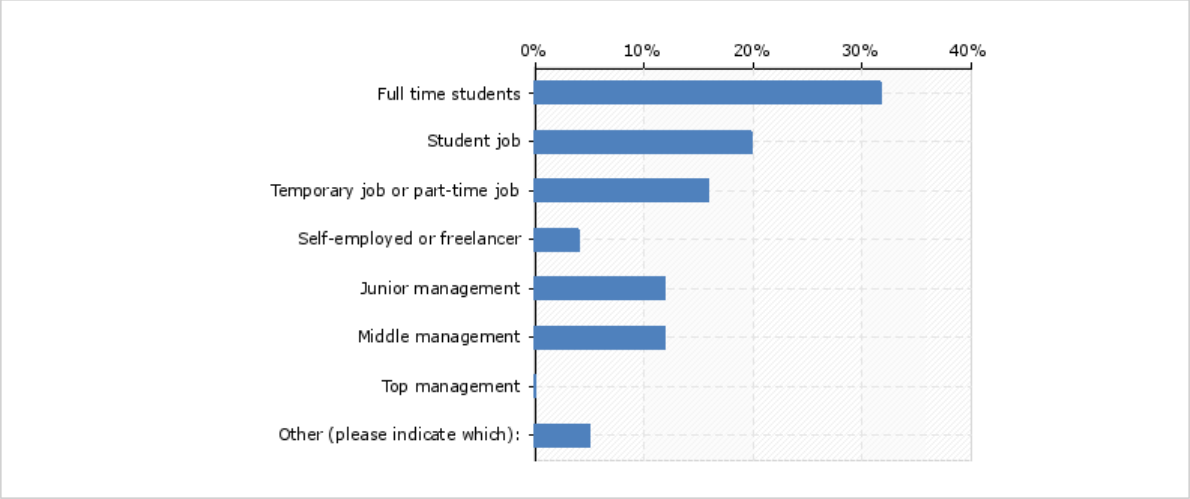
The education background of the respondents encompasses all the levels of education. As the survey was distributed among the FELU community, the majority of the respondents have a business-related degree. More specifically, 29% of respondents have a business-related bachelor degree, while 38% of the respondents have a business-related master degree. Alternatively, 12% of the respondents have either graduated from high school, or, 12% have also obtained a degree which is not related to business. Among the remaining respondents, 4% have non-business related master degree and 4% of the respondents have a PhD degree.

Figure 6. Distribution of Education Levels of the Respondents (n=102)



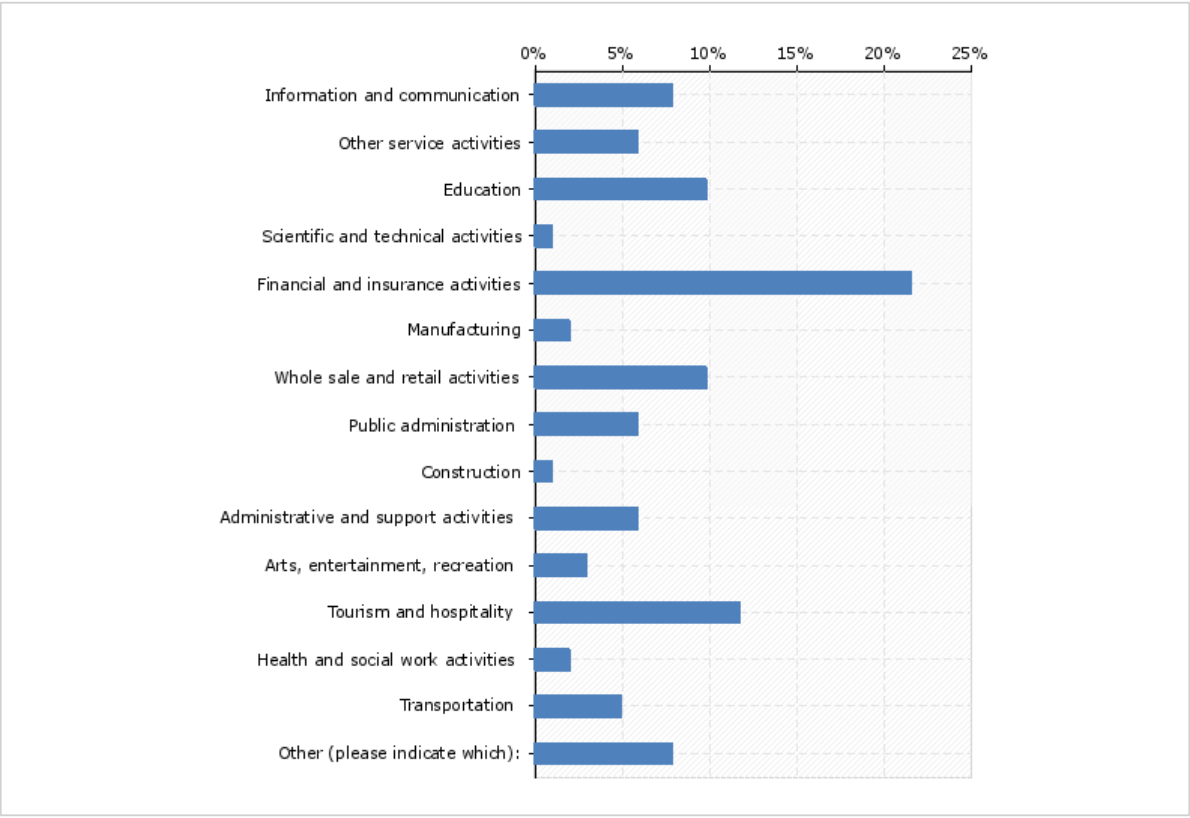
When it comes to other demographic characteristics, 31% of the respondents are full-time students, while others have a student job (20%), or hold a temporary or part-time job (16%). Junior and middle management positions are also represented in the sample (12% each).

Figure 7. Employment Status among the Respondents (n=102)



As can be seen in Figure 8, 22% of the respondents work in financial and insurance services, and 12% of respondents work in tourism and hospitality-related activities. Wholesale, retail and education represent 10% of the respondents, respectively.

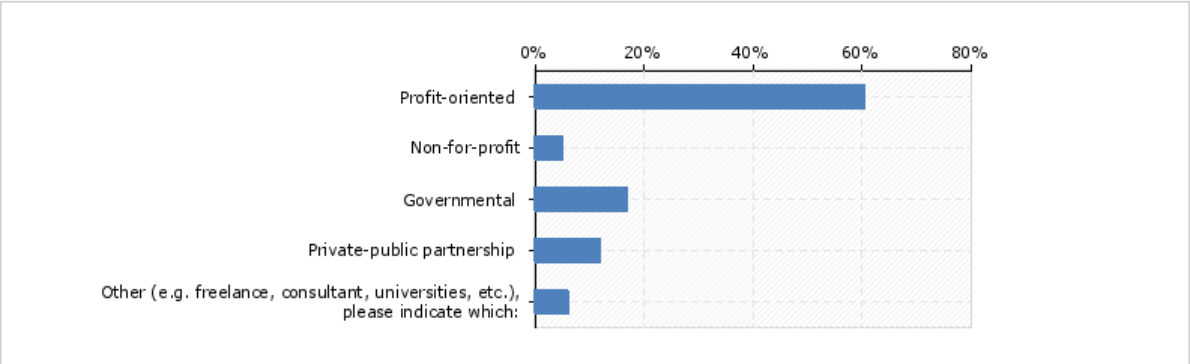
Figure 8. Industry Profile of the Respondents (Either Already Working in, or Wishing to Work for) (n=102)



The majority of the respondents, namely 60%, work in a profit-oriented institution. 17% of the respondents come from the public sector and 12% are from private-public partnerships. Given the fact that the survey was made among the FELU community and that the majority of

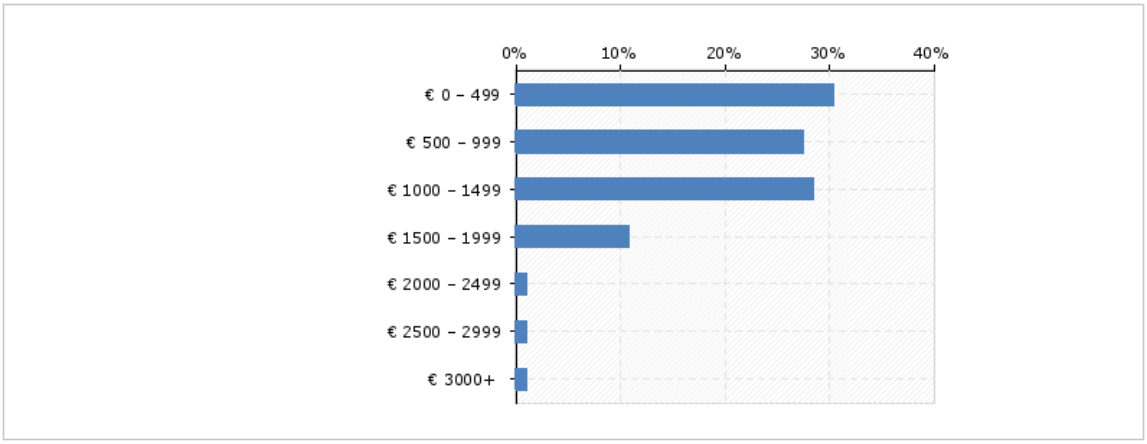
respondents have a business-related degree, the most popular industries and type of organisations to work in are in line with other demographic characteristics of the sample.

Figure 9. Type of Organisation Respondents Work in/Wish to Work (n=102)



The employment status of the respondents positively correlates with the average monthly disposable income per household member among the respondents. As 31% of respondents are full-time students, 20% have a student job and the other 16% have a temporary or part-time job, the average income level is nearly equally distributed among the respondents. In particular, 30% of the respondents in the sample have an average monthly income per household member in the range € 0 – 499, followed by 27% with € 500 – 999 and 28% with average monthly income per household member of € 1000 – 1499. Only 11% of the respondents have a higher income level, as shown in Figure 10. As the average monthly salary in Slovenia in 2016 was approximately € 1.570 gross, it allows to presume that around 1/3 of the respondents had a similar amount available monthly (Slovenia Average Monthly Wages 2005-2016, 2016).

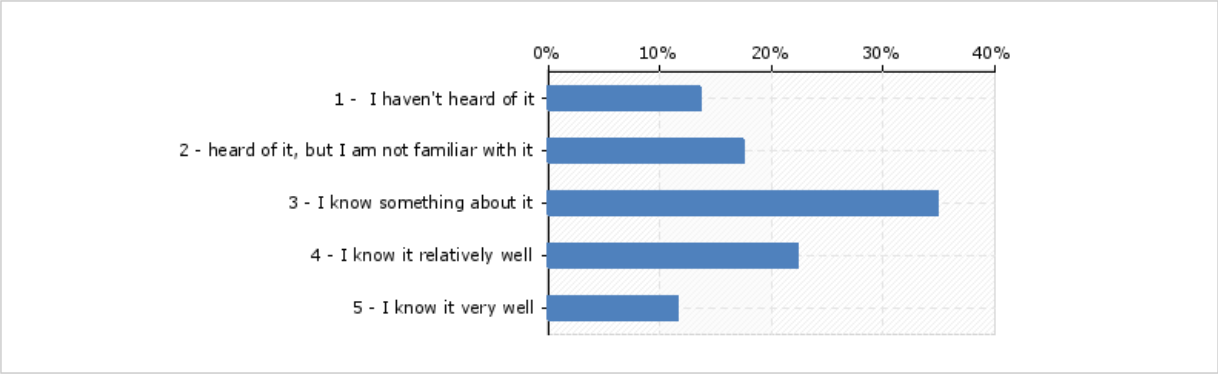
Figure 10. Average Monthly Disposable Income per Household Member (n=102)



Regarding the knowledge of design thinking, among 102 respondents that fully completed the questionnaire, 34% of the respondents indicated that they "know something about it", while 23% answered that they are familiar with the concept "relatively well", and 12% of the respondents said they knew it "very well". Thus, 70% of all the respondents of the survey already have either "some" or "very good" knowledge of the design thinking concept. The remaining respondents who "haven't heard of it" or "heard of it, but are not familiar with it" are represented by 13% and

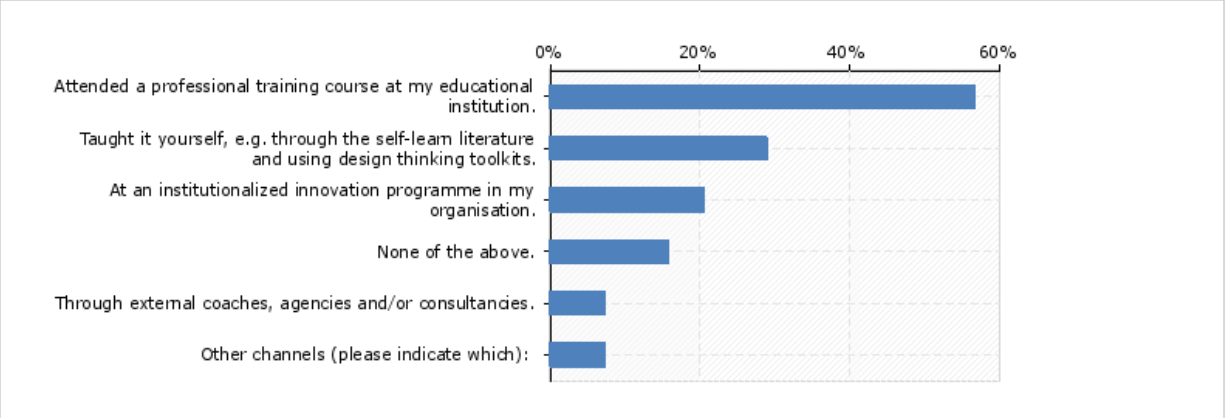
18% of total respondents, respectively.

Figure 11. The Level of Familiarity with the Concept of "Design Thinking" (n=102)



Professional training courses were the main channel for nearly 60% of the respondents to learn about design thinking. Almost one third of the respondents learned about design thinking themselves and nearly one fifth of the respondents have attended institutionalised innovation programmes. Among other possible learning channels, the respondents indicated the Internet as the main source of knowledge about design thinking. In addition, 7% of the respondents use external coaches, agencies or consultants' services to learn about design thinking.

Figure 12. Learning Channels Used by Respondents to Learn about the Design Thinking Approach (Multiple Answers Possible) (n=102)



The respondents took on average 5.6 classes and workshops where design thinking was applied, and have on average 1.2 years of experience using this concept. For instance, given the fact that most undergraduate programmes are 3 years, on average 1.2 years of experience using the design thinking concept is a quiet good result.

4.2.2 Reliability of measurement scales

In order to test the validity and reliability of the questionnaire used in this survey, I employed Factor Analysis (FA) to validate the questionnaire, as well as Cronbach's alpha to test the

internal reliability of my scales. Both approaches were applied according to the procedures and recommendations proposed by Field (2009).

I first performed Factor Analysis on a subset of questions which captured opinions of the respondents regarding the impact of design thinking on the skills and attitudes, relevance for practice and innovation process, since these questions have the same type of measurement scales. As mentioned before, I dismissed all the responses from respondents who are not familiar with design thinking, which left only 70 observations for subsequent Factor Analysis. As the first step (preliminary analysis), I checked the appropriateness of FA results with regard to my sample and items. For this purpose, I employed the Kaiser-Meyer-Olkin (KMO) measure, as an indicator of overall sample adequacy, as well as Bartlett's test statistics to check whether the item-to-item correlations were high enough to justify the employment of FA.

The use of the KMO measure was particularly important in terms of sampling adequacy in my case due to my small sample size (n=70). In my research the obtained KMO measure of sampling adequacy stands at 0.849 (see Table 5), which shows that patterns of correlation between the variables are strong enough to proceed with the FA. Furthermore, KMO values for individual variables obtained as the diagonal of the anti-image correlation matrix are all higher than 7.8, giving additional support to the previous conclusion. The Bartlett's test of sphericity statistics (see Table 5) rejects the hypothesis that the correlation matrix is close to identity, so I can further proceed with FA analysis.

Table 5. KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.849
Bartlett's Test of Sphericity	Approx. Chi-Square	800.797
	df	171
	Sig.	.000

I employed Principal Component Analysis (PCA) as the method for the decomposition of the correlation matrix (see Table 6). Sub-columns of the Initial Eigenvalues show the eigenvalues and their contribution to the explained variance. As the criterion for the selection of the number of factors I used the so-called Kaiser's criterion, which suggests retaining all the factors with eigenvalues higher than one (Kaiser, 1960). In my case, eigenvalues of the three factors exceeded 1. Jointly, these factors explain nearly 67% of the variance of the model, which is very high.

Table 6. Principal Component Decomposition and Total Variance Explained

Component	Initial Eigenvalues		Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	10.337	54.407	10.337	54.407	54.407	4.906	25.823	25.823
2	1.292	6.798	1.292	6.798	61.205	4.632	24.380	50.203
3	1.082	5.697	1.082	5.697	66.903	3.173	16.699	66.903
4	0.905	4.764						
5	0.812	4.274						
6	0.676	3.559						
7	0.664	3.493						
8	0.531	2.794						
9	0.494	2.598						
10	0.424	2.231						
11	0.394	2.073						
12	0.317	1.668						
13	0.285	1.502						
14	0.218	1.146						
15	0.169	0.891						
16	0.137	0.719						
17	0.123	0.647						
18	0.088	0.461						
19	0.052	0.276						

Note: Extraction Method: Principal Component Analysis. Factors rotated orthogonally, using a Varimax rotation method.

Table 7 shows the final result of FA, where the items from the questionnaire have been organised based on the results of FA with corresponding factor loadings shown for each item and the overall internal reliability, as measured by Cronbach's alpha.

Table 7. Factor Loadings and Internal Reliability Statistics

Construct (factor)	Item	Factor loading	Components' Explained variance	Cronbach's alpha
Design thinking in terms of skills and attitude development	Design thinking increases creativity and out-of-the-box thinking within teams (1)	.524	32.7%	0.885
	Design thinking encourages ability to work in interdisciplinary teams (2)	.548		
	Design thinking improves collaboration and knowledge transfer in teams across disciplines and organizational levels (3)	.491		
	Design thinking enforces ability for brainstorming and co-creation in teams (4)	.785		
	Design thinking requires adaptable and variable space for co-creation (5)	.274		
	Design thinking improves ability to focus on users' needs and user-centeredness (6)	.776		
	Design thinking enhances teaching and training formats (7)	.428		
Design thinking in terms of an innovation process	Design thinking serves as a means for creative product/service development (8)	.010	20%	0.886
	Design thinking helps to improve service and experience design (9)	.172		
	Design thinking fosters customers' engagement in creation process (10)	.818		
	Design thinking serves as a means for improving the market-driven innovation process (11)	.431		
	Design thinking helps in creating new business models and go-to-market strategies (12)	.352		
Design thinking in terms of business education relevance for practice	Design thinking enhances relevance of managerial education in practice (13)	.804	44.3%	0.893
	Design thinking fosters teaching attractiveness (14)	.753		
	Design thinking enhances experiential learning which enhances knowledge applicability in practice (15)	.534		
	Design thinking better integrates theory and practice and focuses less on linear argumentation (16)	.765		
	Design thinking serves as an enabler for knowledge development and transfer (17)	.653		
	Design thinking serves as a means for effective problem solving (18)	.453		
	Design thinking encourages prototyping and experimentation in testing potential solutions (19)	.622		

Note: Factor 1 represents the construct "Design thinking in terms of skills and attitude development", as explained in Table 2, and corresponds to the question 7 of the questionnaire (Appendix A). Factor 2 represents the construct "Design thinking in terms of innovation process", as explained in Table 3, and corresponds to the question 9 of the questionnaire (Appendix A). Factor 3 represents the construct "Design thinking in terms of business education relevance for practice", as explained in Table 4, and corresponds to the question 8 of the questionnaire (Appendix A). All items were evaluated by five-point Likert scale, from 1 = "strongly disagree" to 5 = "strongly agree". Factor analysis is based on n=70, as explained in Chapter 4.2.2.

For the first construct, which explains around 33% of the total variance, I can observe that the items "design thinking enforces ability for brainstorming and co-creation in teams (4)" and "design thinking improves ability to focus on users' needs and user-centeredness (6)" are the best to describe the factor 1 with 0.785 and 0.776 of factor loadings. In other words, factor 1 has characteristics very similar to what observable items 4 and 6 measure. On the other hand, observable variables related to items 3, 5 and 7 (factor loadings 0.491, 0.274 and 0.428 respectively) are less correlated with hidden factor 1 because their factor loadings on hidden factor 1 are quite small (minor to 0.50).

The third factor explains on average 44% of the business education relevance for practice construct. Except for item 18 "design thinking serves as a means for effective problem solving" which is not so strongly correlated with factor 3 (factor loading 0.453), all the other items have a medium-high correlation with factor 3 (factor loadings are above 0.5), highlighting item 13 with 0.804 factor loading.

On the other hand, the so-called innovation process construct (factor 2) requires a two-factor solution. The items 8 and 9 in this construct presented non-significant factor loadings. This means that these items can be connected to other factors (constructs) and not only to the innovation process factor or that they do not load strongly on any of them. When they are excluded, the average explained variance for this construct increases to 32.6%. I can observe that the item "design thinking fosters customers' engagement in creation process (10)" with factor loading 0.818 is the most correlated with factor 2, while the items "design thinking serves as a means for improving the market-driven innovation process (11)" and "design thinking helps in creating new business models and go-to-market strategies (12)" are less correlated with this factor. Taking these results into account, I can conclude that my factors exhibit satisfactory, albeit moderately high, explanatory power in representing the constructs in my conceptualisation and research.

As stated previously, I calculated Cronbach's alpha coefficients for each construct to check for the internal reliability of the scale. The coefficients' value range between 0 and 1, where 0 indicates an unreliable construct and 1 corresponds to a perfectly reliable construct. According to Field (2009), there is no strict threshold value to assess reliability, but values indicating high reliability range from 0.7 to 0.8, depending on the type of characteristics of the respondents that are intended to be measured. In my analysis Cronbach's alpha for all three constructs are above 0.8 (see Table 7), implying a sufficiently high internal consistency of the scale.

4.2.3 Testing of hypotheses

In this section, I test the four hypotheses presented in Chapter 3.1. For testing the four hypotheses, I employed different statistical tests and procedures, namely: Factor Analysis, multiple regression, analysis of variance (ANOVA) and independent samples' t-test.

In order to test hypotheses H1, H2 and H3, I employed multiple regression analysis, where design thinking appears as a set of independent variables in two forms (see below), while dependent variables included: skills and attitudes development, innovation process and relevance of business education for practice.

I used the factors extracted from my Factor Analysis (described in Chapter 4.2.2), as the aforementioned dependent variables. However, due to the limited explanatory power of some of the factors in explaining variations of the individual items (especially for the innovation process construct), I further performed an additional robustness check in which I regressed set of independent variables on each single item for these three groups of dependent variables.

As the independent variables in my regression analysis I used two sets of design thinking variables, namely those pertaining to: (1) "real" application and knowledge of design thinking, and (2) the perception of design thinking. Particularly:

- The first group of design thinking measures consists of three variables, namely: a number of classes/workshops attended (question 3 of the questionnaire, Appendix A), years of experience in using design thinking (question 4 of the questionnaire, Appendix A) and frequency of design thinking application in learning/work, measured on a seven-point scale, from 1 = "never" to 7 = "on a daily basis" (question 3 of the questionnaire, Appendix A).
- The second group relates to the attitudes about design thinking expressed in answers from question 6 in the questionnaire (see Appendix A), which consists of 7 different items measuring various attitudes. The attitudes were measured by a five-point Likert scale from 1 = "strongly disagree" to 5 = "strongly agree".

I employed Variance Inflation Factor (VIF) analysis, as a standard tool for collinearity diagnostics in regression analysis, to check whether all 10 independent variables are not correlated. VIF results are presented in Table 8 below.

Table 8. Results of Variance Inflation Factor (VIF) Analysis

Model	**Collinearity Statistics**	
	Tolerance	**VIF**
(Constant)		
Classes	.509	1.964
Experience	.489	2.047
Use	.369	2.712
A holistic and systematic approach for creating solutions	.609	1.643
A method / methodology which enables innovation	.425	2.351
An iterative process for innovation and adaptation to change	.433	2.310
A toolbox – a collection of tools and techniques for user research and group creativity	.339	2.954
A mindset – a way of thinking	.676	1.480
A corporate culture which influences an institution's organisational structure	.558	1.793
An approach to create solutions that are technological feasible and commercial viable	.507	1.974

Note: Variables: "Classes" corresponds to classes/workshops on design thinking measured by a number of classes/workshops a respondent attended (question 3 of the questionnaire, Appendix A). "Experience" is experience in using design thinking measured by a number of years (question 4 of the questionnaire, Appendix A). "Use" corresponds to the frequency respondents use design thinking in learning process and/or at work, measured on a seven-point scale, from 1 = "never" to 7 = "on a daily basis" (question 3 of the questionnaire, Appendix A). The remaining variables corresponds to the perception of what design thinking is, evaluated by a five-point Likert scale, ranging from 1 = "strongly disagree" to 5 = "strongly agree" (question 6 of the questionnaire, Appendix A).

VIF equal to 1 shows that variables are not correlated, VIF from 1 to 5 shows moderate correlation and VIF values higher than 5 shows high correlation between variables (What is a variance inflation factor (VIF)?, 2016). As in my research the values of the VIF are not higher than 3, I can conclude that the problem of excessive collinearity does not affect any of my independent variables.

Table 9 presents a summary and a comparison of the three models where I tested H1, H2 and H3 using factors extracted from previous FA analysis, as proxies for the corresponding dependent variables. The adjusted R-squares for the three regression models presented below in Tables 10 – 12 are very similar, ranging between 0.313 (impact on innovation uptake – hypothesis 2), 0.358 (impact on students' skills and attitude – hypothesis 1) and 0.389 (impact on business education relevance for practice – hypothesis 3). The corresponding adjusted R-squares mean that the regression models explain between 30 – 40% of the variation of the corresponding dependent variables. Such values of R-squared imply that the explanatory power of the independent variables is most likely significant, which is also confirmed by the relevant F-test statistics. The actual p-values for the corresponding F-tests (testing the null hypothesis, whether at least one of the predictors has a significant impact on dependent variable) are 0.001, 0.002 and 0.000 respectively. This implies that I cannot statistically reject H1, H2 and H3, and thus, these three hypotheses can all be confirmed.

Table 9. Summary of the Multiple Regression Results

Model	R squared	R squared adjusted	F test	Sig
H1 Model	0.479	0.358	3.959	0.001
H2 Model	0.443	0.313	3.419	0.002
H3 Model	0.504	0.389	4.368	0.000

Note: H1 corresponds to research hypothesis 1, H2 corresponds to research hypothesis 2, and H3 corresponds to research hypothesis 3, as explained in Chapter 3.1.

I also performed the additional robustness check by running regressions where a set of the independent variables are regressed on each single item. The obtained results (see Appendix B) are very similar to those where the factors have been used as the dependent variables. Adjusted R squares for these regression models vary between 30 and 49%. The individual impacts of the perception of design thinking items are statistically significant and positive.

Each of the three hypotheses model results are presented below in Tables 10 – 12 to identify the predictors that have a significant impact on the corresponding dependent variable.

Table 10. Impact of Design Thinking on Students' Skills and Attitudes (Research Hypothesis 1)

Model	Unstandardized Coefficients		Sig.
	B	Std. Error	
(Constant)	-3.993	.902	.000
Classes	.017	.014	.210
Experience	-.089	.115	.446
Use	-.093	.122	.448
A holistic and systematic approach for creating solutions	-.351	.160	.033**
A method / methodology which enables innovation	.287	.246	.250
An iterative process for innovation and adaptation to change	.102	.241	.675
A toolbox – a collection of tools and techniques for user research and group creativity	.161	.218	.466
A mindset – a way of thinking	.590	.176	.002*
A corporate culture which influences an institution's organisational structure	-.225	.161	.170
An approach to create solutions that are technological feasible and commercial viable	.406	.190	.039**

Note: Dependent variable: Factor of skills and attitudes development, composed of different items that corresponds to the question 7 of the questionnaire (Appendix A). The items were measured by a five-point Likert scale, ranging from 1 = "strongly disagree" to 5 = "strongly agree". Independent variables: Design thinking, as a set of independent variables, as explained in Chapter 4.2.3. * denote 1% significance level. ** denote 5% significance level.

In my analysis I found that when design thinking is perceived as "a mindset – a way of thinking", at 1% significance level, and as "an approach to create solutions that are technological feasible and commercial viable", at 5% significance level, it has positive relationship with students' skills and attitudes development. The increase of the perception of design thinking as "a mindset" and as "an approach to create solutions" by one point on Likert scale each, leads to increase in students' skills and attitudes.

However, the relationship between design thinking as "a holistic and systematic approach for creating solutions" and the factor on skills and attitudes development is negative, at 5% significance level. The increase of the perception of design thinking as "a holistic and systematic approach" by one point on Likert scale will lead to decrease in students' skills and attitudes development.

Table 11. Impact of Design Thinking on Innovation Uptake (Research Hypothesis 2)

Model	Unstandardized Coefficients		Sig.
	B	Std. Error	
(Constant)	-3.918	.931	.000
Classes	-.017	.014	.238
Experience	.062	.119	.606
Use	.021	.125	.870
A holistic and systematic approach for creating solutions	.245	.165	.144
A method / methodology which enables innovation	.934	.254	.001*
An iterative process for innovation and adaptation to change	.120	.249	.632
A toolbox – a collection of tools and techniques for user research and group creativity	-.366	.225	.111
A mindset – a way of thinking	-.238	.181	.197
A corporate culture which influences an institution's organisational structure	.221	.167	.192
An approach to create solutions that are technological feasible and commercial viable	.022	.196	.911

Note: Dependent variable: Factor of innovation process, composed of different items that corresponds to the question 9 of the questionnaire (Appendix A). The items were measured by a five-point Likert scale, ranging from 1 = "strongly disagree" to 5 = "strongly agree". Independent variables: Design thinking, as a set of independent variables, as explained in Chapter 4.2.3. * denote 1% significance level.

As the results of my analysis show, design thinking has a positive impact on increased innovation only when it is being considered by respondents as "a method / methodology which enables innovation", at 1% significance level. The increase of the perception of design thinking as "a method / methodology" by one point on Likert scale, leads to increase in innovation uptake.

Table 12. Impact of Design Thinking on the Relevance of Business Education for Practice (Research Hypothesis 3)

Model	Unstandardized Coefficients		Sig.
	B	Std. Error	
(Constant)	-1.678	.876	.062
Classes	.020	.013	.133
Experience	-.007	.112	.950
Use	.123	.118	.304
A holistic and systematic approach for creating solutions	.305	.155	.055***
A method / methodology which enables innovation	-.352	.239	.148
An iterative process for innovation and adaptation to change	-.304	.234	.201
A toolbox – a collection of tools and techniques for user research and group creativity	.080	.212	.709
A mindset – a way of thinking	.329	.170	.060***
A corporate culture which influences an institution's organisational structure	.346	.157	.033**
An approach to create solutions that are technological feasible and commercial viable	-.076	.185	.684

Note: Dependent variable: Factor on relevance of business education for practice, composed of different items that corresponds to the question 8 of the questionnaire (Appendix A). The items were measured by a five-point Likert scale, ranging from 1 = "strongly disagree" to 5 = "strongly agree". Independent variables: Design thinking, as a set of independent variables, as explained in Chapter 4.2.3. ** denote 5% significance level. *** denote 10% significance level.

My analysis confirmed, at 5% significance level, that design thinking has a positive impact on enhancing business education relevance for practice when it is perceived as "a corporate culture which influences an institution's organisational structure". At 10% significance level, my analysis showed that design thinking has a positive impact on the relevance of business education for practice, when it is perceived as "a mindset" and as "a holistic and systematic approach". The increase of the perception of design thinking as "a corporate culture", "a mindset" and as "a holistic and systematic approach" by one point on Likert scale each, also leads to enhanced business education relevance for practice. Other attributes of design thinking in my research in terms of enhancing the relevance of business education for practice were statistically insignificant and thus do not seem to foster business education relevance for practice.

I further test hypothesis H4 pertaining to the influence, or rather lack thereof, on demographic characteristics. The main demographic characteristics which were included in the analysis were: gender, age, average income and education level. In the first case, I have considered the complete sample, while in the second case, I have considered only respondents that indicated a suitably high level (> 3 on a 5-point scale) of familiarity with the concept of design thinking (question 1 of the questionnaire, Appendix A). The influence of the demographic characteristics on general knowledge on design thinking is presented in Table 13.

Table 13. Impact of Demographic Characteristics on Design Thinking Knowledge

	Parametric			**Non-parametric**		
Demographic characteristic	**Type of test**	**Test statistics**	**Sig**	**Type of test**	**Test statistics**	**Sig**
Gender	t (equal variances)	0.765	0.446	M-W	1115.4	0.425
Age	ANOVA	1.896	0.024	K-W	8.339	0.015
Income	ANOVA	4.223	0.001	K-W	20.855	0.001
Education	ANOVA	3.905	0.002	K-W	17.353	0.004

Note: M-W corresponds to a Man-Whitney test. K-W corresponds to a Kruskal-Wallis test. Gender is presented by male or female (question 10 of the questionnaire, Appendix A). Age is measured by a number of years (question 11 of the questionnaire, Appendix A). Income is measured as an average disposable income per household member, based on groups € 0 – 499, € 500 – 999, € 1000 – 1499, € 1500 – 1999, € 2000 – 2499, € 2500 – 2999, and € 3000+ (question 12 of the questionnaire, Appendix A). Education is measured by the highest level of education obtained (question 13 of the questionnaire, Appendix A).

In the first case, a null value means that gender has a significant impact on design thinking knowledge. In other three cases, a null value means that at least one of the categories of demographic characteristics has a significant impact on design thinking knowledge. The results of the analysis imply that gender has no impact on design thinking knowledge. In contrast, all other demographic characteristics have a significant impact. These results are confirmed by both parametric and non-parametric test options, as can be seen from Table 13.

Further, I also made an analysis on a sub-sample of respondents that are familiar with design thinking in the same manner. The corresponding results are presented in Table 14.

Table 14. Impact of Demographic Characteristics on Design Thinking Use

	Parametric			Non-parametric		
Demographic characteristic	**Type of test**	**Test statistics**	**Sig**	**Type of test**	**Test statistics**	**Sig**
Gender	t (equal variances)	0.534	0.595	M-W	580	0.882
Age	ANOVA	2.063	0.032	K-W	7.926	0.019
Income	ANOVA	1.929	0.102	K-W	10.174	0.038
Education	ANOVA	0.747	0.614	K-W	11.852	0.037

Note: M-W corresponds to a Man-Whitney test. K-W corresponds to a Kruskal-Wallis test. Gender is presented by male or female (question 10 of the questionnaire, Appendix A). Age is measured by a number of years (question 11 of the questionnaire, Appendix A). Income is measured as an average disposable income per household member, based on groups € 0 – 499, € 500 – 999, € 1000 – 1499, € 1500 – 1999, € 2000 – 2499, € 2500 – 2999, and € 3000+ (question 12 of the questionnaire, Appendix A). Education is measured by the highest level of education (question 13 of the questionnaire, Appendix A).

Again, gender seems to have no influence on the use of design thinking, which is confirmed both by parametric and non-parametric test approaches. Alternatively, age has significant impact on design thinking knowledge and use, and this is confirmed by both parametric and non-parametric options of ANOVA. However, in the case of income and education, I got different results for parametric and non-parametric options. Having in mind that non-parametric tests are based on less rigid assumptions, I prioritised these results relative to those obtained by the parametric tests.

Summarising the results of my hypotheses' testing (see Table 15), I found that indeed design thinking has a positive impact of innovative students' skills and attitudes development (research hypothesis 1), innovation uptake during education process (research hypothesis 2) and enhanced business education relevance for practice (research hypothesis 3). However, I cannot draw a straightforward conclusion about the role/impact of demographic characteristics on design thinking knowledge and use. The corresponding research hypotheses can mostly be rejected, except in case of gender which seems to have no influence on design thinking knowledge and use.

Table 15. Summary of Hypotheses Testing

Hypothesis	**Content of hypothesis**	**Results**
H1	Design thinking has a positive impact on students' skills and attitudes which fosters their capability to innovate.	Confirmed
H2	Design thinking increases so-called innovation uptake during the education process.	Confirmed
H3	Design thinking enhances the relevance of business education for practice.	Confirmed
H4	Demographic characteristics do not have a significant influence on design thinking knowledge and use.	Rejected
H4a	Gender does not have influence on design thinking knowledge and use.	Confirmed
H4b	Age does not have influence on design thinking knowledge and use.	Rejected
H4c	Average income does not have influence on design thinking knowledge and use.	Rejected
H4d	Education level does not have influence on design thinking knowledge and use.	Rejected

4.3 Research limitations

Like any research, my study contains limitations related to both operationalisation and measurement of constructs as well as data collection (sampling). The constructs for my research were based on existing design thinking studies and case studies that do not focus on capturing design thinking impacts on education or on entrepreneurship education. Despite the fact that most of these cases come from the business sector, some items in these constructs might not properly reflect specificities of design thinking in business education context. Hence, amended measurement scales that would better represent/reflect design thinking in a business education context and the links between them would probably lead to more reliable results.

Using a simple convenience sample, as well as having a small sample are other important limitations of my research. In terms of sampling, the non-probability-based nature of my sampling approaches prevents any sort of generalisation of my results beyond the actual sample. Out of 280 entries within my electronic survey, only 102 questionnaires were completed. This represents only slightly more than 36% of respondents' replies and might indicate that overall students might not be aware of when professors use design thinking or elements of it. I also did not check for non-response bias. As the majority of my FELU network relates to master or doctorate students, undergraduate students' opinions and understanding of design thinking approach might not be well reflected in the research findings despite FELU professors' help in distributing the survey. In addition, I did not access participants from various academies, start-up weekends as well as summer and executive school. Their views and more extensive professional experience in using design thinking outside university could have contributed to my research. Thus, a larger and more diverse sample is very much advisable to be used in future studies.

Finally, if I had been able to implement this research in different European business schools, my research could have provided more data for analysis and more opportunity for comparison among different business schools, thus eliminating the drawbacks of a single business school setting. Despite the fact that I was in extensive contact with two other business schools in Europe, unfortunately, I had to exclude them due to too low response levels. Also, their professors refused to share the survey with their students. More similar studies on design thinking use in business schools and closer cooperation with partner universities on concrete topics, e.g. design thinking implementation, could encourage other universities to be more cooperative when approached also by students from partner universities.

5 IMPLICATIONS

5.1 Theoretical implications

In my master thesis I analysed design thinking and business education relation in a concrete business school context, contributing to the development of theoretical knowledge and limited body of literature on design thinking and its linkage to entrepreneurship education. While there

are a number of cases on how design thinking can benefit entrepreneurship efforts, existing studies hardly ever mention the link between design thinking and business education or education in general.

My analysis also contributes to one of the most prevailing points of criticism of design thinking which is related to the lack of an accepted definition and theory of the so-called design thinking approach. Particularly, scholars like Johansson and Woodilla (2010) and Petersen (2014) have argued for the need of an established and detailed definition of design thinking, if it is to develop as a mainstream concept and paradigm in the broader business and management literature, as well as to be more widely adopted in practice.

While my research could not provide a single answer to the questions how design thinking could be defined in the context of a business school, I still obtained some useful insights. My research indicated that design thinking has a positive relationship with the development of students' skills and attitudes and the increased business education relevance for practice when it is perceived as "a mindset – a way of thinking". The notion of design thinking as "a mindset" was strongly emphasised by such scholars as Dunne and Martin (2006, p. 517) and practitioners as Hasso-Plattner-Institut (Mindset – Design Thinking, 2015, para. 1). As design thinking helps students to develop relevant skills for the job markets, they also likely consider that their education is more relevant for practice.

My analysis also indicated other perceptions of the design thinking approach that were significant when analysing them with regard to the three different constructs. These design thinking attributes which might be considered in defining the concept in business education were the following:

- My analysis showed that design thinking has a positive impact on students' skills and attitudes development when it is perceived as "an approach to create technological and commercial feasible solutions", noted by Hasso-Plattner-Institut (Mindset – Design Thinking, 2015, Background – Design Thinking, 2015), Hasso Plattner Institute of Design at Stanford (Our point of view, 2015), and IDEO (About IDEO, 2014). In contrast to the insights made by Kirby (2004, p. 513), Faste (1981, p. 85) and Hasso-Plattner-Institut (Background – Design Thinking, 2015, Mindset – Design Thinking, 2015), my research does not provide evidence that design thinking in this concrete business school context has positive impact on the development of students' skills and attitudes when it is perceived as "a holistic and systematic approach for creating solutions".
- Design thinking has a positive effect on innovation uptake when it is considered by respondents as "a method / methodology which enables innovation", strongly supported by scholars like Faste (1994, pp. 2–3) and Plattner et al. (2010, p. xiv–52).
- My research confirmed that design thinking has a positive impact on the relevance of business education for practice when it is perceived as "a corporate culture which influences an institution's organisational structure", especially supported by practitioners Köppen (2015a, 2015b), Krigsman (2011) and Schmiedgen (2015a, 2015b), among others; and when

it is perceived as "a holistic and systematic approach for creating solutions", noted by Kirby (2004, p. 513), Faste (1981, p. 85) and Hasso-Plattner-Institut (Background – Design Thinking, 2015, Mindset – Design Thinking, 2015).

These aforementioned perceptions of design thinking could be further explored and potentially included in defining the design thinking approach in business education context. Special focus could be placed on design thinking as "a mindset" notion since it contributes to the improvement of perceptions towards design thinking itself and is likely to enhance its acceptance in business education context. Further research based on a larger sample and involving greater number of business schools could confirm and extend these findings as well as better showcase design thinking potential in business education contexts.

However, if a research context and/or constructs are different, all potential design thinking definitions should be included in an attempt to identify a detailed definition of design thinking. This is especially important because currently the interpretation of what design thinking is greatly depends on the context. Similarly, definitions coming from management discourse of design thinking and so-called "designerly thinking" discourse (Johansson & Woodilla, 2013) should be linked to explore different attributes of design thinking and benefit theoretical knowledge development.

My research indicated that design thinking impacts on my constructs stem only from its perception rather than from the knowledge about it and its use. It is intuitive that a positive perception of design thinking corresponds to positive opinions on the application of design thinking. Nonetheless, one would expect that design thinking benefits increase when it is used more frequently. Future research could explore further the link between design thinking and business education depending on knowledge and use, to provide more practical evidence to both educators and learners to use the concept. Also, it can be valuable to analyse how certain perceptions of design thinking contribute to its perceived and real added-value, and the specific benefits of design thinking in the business education process. Future research is needed to explore how different demographic characteristics influence design thinking in terms of knowledge and use.

Finally, even though the quantitative research of the design thinking constructs and the corresponding survey of my research were inspired by a recent study of the Hasso-Plattner-Institut (Schmiedgen et al., 2015) and various case studies on design thinking rather than existing and scientifically tested model, the questionnaire showed appropriate internal consistency with regard to the employed scales (according to Cronbach's alpha indicator). However, scientifically tested models are to be developed that properly capture both design thinking and business education contexts and could better analyse the relationship between the two. This would significantly contribute to the development of theoretical and practical knowledge on design thinking and its links to entrepreneurship education.

5.2 Practical implications

According to "The Future of Jobs Report", by 2020 creativity will become one of the top-three core skills sought by employers (World Economic Forum, 2016a, 2016b). As in my research I found that design thinking indeed contributes to creativity-related skills and attitudes, business education as well as education systems generally might consider implementing design thinking coherently during the whole education process, starting as early as in kindergartens. Students that are able to think more creatively and broadly, will more likely fit better in working cultures of organisations allowing them to be more successful and competitive in job markets.

Nevertheless, design thinking should not become the only method to introduce an entire course, nor should it become the sole teaching technique in business education context. Contrary to Owen's (2006, p. 26) argument that project-oriented learning methods, including design thinking, are to be preferred ones, my analysis contributed to the understanding that design thinking should complement traditional teaching and learning methods in business schools' context, rather than replace them.

When traditional teaching techniques are likely to continue to be an answer on what to learn in business education, design thinking could be successfully implemented on how to apply this knowledge in practice. As my research showed, the ability of design thinking to better integrate theory and practice and enhance teaching attractiveness is closely associated with enhancing business education relevance for practice. Such a combination would allow to diminish the dichotomy of applied and pure education as well as enhance work-related practical skills and competences that employers are sought after, as emphasised by "The Future of Jobs Report" (World Economic Forum, 2016b, pp. 32–54).

Similarly, systematically merging traditional and non-tradition teaching and learning techniques is likely to foster creation of technological and commercial viable innovations in business schools. Design thinking helps students to embrace certain ways of working – such as predisposition toward multi-functionality, ability to visualise, conditioned inventiveness and others – that enhance innovation (Owen, 2006, pp. 23–27). This also contributes to developing working values and habits that allow students to adapt better to the working environment and corporate culture. Companies like Optiprint, Printbox and Kibuba are concrete outputs and could become good practice examples for other business schools to get inspired from.

My research found that whereas gender does not have influence on design thinking knowledge and use; age, and education level, as well as higher average disposable monthly income (which can be related to both age and education level) do have influence on design thinking knowledge and use. Whereas this by no ways means that design thinking should not be introduced during undergraduate studies or even earlier, the approach should fit the age and interest level of students in order to bring expected benefits. To make design thinking more relevant as a teaching and learning technique, it is necessary to enhance cooperation between practitioners and educators in order to better adapt the complexity of design thinking courses for diverse students.

At the education policy making level my research brings at least a partial answer regarding how to increase business education relevance for practice, which remains one of the main critiques of business education nowadays. My study shows that combining traditional teaching and learning methods and novel ones, such as design thinking, can have positive and significant impact in terms of an increased creativity and innovation among students, and enhanced business education relevance for practice. Based on "The Future of Jobs Report", creativity-based skills will be essential for employees in the job market by 2020 (World Economic Forum, 2016a, 2016b). Therefore, policy makers can contribute to long-term labour market resilience by enabling policy actions that allow to adjust and develop education content and teaching practices to meet the changing needs of future job markets.

CONCLUSION

The purpose of my thesis was to analyse and understand what benefits implementing a so-called design thinking approach (combined with the traditional teaching and learning practices) can bring in fostering creativity and the culture of innovation in business schools context. The advantages I examined in my research are related to the development of creativity-related skills and attitudes, increased innovation uptake and business education relevance for practice. As the hypotheses related to these three constructs were confirmed, it allows me to conclude that design thinking indeed brings significant benefits which build on important skills needed for the job market.

According to "The Future of Jobs Report", only equipped with adequate skills that match business requirements, the growing population will be able to tackle issues related to unemployment and inequality as well as slow job creation (World Economic Forum, 2016b, pp. 6–14). As the creativity and creativity-related skills such as ability to innovate will be among the most desired skills by employers in 2020 (World Economic Forum, 2016a, 2016b), truly creative employees will be more competitive, highly valued by employers and thus more successful in future job markets.

My research also yielded some important insights in an attempt to answer what the design thinking approach is in business education context. Even though "a mindset" might be perceived as a "soft" concept, I found that particularly the perception of design thinking as "a mindset – a way of thinking" both positively affects the development of students' skills and attitudes and fosters relevance of business education for practice. The changes in students' mindset seem to determine most students' success in developing creativity and other important skills required by the job markets. As students' skills match better job markets' needs and they can be more competitive, they naturally consider that the business education they received was more relevant for them for practice. This further is likely to improve positive perceptions towards design thinking and enhance its acceptance in business education, and in education in general.

"The Future of Jobs Report" highlighted that relevant education and training systems that are able to develop "future-proof" skills are essential in preparing global population to be

competitive and successful in the future workplace (World Economic Forum, 2016b, pp. 6–14). While the design thinking approach should not be seen as a solution to all issues in business or in business education, my empirical research based on the FELU case study has showed that the causal link between design thinking and enhanced creative skills, innovation and business education relevance for practice exists. This research allows to assume that design thinking could also bring similar benefits in other business schools in Europe and beyond.

Design thinking implementation in FELU has been a 10-year tradition and the faculty might explore different possibilities to promote the design school, its achievements and important lessons learnt among other business schools in Europe and other regions. This would allow FELU even further strengthen links with current and future partner universities. It will also reinforce the FELU's reputation of excellence, and as the institution that fosters creativity and provides "future-proof" skills, empowering its students to be competitive in future job markets and have more fulfilling professional careers.

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APPENDIXES

TABLE OF APPENDIXES

Appendix A: Survey questions

Q1 – On a 5-point scale, please indicate the level of familiarity with the concept of "design thinking":

- ○ 1 – I haven't heard of it
- ○ 2 – heard of it, but I am not familiar with it
- ○ 3 – I know something about it
- ○ 4 – I know it relatively well
- ○ 5 – I know it very well

IF (1) Q1 = [3, 4, 5]

Q2 – How did you learn and which learning channel did you use to learn the design thinking approach? You can choose more than one option.

- ☐ Attended a professional training course at my educational institution.
- ☐ Taught it yourself, e.g. through the self-learn literature and using design thinking toolkits.
- ☐ At an institutionalized innovation programme in my organisation.
- ☐ Through external coaches, agencies and/or consultancies.
- ☐ Other channels (please indicate which):
- ☐ None of the above.

IF (1) Q1 = [3, 4, 5]

Q3 – How many classes/workshops using the design thinking approach did you take? Please indicate the number of classes/workshops:

IF (1) Q1 = [3, 4, 5]

Q4 – How many years of experience with design thinking do you have? Please indicate the number of years:

IF (1) Q1 = [3, 4, 5]

Q5 – How often do you use the design thinking approach in learning process and/or at work?

- ○ 1 – Never
- ○ 2 – Less than once a year
- ○ 3 – Once to six times a year
- ○ 4 – Seven to eleven times a year
- ○ 5 – Once a month, but less than once a week
- ○ 6 – Once a week
- ○ 7 – On a daily basis

IF (1) Q1 = [3, 4, 5]

Q6 – What is design thinking for you?

	1 – strongly disagree	2 – somewhat disagree	3 – neither disagree, nor agree	4 – somewhat agree	5 – strongly agree
A holistic and systematic approach for creating solutions.	◯	◯	◯	◯	◯
A method / methodology which enables innovation.	◯	◯	◯	◯	◯
An iterative process for innovation and adaptation to change.	◯	◯	◯	◯	◯
A toolbox – a collection of tools and techniques for user research and group creativity.	◯	◯	◯	◯	◯
A mindset – a way of thinking.	◯	◯	◯	◯	◯
A corporate culture which influences an institution's organisational structure	◯	◯	◯	◯	◯
An approach to create solutions that are technological feasible and commercial viable.	◯	◯	◯	◯	◯

IF (1) Q1 = [3, 4, 5]

Q7 – What is design thinking for you in terms of skills and attitude development?

	1 – strongly disagree	2 – somewhat disagree	3 – neither disagree, nor agree	4 – somewhat agree	5 – strongly agree
Design thinking increases creativity and out-of-the-box thinking within teams.	◯	◯	◯	◯	◯
Design thinking encourages ability to work in interdisciplinary teams.	◯	◯	◯	◯	◯
Design thinking improves collaboration and knowledge transfer in teams across disciplines and organizational levels.	◯	◯	◯	◯	◯
Design thinking enforces ability for brainstorming and co-creation in teams.	◯	◯	◯	◯	◯
Design thinking requires adaptable and variable space for co-creation.	◯	◯	◯	◯	◯
Design thinking improves ability to focus on users' needs and user-centeredness.	◯	◯	◯	◯	◯
Design thinking enhances teaching and training formats.	◯	◯	◯	◯	◯

IF (1) Q1 = [3, 4, 5]

Q8 – What is design thinking for you in terms of business education relevance for practice?

	1 – strongly disagree	2 – somewhat disagree	3 – neither disagree, nor agree	4 – somewhat agree	5 – strongly agree
Design thinking enhances relevance of managerial education in practice.	◯	◯	◯	◯	◯
Design thinking fosters teaching attractiveness.	◯	◯	◯	◯	◯
Design thinking enhances experiential learning which enhances knowledge applicability in practice.	◯	◯	◯	◯	◯
Design thinking better integrates theory and practice and focuses less on linear argumentation.	◯	◯	◯	◯	◯
Design thinking serves as an enabler for knowledge development and transfer.	◯	◯	◯	◯	◯
Design thinking serves as a means for effective problem solving.	◯	◯	◯	◯	◯
Design thinking encourages prototyping and experimentation in testing potential solutions.	◯	◯	◯	◯	◯

IF (1) Q1 = [3, 4, 5]

Q9 – What is design thinking for you in terms of an innovation process?

	1 – strongly disagree	2 – somewhat disagree	3 – neither disagree, nor agree	4 – somewhat agree	5 – strongly agree
Design thinking serves as a means for creative product/service development.	◯	◯	◯	◯	◯
Design thinking helps to improve service and experience design.	◯	◯	◯	◯	◯
Design thinking fosters customers' engagement in creation process.	◯	◯	◯	◯	◯
Design thinking serves as a means for improving the market-driven innovation process.	◯	◯	◯	◯	◯
Design thinking helps in creating new business models and go-to-market strategies.	◯	◯	◯	◯	◯

Q10 – Gender:

◯ Female

◯ Male

Q11 – Please indicate your age:

Q12 – Average monthly disposable income per household member:

- ◯ € 0 – 499
- ◯ € 500 – 999
- ◯ € 1000 – 1499
- ◯ € 1500 – 1999
- ◯ € 2000 – 2499
- ◯ € 2500 – 2999
- ◯ € 3000+

Q13 – Your highest education level:

- ◯ High school
- ◯ Bachelor degree – business-related degree
- ◯ Bachelor degree – other than business-related degree
- ◯ Master degree – business related degree
- ◯ Master degree – non-business related degree
- ◯ PhD
- ◯ Other (please indicate which):

Q14 – Your current employment status:

- ◯ Full time students
- ◯ Student job
- ◯ Temporary job or part-time job
- ◯ Self-employed or freelancer
- ◯ Junior management
- ◯ Middle management
- ◯ Top management
- ◯ Other (please indicate which):

Q15 – The industry you work in / wish to work in:

- ◯ Information and communication
- ◯ Other service activities
- ◯ Education
- ◯ Scientific and technical activities
- ◯ Financial and insurance activities
- ◯ Manufacturing
- ◯ Whole sale and retail activities
- ◯ Public administration
- ◯ Construction
- ◯ Administrative and support activities

- ○ Arts, entertainment, recreation
- ○ Tourism and hospitality
- ○ Health and social work activities
- ○ Transportation
- ○ Other (please indicate which):

Q16 – What describes best the organisation you work in/wish to work:

- ○ Profit-oriented
- ○ Non-for-profit
- ○ Governmental
- ○ Private-public partnership
- ○ Other (e.g. freelance, consultant, universities, etc.), please indicate which:

Appendix B: Summary of the single-items regression (robustness check)

Table. Summary of the Single-Items Regression (Robustness Check)

Model	R squared	R squared adjusted	F test	Sig
H1 a	0.469	0.362	4.408	0.000
H1 b	0.536	0.444	5.787	0.000
H1 c	0.436	0.321	3.792	0.001
H1 d	0.517	0.419	5.252	0.000
H1 e	0.440	0.326	3.850	0.001
H1 f	0.576	0.486	6.382	0.000
H1 g	0.533	0.434	5.374	0.000
H2 a	0.473	0.368	4.495	0.000
H2 b	0.478	0.372	4.469	0.000
H2 c	0.489	0.384	4.683	0.000
H2 d	0.487	0.383	4.659	0.000
H2 e	0.428	0.306	3.515	0.002
H3 a	0.523	0.426	5.379	0.000
H3 b	0.494	0.391	4.784	0.000
H3 c	0.435	0.320	3.779	0.001
H3 d	0.428	0.309	3.597	0.001
H3 e	0.446	0.333	3.946	0.001
H3 f	0.558	0.446	6.062	0.000
H3 g	0.457	0.342	3.962	0.001

Note: A letter next to hypotheses notation corresponds to the relevant item from the survey which is modelled, i.e. H1 a corresponds to the first item of the question 7, H2 corresponds to the items of question 9 and H3 corresponds to the items of question 8 of the questionnaire (Appendix A).